APPROVAL SHEET

Title of Thesis: An Integration of Prices, Wages, and Income Flows in an Input-Output Model of the United States

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ABSTRACT

Title of Dissertation: An Integration of Prices, Wages, and Income Flows in an Input-Output Model of the United States

David Bruce Belzer, Doctor of Philosophy, 1978

Dissertation directed by: Dr. Clopper Almon, Jr., Professor of Economics

An existing input-output model of the U.S. (INFORUM, Interindustry Forecasting Model, University of Maryland) was expanded to incorporate a consistent set of submodels explaining prices, wages, and income distributions by industry. An "income" submodel was developed to provide forecasts of major income components for fifty industries in the private economy. Aggregate tax and transfer payments functions were estimated to derive nominal disposable personal income. An estimate of the Personal Consumption Deflator—to deflate this nominal income—is provided by a separate price and wage forecasting model. The resulting value for real disposable personal income, which is used as a major explanatory variable for the consumption functions in the existing INFORUM model, serves to close the expanded model on the income side. The price-wage model also generates forecasts of prices for approximately 200 goods and services, which also are used in explaining consumption as well as in the foreign trade equations.

With given vectors of product outputs and prices, the income model generates industry value added which is consistent with the Bureau of Economic Analysis's series on Gross Product Originating (GPO) by industry.

A procedure to bridge between the concept of value added in the U.S. input-output tables and that in the GPO series was developed. Functions for labor compensation, proprietors' income, capital consumption allowances and indirect business taxes were estimated.

Labor compensation is derived from forecasts of total manhours and BLS hourly earning indexes by industry. Equations within the income model (1) divide the manhours forecasts between employees and the self-employed and (2) bridge between the BLS hourly earning indexes for "production" workers and "average" wages and salaries per manhour for all employees. Proprietors' income equations—for 23 sectors—use the self-employed manhours estimates, labor compensation rates, and the total nonwage factor income in the sector as explanatory variables. Capital consumption allowances are forecasted for 36 industries by depreciating a set of vintage stocks at historical prices (for both equipment and strucutres) with a combination of straight-line and double-declining balance methods. Indirect business taxes by industry, with the exception of federal excise taxes, are estimated on the basis of a regression shares model applied to estimates of aggregate tax payments. The remaining items of GPO by industry are (i) corporate profits plus IVA, (ii) net interest, and (iii) business transfer payments; the sum of these three items is obtained as a residual. A set of aggregate tax and transfer payment functions was estimated to convert the industry-related factor incomes to disposable income estimates.

The separate price-wage model provides a set of annual prices and wages for approximately 200 products which, in turn, are aggregated to display the major GNP deflators and the wholesale price index. The model itself is a dynamic, input-output system which operates in a quarterly time interval. Wage-change equations were estimated for four major aggregates in the private economy; wage indexes for 100 industries are obtained through a set of relative wage functions. "Value-added" price equations were estimated for approximately 40 sectors which use measures of demand pressure from previous runs of the real side of the INFORUM model. These equations assure reasonable behavior of factor income shares for medium-term forecasts. Indirect business taxes are included in the determination of output prices; a procedure to convert wholesale prices to retail prices was also developed.

A test of the price-wage and income models was conducted over the 1972-75 period. An analysis of errors strongly indicates that a number of published wholesale prices did not reflect transactions prices for the 1974-75 period. A multiplier analysis of the integrated system of models was carried out, and the real GNP-government expenditure multipliers were generally consistent with those of other large-scale models. A forecast for the period 1977-82 was also developed.

ACKNOWLEDGEMENTS

I am deeply indebted to Dr. Clopper Almon, my major advisor, for his guidance and encouragement throughout the undertaking of this project. I also wish to thank Dr. Wayne Vroman for many constructive comments on the subject of wage determination.

The Interindustry Economics Division of the Bureau of Economic Analysis (BEA) graciously provided worksheet data relating to the 1967 U.S. input-output table. I especially wish to thank Mr. Jack Gottsegen and Mrs. Vesta Jones of BEA for helpful discussions regarding the Gross Product Originating data.

Dr. Douglas Nyhus and Ms. Margaret Buckler of the INFORUM staff provided valuable assistance in communicating many of the technical aspects of the INFORUM model. I am indebted to Mrs. Daisy Foster for typing the various drafts of the thesis.

All computations were undertaken on the University of Maryland Univac 1108. Generous support by the University of Maryland Computer Science Center is gratefully acknowledged.

My wife, Karen, deserves my most heartfelt thanks for her continuous support and encouragement throughout my period of graduate study.

AN INTEGRATION OF PRICES, WAGES, AND INCOME FLOWS IN AN INPUT-OUTPUT MODEL OF THE UNITED STATES

by
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Dissertation submitted to the Faculty of the Graduate School
of the University of Maryland in partial fulfillment
of the requirements for the degree of
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CHAPTER I

OVERVIEW OF MODEL

1.1 Introduction

For the past ten years a group at the University of Maryland has been operating a detailed input-output model of the U.S. economy. The INFORUM model (INterindustry FORcasting Model, University of Maryland), as it is now called, has been used in a large number of planning and policy simulation studies by both private corporations and government agencies.[1] Its great industrial disaggregation (nearly 200 industry sectors) makes it useful in analyzing a variety of problems that cannot be addressed by the available "macro" economic models.

Throughout most of this decade, the model could be characterized as a dynamic, open Leontief-type model operating in real terms. The term dynamic refers to the fact that at least some components of final demands notably investment expenditures are dependent on previous levels of activity. It is "open" in the sense that there is no explicit scheme of generating factor incomes. Thus, one important determinant of consumption behavior, real disposable per capita income, has been exogenous in the INFORUM model.

This thesis deals with a project to expand the current version of the INFORUM model to incorporate prices, wages, and income flows at a

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[1] A complete description of the model can be found in Clopper Almon, Jr., Margaret B. Buckler, Lawrence M. Horwitz, and Thomas C. Reinbold, 1985: Interindustry Forecasts of the American Economy, (Lexington, MA: D.C. Heath, 1974).

highly disaggregated industry level. As a general statement, a complete nominal side to the existing "real" model is developed. The models described in this thesis have as their primary purpose the "closing" of the INFORUM model on the income side. Estimates of both real disposable income and relative prices by product, which over much of the history of the INFORUM project have been exogenous, are now endogenous variables in an integrated system of models. A method is developed to forecast distributions for five major income components for 50 industries in the private economy. This effort is the first econometric model to attempt to estimate nonwage incomes for industries at the two-digit SIC level in a theoretically consistent framework.

Rationale for Expanded INFORUM Model

The motivation for undertaking the work in this study will become apparent after a brief discussion of the existing INFORUM model. We can start simply by looking at the solution procedure of the existing INFORUM model prior to the modifications developed here. One begins with an assumed level of real per capita disposable income for a given year. This, along with the change in income, relative prices, and trend effects, determines consumption demands by product. The remaining final demand components -- exports, imports, investment, and government -- are determined by econometric functions or are exogenous. Given the vector of total final demand, f (t), a vector of real gross outputs by industry, s (t), is obtained by solving the familiar Leontief relation:[2]

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[2]This procedure is highly simplified as compared to the actual INFORUM procedure. The complexities in the actual procedure stem from the simultaneous relationships between current output (X(t)) and (1) the investment, (2) imports, and (3) inventory change components of the current final demand.

$x(t) = A(t)\,x(t) + f(t)$. The matrix of input-output coefficients, A, is time subscripted since certain portions of it are projected each year.

Given the vector of outputs by industry, the final step for a given year is to generate the number of manhours employed for each industry by using industry trends in labor productivity. After adjustments for length of the work week, multiple job holders, and government employment, the model predicts the level of total employment. This magnitude is compared to an exogenous estimate of the total labor force and an overall unemployment rate is computed.

If this unemployment rate is quite different from its "desired" magnitude, the most expedient method of changing it is to try a new level of disposable income. This, of course, generates a new vector of consumption demands and industry outputs; and finally, a new level of overall employment. The process of readjusting disposable income continues until the calculated unemployment rate is sufficiently close to the target unemployment rate.

This procedure has normally been justified on the grounds that government policymakers will eventually pursue policies which will lead to the full employment level of disposable income. The key word here is eventually. For long-run forecasts of the economic activity (say, more than five years into the future) this assumption may be adequate, since the government will have had time to revise fiscal and monetary policies to counter adverse shocks to the economy. However, this assumption certainly is not true in the short run, as recent economic conditiions demonstrate. The U.S economy suffered two full years of high unemployment rates (1975-76) in the wake of the extraordinary events of 1974 and "full" employment under the loosest of definitions is some distance away.

The development of an income side permits levels of income and unemployment in the near term to be endogenous, rather than exogenous variables, in the INFORUM model. With the addition of the income side, we are required to make explicit changes in tax policies that affect disposable income. In long-run forecasting applications, we are also forced to look more carefully at all sources of aggregate demand, not only consumption. That is, if we required an unreasonable reduction in personal income tax rates to achieve full employment ten years hence, we would be justified in being suspicious of our final demand projections for government, foreign trade, or (exogenous categories of) investment.

Nearly all econometric models have treated income components in current dollars and this model follows that procedure. Thus, the development of a system to forecast wages and prices is required. The price and wage model also serves to forecast cyclical and secular income shares to labor and capital.

Order of Presentation

The preceding discussion describes briefly the context in which the work of this thesis was undertaken. In Section 1.2 we provide a brief exposition of the interrelationships between the real, the price-wage, and the income models. Finally, we summarize earlier work by two previous INFORUM researchers toward the building of an integrated model.

First, the reader may be aided at this point by a brief account of the contents of the remaining chapters. In Chapter II we look at the

1967 Bureau of Economic Analysis (BEA) input-output table and discuss in detail the treatment of value added by industry. Chapter III follows up on this topic by describing our method of forecasting current dollar gross product originating (i.e., value added) for fifty sectors in the private economy. Chapter IV shows the use of a perpetual inventory method to forecast (original cost) capital consumption allowances by industry. Wage determination is the subject of Chapter V where we present a scheme which uses both conventional and absolute wage-change equations and relative wage equations by industry. Chapter VI explains our procedure for forecasting the hours worked by proprietors and proprietors' income for 23 industry groups. With the exception of an explanation of industry price formation, Chapters III-VI together are sufficient to explain functional distributions of income in the aggregate. Chapter VII describes the aggregate tax and transfer functions which are required for the derivation of disposable personal income.

Chapters II-VII comprise the original scope of the estimation phase of the thesis. Deficiencies with the then available industry price model required an alternative approach to make the overall model fully integrate prices, wages, and incomes on an industry basis. Chapter VIII describes the specification and estimation of a set of price markup (over unit factor cost) equations for two-digit SIC industries. These equations, while lacking the industrial disaggregation of the earlier price model, have more desirable equilibrium properties with respect to functional income distribution.

Chapter IX describes the mechanics of the price-wage submodel. The submodel may presently be characterized as "quasi"-quarterly. That is, most of the demand-pressure variables for both product and labor markets are interpolated from the annual output of the standard INFORUM model. Although such a procedure cannot pinpoint the exact timing of fluctuations in demand, the quarterly format is useful in a variety of situations. A realistic view of the inflationary process in a modern industrialized economy suggest that prices and wages (and costs) are constantly in a state of dynamic disequilibrium. Prices lag unit costs; wages lag prices, wages lag other wages, and so on. The quarterly format allows the introduction of exogenous shocks to this system whose impacts will not be fully worked out in the given period. Thus, we expect an improvement in our annual forecasts, given that we know that a certain price changes in the fourth quarter of the year rather than the first quarter. Although the system of lags used for this present model are quite rudimentary, the foundation is laid for future refinements.

In Chapter X we make a test of the price-wage and income models over the period 1972-75. Model prices are generated first with industry wages fixed at their actual levels and, second, with wages endogenously generated by the absolute and relative wage equations. Incomes by industry are compared with known GPO data and errors for personal income are displayed for alternative runs with varying degrees of endogeneity within the complete model.

A multiplier analysis is presented in Chapter XI to demonstrate how the complete system operates. The income and price effects over a four year period following a change in federal nondefense spending are displayed. In the second part of the chapter a forecast of incomes by industry for the 1977-82 period is presented.

In Chapter XII we review some of the major accomplishments of the thesis and lay out some directions for future improvements of the model.

1.2 Structure of the Model

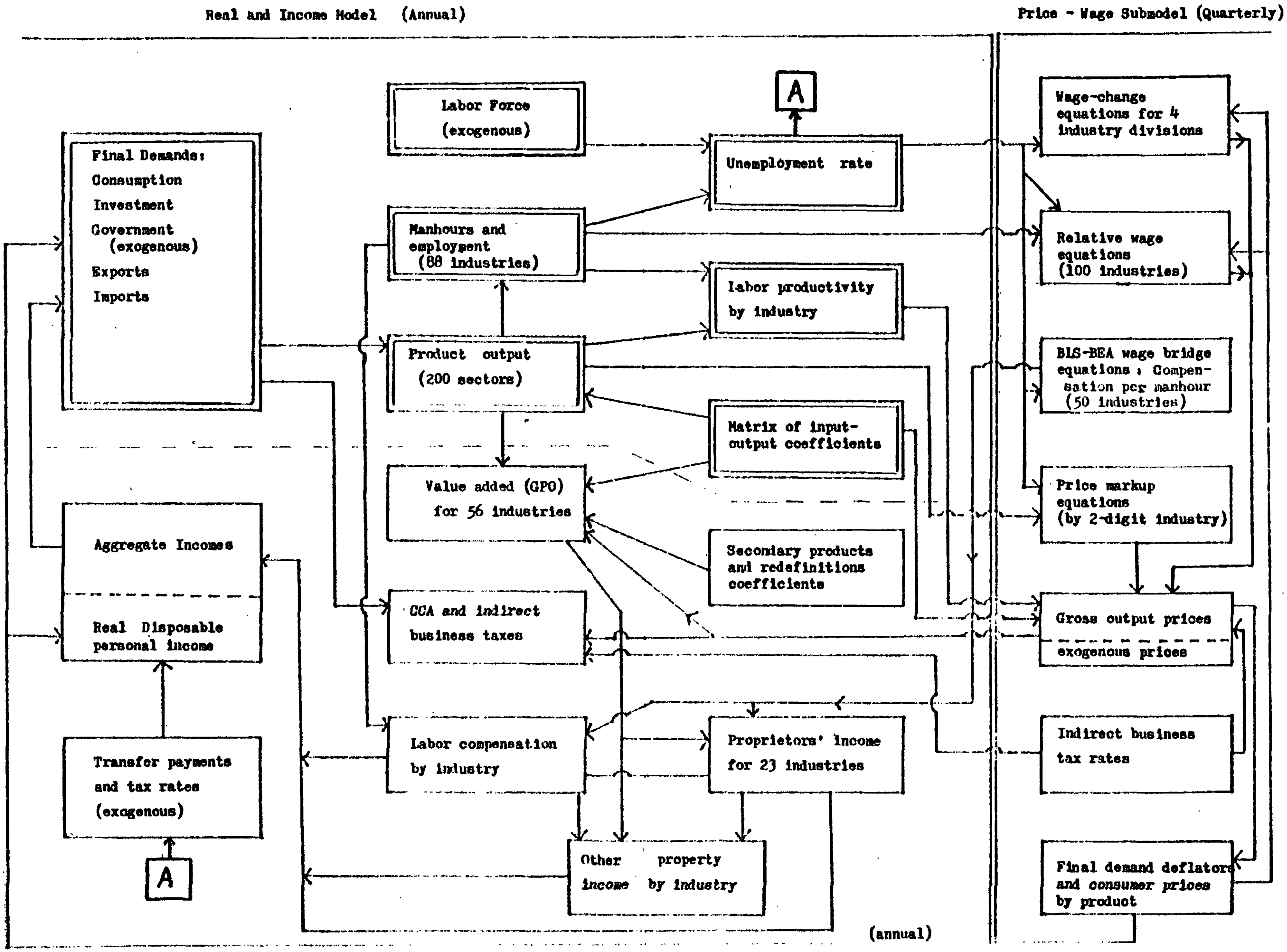
As an aid toward understanding the integrated INFORUM model, the reader is referred to Chart I-1. The boxes with double borders represent the real INFORUM model which has been in operation for the past decade. In the other boxes to the left of the double lines we have indicated the major items comprising the income submodel. To the right of the double lines are the major elements of the price-wage submodel. The arrows crossing the double lines, of course, show the major links between the price-wage and real-income models.

A word may be helpful on our use of the word "model" in this and subsequent chapters. In many large-scale econometric models, groups of equations dealing with a particular subject are often termed "blocks." I have instead used the word "model" to refer to the work on prices and wages, and incomes because the computer programs dealing with prices and wages, and incomes can be operated independently of those making up the real model. "Submodel" will be used when we wish to emphasize the solution of the complete system as a whole. For the price-wage model, in particular, a wide variety of analytical studies could be undertaken without reference to a particular solution of the real model. (As a simple example, the magnitude and timing of the change in the aggregate deflators from a change in a raw materials price under simple "pass-through" assumptions.)

We may now trace through briefly the mechanics of a solution to the complete system with the help of Chart I-1. We begin by forecasting

CHART I - 1

Overall Structure of the INFORUM Model - 1977 Version



a vector final demands (in the large box on the upper left) given an assumed real disposable income and relative prices by product. Product outputs are next determined for 200 sectors, given a matrix of input-output coefficients. The outputs are aggregated to 88 sectors and then employment is determined, via labor productivity equations, for these same 88 sectors. From the top box in the chart we take an exogenous estimate of the labor force and, together with our employment forecast, obtain the overall unemployment rate. This completes the solution for the conventional real model. As we have stated earlier, the level of real income has been the usual tool used to obtain a "target" unemployment in forecasting applications.

A major purpose of the income model is to force the disposable income estimate assumed for the consumption equation to be the same as that accruing in the productive process. We first determine GPO for fifty industries in the private economy, Household, Rest of the World, and four government sectors. The box for this step is shown below that for the real output determination. Arrows from the 200-order outputs, prices, the I/O matrix, and secondary products coefficients illustrate all of these items as determinants of GPO. Capital consumption allowances (CCA) and indirect business taxes (IBT) are first deducted from GPO to arrive at basically national incomes by sector. The arrow extending "southeast" from Final Demands to CCA and IBT box represents fixed business investment.

Wages and salaries plus wage supplements are determined next for the same 56 sectors. The estimates of total manhours by industry are adjusted to exclude the hours of the self-employed (not shown in chart).

Once that is done, an aggregate "average compensation per manhour" can be computed for each sector.

Proprietors' income, shown in the lower right of the real-income model can then be determined on the basis of total nonwage factor income in the (appropriate) sector, the employee compensation rate, and the number of proprietors. A breakdown of proprietors' income to the full 50 sectors in the model is accomplished by assuming that each subsector within the 29 sector aggregation maintains the base year proportions of income. With proprietors' income in hand, "Other property income" (corporate profits + IVA, net interest, business transfer payments) is obtained as a residual for the 50 sectors in the private economy.

The labor and property incomes are finally aggregated across industries as shown in the box labeled "Aggregate incomes." Tax and transfer payment functions are applied to obtain disposable personal income per capita (DPI) in current dollars. DPI in constant (1972) dollars is calculated by simply dividing the current dollar figure by the annual Personal Consumption Deflator from the price-wage model. This linkage is illustrated, of course, by the horizontal line extending across the bottom of the chart.

The computer routine making up the income submodel can be run independently from the real model or as simply an extension of the real model. In this latter mode, the program checks the real DPI emanating from the income submodel with that used in the consumption functions. If the difference is greater than some tolerance value (presently $3 per capita), the program automatically uses the new disposable income in the calculation of new final demands and thus, a second estimate for DPI. The entire procedure is repeated until a consistent solution for real DPI is obtained. An aggregate marginal propensity to consume which is less than unity assures convergence toward a unique solution. In practice, the model requires usually no more than three iterations with a reasonable first guess of income.

We have briefly sketched the structure and solution procedure for the real and income model, given vectors of wages and prices. A full model solution next requires the solution of the price-wage model consistent with the latest output of the real and income model. The top two boxes in the right portion of Chart I-1 illustrate the aggregate unemployment as a key variable affecting rates of changes for four aggregate wage indexes as well as relative wages by industry. The rate of change of industry employment also affects industry wages. The value-added price markup equations, in the fourth box down, are affected by unemployment rates, changes in output, and output/capital stock ratios. Gross output prices depend on the real model for the matrix of input-output coefficients and labor productivity by industry. Final demand deflators are obtained by aggregating the gross output prices with fixed weights. Since the output of the price-wage model is quarterly, the vectors of prices and wages for use in the real and income model are annualized by simply taking four-quarter calendar year averages.

At this point we have made one iteration of the complete system. The first step in the second iteration is to use the revised vectors of prices and wages to solve for real outputs, income, and the unemployment rate. The solution procedure thus consists of iterating back and forth between the two models until all outputs and prices (and incomes) do not differ by more than a specified tolerance from one iteration to the next.

The details of a rigorous solution to the complete model are described in Chapter XI. In practice, this solution procedure may extend over a period of weeks prior to the completion of a formal INFORUM forecast. The models are iterated against each other as changes are made in the exogenous assumptions and errors corrected. If these changes are not large, revised solutions may not require more than several iterations of the complete system.

1.3 Previous Work Toward a Complete INFORUM Model

The work described in this thesis is not the first in the history of the INFORUM project dealing with income and price determination. These two areas have been the subjects of two previous Ph.D dissertations. In this section we review the major results of these studies and explain why much of this prior work could not be incorporated in the full model outlined in the previous section.

O'Connor Income Model

Brian O'Connor completed a thesis in 1973 entitled "An Income Side to an Input/Output Model of the United States."[3] The major focus of this study was to close the INFORUM model on the income side, as well as providing an industrial orientation to the income flows. However, O'Connor worked under the handicap of not having a set of price and wage equations. Industry prices and industry wages were the topics for two other doctoral research projects which were yet

[3] Brian O'Connor, "An Income Side to an Input/Output Model of the United States," unpublished Ph.D. dissertation, University of Maryland, 1973.

in the formative stages. As a result, rather ad hoc procedures were required in order to generate an actual forecast of the O'Connor model. Wage and salary (per employee) equations were simple time trends and (nomial) gross profits by industries were regressed against constant-dollar shipments and time. The nominal incomes generated by these procedures were then deflated by exogenously given values of the P Personal Consumption Deflator. These procedures, of course, divorces any link between real wages and real incomes and provided no built-in constraints on functional income shares by industry for long-range forecasts.

The most significant contribution of the O'Connor model was the development of a system to forecast wage and salary income distributions by size-class for individual industries. The Bureau of Labor Statistics' 1965 industry-occupation matrix was used to infer income distributions for 54 industries. The purpose of this exercise was to improve the accuracy of the federal individual income tax forecasts. Accordingly, income distributions for rental income, interest income and proprietors' income were also developed.

Given the computer requirements of achieving consistency between prices and incomes in the current model, the maintenance of income distributions by industry did not seem to have a high benefit/cost ratio. Moreover, the O'Connor distributions for future years required the use of a projected BLS industry-occupation matrix. Besides the uncertainty involved in the use of such projections, the updating effort itself (to use a more recently projected matrix would have been considerable. Accordingly, the study here has used a simpler, more flexible aggregate approach to forecasting federal individual income taxes, as explained in Chapter VII.

I have also omitted the industry functions, as estimated by O'Connor, for both dividends and corporate income taxes. Such equations would be required to derive retained earnings by industry, but nowhere in the model are retained earnings themselves required as explanatory variables. Aggregate functions appear quite satisfactory in explaining total corporate taxes and dividends. The latter, of course, are a part of personal income.

The O'Connor model made use of published industry data classified on a company basis only. For the present study, the industry data derives from the Bureau of Economic Analysis' (BEA) Gross Product Originating series which is adjusted to an establishment classification. We have been able to develop a correspondence between their time series industry data and that for the (1967) U.S. input-output table. Thus, the incomes by industry can be explicitly related to the forecasted input-output tables (and prices) rather than being independent as O'Connor was forced to make them.

Significant improvements have also been made in the computer structure of the income model. O'Connor's model could only be run independently from the real model. Each model was run for a 10 to 15 year forecast period, in turn, and each new sequence of disposable incomes coming out of the income model was entered manually as input to the real model for the next iteration. The model here has been programmed to automatically seek a disposable income solution on a year-by-year basis.

In conclusion, the building of the current model, at least in its initial stages, was aided by the existing conceptual framework of the O'Connor model. However, the development of consistency between the income model and, in turn, an endogenous price and wage system, the GPO industry data conventions, and the published input-output tables, required research efforts in many totally new directions.

Gilmartin Price Model

A Ph.D. thesis dealing with industry price determination was completed by David Gilmartin in 1976.[4] In "Forecasting Prices in An Input-Output Framework," Gilmartin constructed a disequilibrium model which sought to forecast prices at the full industry detail of the INFORUM model. In our review of literature on price determination in Chapter VIII, we discuss the Gilmartin model in some detail; therefore, only a general overview is needed here.

An important characteristic of the Gilmartin model preserved in the price-wage part of the present model is that it is totally recursive. Price equations using monthly data were estimated for approximately 130 industries where distributed lags of unit costs and output levels were the sole explanatory variables. The wage equations in the model (which were estimated by the present author) used only lagged prices in addition to other explanatory variables supplied by the real INFORUM model. Considerable attention was given to the estimation of the lag distribution. Thus, given the history of each industry's price and wage levels over

[4]David Gilmartin, "Forecasting Prices in an Input-Output Framework," unpublished Ph.D. dissertation, University of Maryland, 1976.

the previous 12 to 24 months, plus the explanatory variables exogenous to the price-wage model, the current month's prices and wages could be determined. Once the history (in terms of a computer file) is revised to include the new month's output, the model is ready to calculate prices and wages for the succeeding month, and so on.

Several main features of the Gilmartin model have been carried over in the price-wage model constructed here. First, the recursive structure is maintained except that the solution interval has been changed from months to quarters. This change was motivated primarly by a desire to decrease the rather substantial computer time requirements of the Gilmartin monthly model. The quarterly format also enhances the availability of certain time series for estimation purposes and provides a more accessible basis of comparison with the results of other researchers. I have also retained the price-wage model as an independent set of computer routines as in the Gilmartin model. The programming requirements to link the real, income, and price block within a single computer program would have been enormous.

The regression equations of the Gilmartin study were dropped in favor of a more deterministic approach for the present model. Basically, these equations could not be relied upon to provide reasonable income distributions by industry for long-run forecasting. A discussion of the issues involved here is given in Chapter VIII. The procedure in the present model ensures that the predicted behavior of prices, at least at the two-digit SIC industry level, is at least consistent with past behavior of value-added shares by industry. We also explicitly incorporate indirect business taxes in our price determination procedure, a factor which the Gilmartin model omitted. More careful attention is also given to the derivation of the aggregate consumer price indexes.

A Perspective on the Current Model

Unfortunately, the O'Connor and Gilmartin studies — as means toward a complete, disaggregated model of the economy — fell prey to one of the major stumbling blocks of the original Brookings model. In the de-velopment of the Brookings model, each block of equations worked fine as long as it was in the hands of the expert who built it. The problem, however, came when the entire system had to be put together. The eventual result was that the entire model had to be re-estimated with a consistent set of data and with the recognition of which (potential explanatory) variables would be endogenous in the final system.

As I have discussed above and will demonstrate in the succeeding chapters, the development of a consistent model required far more than a simple re-estimation of existing equations. The entire model had to be conceptualized in advance of major empirical work on individual sections of the model. As a result, most of the structure of the previous income and price models had to be abandoned.

The foregoing discussion provides the reader with a rationale for the broad scope of this study. However, in pursuing a consistent, complete model, I have not tried to substitute breadth for depth. In the following chapters I have attempted to be as rigorous in specifying equations as possible, given the restrictions of a complete econometric model.

Chapter II

THE STATISTICAL FRAMEWORK OF INDUSTRY VALUE ADDED

The input-output tables prepared by the Department of Commerce have been constructed within the framework of the U.S. National Income Accounts (NIA). This implies immediately that both the sum of final demands, and the sum of value added by industry are each equal to Gross National Product. Our concern is with the statistical relationship of the industrial distribution of value added in the published input-output table to the series prepared by the Bureau of Economic Analysis (BEA) for gross product originating (GPO) by industry.

The first part of this chapter analyzes this relationship in the 1967 input-output table. The information behind this study was painstakingly assembled from worksheet data graciously provided by BEA. In the second part of the chapter, we discuss how we employ this supplementary data in updating the INFORUM input-output table. Chapter III shows our use of this information in the income model proper.

2.1 Description of the GPO Data Series

We begin with a brief description of the statistical sources and methods underlying the GPO industry series.[1] This program began in

[1]See "GNP by Major Industries - Concepts and Methods," BEA unpublished document, 1966. Also see Jack J. Gottsegen and Richard C. Ziemer, "Comparison of Federal Reserve and OBE Measures of Real Manufacturing Output, 1947-1964," The Industrial Composition of Income and Product, ed. John W. Kendrick. (New York: Columbia University Press), NBER Studies in Income and Wealth, vol. 32, 1968.

1962 with the purpose of developing measures of the industrial origin of existing series of gross national product. BEA compiles this data for 64 two-digit SIC industries; within each industry thirteen separate value-added components are given as listed below:

1. Wage and salaries
2. Wage supplements
3. Corporate profits
4. Non-corporate income
5. Corporate inventory valuation adjustment
6. Non-corporate inventory valuation adjustment
7. Net interest
8. Corporate capital consumption allowances
9. Non-corporate capital consumption allowances
10. Indirect business taxes
11. Business transfer payments
12. Rental income
13. Subsidies

The data begins in 1947. The two-digit SIC data is not considered by BEA to be of publishable quality, but it can be obtained upon request. Totals for broad groups are published annually in the July issue of the Survey of Current Business.

The largest component of GPO is, of course, wage and salary payments. The primary source of wage and salary data is from tabulations prepared by the state Unemployment Insurance agencies (UI). This data is reported quarterly to the Department of Labor on a three-digit SIC basis and contains both total payroll and employment. These programs now cover about 85 percent of the employment in the private non-farm economy; BEA constructs estimates for the remainder from a variety of other sources. Wage supplements comprise employer contributions for social insurance and for private pension and welfare plans. The industrial composition of the social security contribution is based on reports to the Treasury. Employer contributions for pensions and other benefits are taken primarily from corporate tax returns submitted to IRS and published in Statistics of Income.[2]

An industry allocation of indirect business taxes and nontaxes is determined on the basis of legal responsibility for payment. The estimates are made for the following three categories:

(1) Excise taxes and customs duties

Specific excise taxes are not difficult to allocate since they are easily identified at the two-digit industry level. Customs duties are put into the value added for wholesale trade.

(2) Property taxes

The estimate of property taxes paid by industry are prepared so that the sum matches the total tax revenues reported by the individual states. This source, however, is not used for constructing the industry allocations. Some regulated industries provide data in their reports for the regulating agencies from which property taxes can be determined directly. In manufacturing, a primary source is the 1958 Census which published estimates of property taxes paid by each four-digit industry. These payments are moved forward by IRS depreciable assets data by industry and adjusted to conform to appropriate totals.

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[2]This procedure may be changed substantially in the recently issued 1972 benchmark revisions of the National Accounts.

(3) Sales and other taxes (including nontaxes)

Sales taxes are allocated primarily to wholesale and retail trade. The remaining items in this category (mainly licenses and fees) are assigned on the basis of detailed examination or allocated by industry sales or income originating.

Business transfer payments are of three types: consumer bad debts, business gifts to institutions, and other payments (mainly payments for personal injury). The first two are allocated primarily on the basis of IRS data. The greater part of personal injury payments is allocated by industry motor vehicle license fees.

Federal subsidies apply only to a handful of industries and are easily assigned by examining the specific program under which the payments are made. Farm subsidies comprise the largest portion of total subsidies; with railroads, water transportation, and real estate receiving the remainder.

A consideration of the remaining items of gross product originating—net interest, depreciation, and profits--leads to one of the most difficult measurement problems of national income accounting. This difficulty stems from the common ownership of establishments classified in more than a single industry. Conceptually, at least, two approaches are available to measure capital income for "pure" industries.[3] The first is to estimate profits directly from data for establishments. In manufacturing, annual Census data for value added by four-digit industry would provide a logical starting point. However,

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[3]Michael Gort, "The Analysis of Factor Shares by Industry," in The Behavior of Income Shares, NBER Studies in Income and Wealth, vol. 27, (Princeton, N.J.: Princeton University Press for NBER, 1964), pp. 287-316.

there are a host of serious problems associated with this approach. First, since Census value added data includes purchased business services, an estimate for these would be required on an annual basis. Secondly, an estimate of operating income derived as the difference between value of shipments and expenses for an establishment may not be a satisfactory measure of property income. The prices of shipments between operating plants of the same company may deviate from market prices. Furthermore, for multi-establishment campanies, a significant portion of expenses is omitted in reports of manufacturing establishments. Expenses for sales, advertising, engineering, legal services, and central administration are common to more than one establishment and in large companies, common to establishments classified in separate industries.

Finally, a major problem in using Census value added data would exist in making estimates for industries outside of manufacturing where no annual establishment data are availabe and in fitting all of the industry estimates within the totals provided by the IRS.

BEA takes the alternative approach of beginning directly with the IRS data on net interest, depreciation, and profits and reallocating the published totals on the basis of information linking companies to specific establishments. The source for this reallocation is the Census Bureau publication Enterprise Statistics. The Census link was first made for the 1958 Census and has been published for both the 1963 and 1967 Economic Censuses. Part three of this report shows a cross classification of employees by the industry of the owner company

(IRS classification) and the industries of the associated SIC classified establishments.

The Census link data is collapsed to approximately a 90 by 90 matrix. Each column of this matrix shows the distribution of employment in all SIC establishments owned by companies in a given IRS classification. That is, the entries in each column sum to 1.0. Profit and depreciation totals are then constructed for each of 90 IRS industries. The reallocation procedure followed for obtaining capital income by establishment based industry is akin to the "purification" of the INFORUM input-output table. In the INFORUM procedure, intermediate inputs are reallocated by outputs; assuming (initially, at least) that the input structure for a given product is the same regardless of where it is produced.[4] The assumption underlying the BEA reallocation procedure is that profits or depreciation per employee is the same in all establishments of a given industry regardless of the classification of the parent company. Thus, once the data are in hand, the solution is obtained by simple simultaneous solution of the 90 linear equations. In the 1972 benchmark BEA used the 1963 and 1967 enterprise-establishment studies to reallocate the more recent IRS data.

For certain industries (Transportation, Communication, Utilities, Finance) the SIC definition is that of an enterprise rather than an

[4]See Chapter 10 of Almon, Buckler, Horwitz, and Reimbold, 1985: Interindustry Forecasts of the American Economy, (Lexington, Mass.: D.C. Heath, 1974).

establishment basis. No adjustment was made for these industries as well as most service industries in which the problem of company and establishment classification is small. Net interest is a relatively small share of value added and is not allocated with the above procedure. It is taken directly from Statistics of Income and classified on a two-digit SIC basis. The above adjustments apply only to corporate profits and depreciation. Proprietor ownership of establishments in more than a single industry is rare, and so industry data for proprietors comes without change from IRS.

Estimates for the corporate and non-corporate inventory valuation adjustment are made for each two-digit SIC industry. There is presumably no problem with enterprise-establishment classification as these estimates are worked up primarily from Census establishment information on the book value of inventories and BLS wholesale prices.

The sum of the components for each industry is taken to be the gross (national) product originating (GPO) in that industry. The discussion here has been limited to allocation of current dollar items; a large portion of the BEA program is devoted to deriving constant dollar magnitudes. We shall consider briefly this aspect in the next chapter. We now turn to comparison of the GPO allocation of industry value added with that published in the 1967 input-output table.

2.2 Value Added in the 1967 Input-Output Table

Our objective in comparing the GPO series with the value in the published input-output tables is not merely to explain the source of the differences, but to develop an explicit transformation between the two data sets. We desire a transformation, F, such that

$$\text{I/O Table Value added} = F\ (\text{GPO, Supplementary Census Data}) \text{ and,}$$

$$\text{GPO} = F^{-1}\ (\text{I/O Value added})$$

F is necessary if we wish to use the available GPO data to help update the input-output table. F^{-1} is required if we want to use the INFORUM forecast values of input requirements, outputs, and prices to forecast the only consistent (and generally accepted) series on industry value added, namely, the Commerce Department GPO series. Since the INFORUM model operates from a given base year, we expect F^{-1} to reproduce exactly the GPO for that year. Aggregate values of the GPO components for forecast years are, of course, used to affect final demand expenditures and thus close the model on the income side.

We turn next to an analysis of the 1967 input-output table with respect to its treatment of value added. Further on in Chapter II we will lay out explicitly the F transformation, our procedure for updating value added in the INFORUM table. In Chapter III we will consider the forecasting of GPO from our input-output model, i.e., F^{-1}.

The development of F begins with an article in the Survey of Current Business describing value added in the 1963 input-output study.[5] The appendix of this article presented a reconciliation of the 1963 Gross Product Originating and value added in the 1963 table for a dozen or so broad industry groups. This broad reconciliation

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[5]Albert J. Walderhaug, "The Composition of Value Added in the 1963 Input-Output Study," Survey of Current Business, vol. 53, no. 4 (April, 1973), pp. 34-44.

was of little use in preparing industry value added for a more current year at the 200-order sector level of the INFORUM table. I was fortunate, however, to obtain from BEA much of the detailed data underlying the published value added for the 1967 I/O study. This data included estimates of value added--at seven component detail--for each of 484 industries. From this and other supplementary information, a reconciliation similar to that for the 1963 study was constructed. It is shown in Table II-1.

Column 1 of this table shows the GPO estimates of total value added which incorporate the revisions for the 1967 benchmark of the National Accounts.[6] The industry estimates do not include the inventory valuation adjustment which is shown at the bottom as a total for all industries. The category "Other" includes private households, government and government enterprise, and rest of the world. Column 2 shows several revisions that were made subsequent to the initial 1967 GPO benchmark figures and were incorporated in the table.

Before considering the remaining columns we note that an important objective in the construction of the U.S. input-output tables has been to achieve homogeneity of input structures of the commodities or activities within a single input-output sector. Industries with similar output distribution patterns were also considered for aggregation.

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[6]This data was obtained about a year in advance of the scheduled publication of the 1972 benchmark of the National Accounts and may differ from the final BEA values for industry GPO.

TABLE II-1

Reconciliation of 1967 Input-Output Value Added and Industry GPO - Industry Groups

	1967 GPO Benchmark (1)	Revisions (2)	SIC Reclassification (3)	Space Rental & MSO (4)	Force Account (5)	Activity Redefinition (6)	Miscellaneous & Unallocated (7)	Table Control (8)	Input-Output Value Added (9)
Farm	23598.0	-1559.2						22038.8	22038.8
Ag. Serv.	1881.9		-393.5			+558.9		2047.3	2343.0
Mining	14221.5		-1037.7		-524.5		-319.4	12339.9	13490.2
Construction	36640.8		+1037.7		9715.9	-1208.3		46186.1	45575.0
Manufacturing	223075.3			+3754.0	-542.6	+421.4	-23.3	226684.8	228995.1
Transportation	32385.8				-875.5	-2.5		31507.8	30996.2
Communications	17623.3			-20.1	-489.2		+342.7	17456.7	17608.9
Utilities	18775.2			-14[illegible].0	-1007.7			17625.5	17712.0
Trade	129789.2	39.8	98.6	-3816.8	-50.9	-6313.4		119746.5	118265.0
Finance & Ins.	27028.8			-11.8	-20.0			26997.0	26899.4
Real Estate	83437.5	238.0		1861.8	-1616.8	152.2		84072.7	84072.7
Services	83685.7	59.4	294.9	-1625.1	-150.4	6391.7		88655.8	88505.6
Other	105167.6				-4438.3			100729.3	100729.3
IVA	-1843.0							-1843.0	-1843.0
Stat. Disp.	1143.0							1143.0	-
TOTAL	796610.6	-1222.4	0.0	0.0	0.0	0.0	0.0	795388.2	795388.2

One means of satisfying these criteria is reclassification of minor SIC industries. An example is the treatment of SIC 0772, veterinary services; which is moved from Agriculture Services, Forestry and Fisheries (SIC 07-09) to Medical Services. Column 3 shows the net effects of these adjustments. The entries in mining and construction show the reclassification of SIC 138, oil and gas well drilling. Trade has been increased by the value added of trading stamp companies (SIC 7396) moved out of Services.

Two special adjustments are shown in column 4. The gross margin of manufacturer's sales offices in trade (MSO's) are taken out of trade, where GPO put them, and moved into manufacturing. Presumably these margins are covered by the value of shipments reported in the Census of Manufactures. The industrial distribution within manufacturing is based on data for employment and payroll of MSO's in the Census of Wholesale and Retail Trade. The space rental adjustment moves all the rent receipts of non-manufacturing industries into the real estate industry. (The rents and royalty receipts for manufacturing industries are also moved into the real estate sector, but this is done via explicit "transfers." As such, they would appear as entries in the 484-level table obtainable from BEA on magnetic tape.)

The primary means of achieving more homogeneous groups is through "redefinition" of certain activities from one industry to another. Estimates of all construction work performed by employees not in the construction industry (force account) were transferred to the construction industry. As shown in column 5 of Table II-1 this amounts to over 20 percent of the published value added in the construction industry for 1967. The estimates of this construction work includes that for new and maintenance and repair. The largest single redefinition was that for maintenance and repair of highways performed by state and local government employees.

Numerous other redefinitions of activities were made, affecting especially the trade sectors. These are shown in column 6. Activities removed from retail trade include auto repair in service stations, meat cutting and bakeries in grocery stores, and the many services performed in large retail department stores.

The sum of GPO and the various adjustments is displayed in column 8. The next column plainly shows that the final table was not balanced to achieve exact agreement with estimated value added even for these broad groups. The major discrepancies between the guideline controls and the final value added are in minimg, manufacturing, and trade. It is apparent that these groups are absorbing most of the statistical discrepancy of 1143.0 so that the differences are not as large as at first glance.

With the nature of these special adjustments in mind, we turn next to examine more thoroughly the strategy pursued by BEA in balancing the 1967 table and the 1967 estimates at a finer industrial disaggregation.

For the 1967 table, BEA decided to prepare in advance independent estimates of value added at the most detailed level. Aggregated to 13 sectors, they are shown in column 8 of Table II-1. These were constructed as the sum of seven components--wages and salaries, wage supplements, net interest, indirect business taxes, depreciation, business transfers, and profit income. In nonmanufacturing, the sources for this information were essentially the same as for the GPO series. In manufacturing, the basic procedure was to use Census data to allocate GPO control totals for all manufacturing or smaller groups.[7] This information was eventually aggregated to the BEA 87-industry level and the components were collapsed to labor compensation, indirect business taxes, and profit type income.[8] The various reclassifications and redefinitions were added and subtracted, also broken down into these three components. During the balancing phase of the table-making process, the difference between output and the sum of intermediate input on the one hand and this independent estimate of value added on the other were compared at the 87-sector level. Some adjustments were made to intermediate inputs—on the basis of this comparison—to achieve as much consistency as possible between the two magnitudes. Some idea of the importance of the discrepancies between the two measures of value added which remained in the final table—at a two-digit SIC level—can be gained by examining Table II-2.

The force account and other redefinitions have been excluded from the input-output value added components to achieve comparability with the corresponding GPO item. The input-output value added controls, however, include the SIC reclassifications, manufacturers' sales

[7]The profit and depreciation items came from the reallocation of approximately three-digit IRS data. This was sufficient to produce profit and depreciation at the 87-sector level, which was eventually considered in the balance.

[8]The degree of disaggregation for value added was presented in the published 87-sector (1967) I/O table appearing in the February, 1974 issue of the <u>Survey of Current Business</u>.

TABLE II-2

COMPARISON OF 1967 GPO AND I/O TABLE VALUE ADDED BY INCOME SECTOR*

	WAGES		SUPPLEMENTS		IND BUS TAX		CCA		OTH PROFIT INC		TOTAL V.A.	
	GPO	**LF**	**GPO**	**LF**	**GPO**	**LF**	**GPO**	**LF**	**GPO**	**LF**	**GPO**	**LF**
1 FARMS	3219.	1.000	161.	1.000	1735.	1.000	5217.	.996	11737.	1.000	22039.	1.000
2 AG. SERVICES, FORESTRY, & FISHERIES	673.	1.000	51.	1.000	69.	1.000	254.	1.000	442.	1.670	1488.	1.199
3 METAL MINING	616.	1.000	70.	1.000	105.	1.000	135.	1.000	-85.	-2.381	841.	1.343
4 COAL MINING	1012.	1.000	235.	1.000	69.	1.000	252.	1.000	256.	1.117	1824.	1.016
5 CRUDE PETROLEUM & NATURAL GAS	2176.	.719	153.	.784	795.	.930	2427.	.933	3968.	1.227	9199.	1.014
6 NONMETALLIC MINERAL MINING	847.	1.000	80.	1.000	68.	1.000	381.	1.000	463.	1.189	1839.	1.048
7 CONTRACT CONSTRUCTION	24538.	.891	2339.	.885	611.	1.062	1937.	.970	7147.	.735	36572.	.942
8 FOOD AND KINDRED PRODUCTS	11308.	.973	1338.	1.032	4384.	1.009	1601.	1.012	3363.	1.338	21994.	1.056
9 TOBACCO MANUFACTURES	454.	1.009	95.	.861	2153.	1.001	65.	1.000	716.	1.313	3483.	1.062
10 TEXTILE MILL PRODUCTS	4753.	.985	438.	1.114	120.	1.183	570.	1.011	1042.	1.384	6923.	1.073
11 APPAREL	5924.	.981	594.	1.012	95.	1.063	140.	1.021	939.	1.347	7692.	1.026
12 LUMBER AND WOOD PRODUCTS	3095.	.942	262.	1.239	121.	1.025	498.	1.002	1072.	1.330	5048.	1.052
13 FURNITURE AND FIXTURES	2469.	.948	225.	1.142	62.	1.000	128.	1.008	510.	1.460	3394.	1.041
14 PAPER AND ALLIED PRODUCTS	4878.	.996	478.	1.256	211.	1.085	960.	1.005	1555.	1.206	8082.	1.066
15 PRINTING AND PUBLISHING	7395.	1.005	674.	1.077	170.	1.023	578.	1.009	1847.	1.086	10665.	1.024
16 CHEMICALS AND ALLIED PRODUCTS	8152.	.988	1202.	.931	368.	1.163	1931.	1.010	4158.	1.337	15811.	1.104
17 PETROLEUM REFINING	1961.	1.022	684.	.461	3954.	1.003	1155.	1.001	374.	1.077	7228.	.960
18 RUBBER AND MISC. PLASTICS	3422.	1.015	473.	1.081	572.	1.009	384.	1.005	786.	1.535	5637.	1.092
19 LEATHER AND LEATHER PRODUCTS	1632.	.944	155.	1.099	25.	1.040	49.	1.000	305.	1.194	2166.	.993
20 STONE, CLAY, AND GLASS PRODUCTS	4291.	.978	531.	1.021	150.	1.106	738.	1.007	841.	1.695	6542.	1.094
21 PRIMARY METALS	10437.	1.011	1718.	1.051	452.	1.190	2449.	1.006	3245.	.743	18301.	.985
22 FABRICATED METAL PRODUCTS	9690.	1.013	1083.	1.221	292.	1.017	777.	1.003	2849.	1.254	14691.	1.077
23 MACHINERY, EXCEPT ELECTRICAL	15485.	.979	1841.	1.049	399.	1.058	1708.	1.010	4626.	.964	24060.	.997
24 ELECTRICAL MACHINERY	13916.	1.029	1461.	1.257	295.	1.105	1207.	1.008	3677.	.907	20556.	1.032
25 TRANS. EQUIP. & ORDNANCE	12361.	1.078	1538.	1.157	305.	1.217	703.	1.001	1288.	.740	16194.	1.058
26 MOTOR VEHICLES	7050.	.975	2279.	.588	1995.	1.002	1055.	1.006	2853.	.624	15232.	.865
27 INSTRUMENTS	3073.	.994	359.	1.041	73.	1.041	425.	1.023	1279.	1.113	5210.	1.005
28 MISC. MANUFACTURING INDUSTRIES	2452.	.973	248.	1.034	63.	1.064	151.	1.007	558.	1.451	3472.	1.064
29 RAILROADS	5668.	1.000	810.	1.000	430.	1.000	1560.	1.000	545.	-.282	9015.	.922
30 LOCAL, SUBURBAN, & HIGHWAY PASSENGER	1547.	1.000	161.	1.000	122.	1.000	291.	1.000	1829.	.987	2778.	.997
31 TRUCKING AND WAREHOUSING	7106.	1.000	647.	1.000	762.	1.000	1274.	1.000	1793.	.719	11582.	.957
32 WATER TRANSPORTATION	1082.	1.000	189.	1.000	77.	.974	326.	1.000	49.	2.428	2524.	1.027
33 AIR TRANSPORTATION	2615.	1.000	339.	1.000	307.	.997	991.	1.000	402.	.879	4683.	.989
34 PIPELINE TRANSPORTATION	158.	1.000	15.	1.000	49.	.980	181.	1.001	457.	.947	861.	.967
35 TRANSPORTATION SERVICES	547.	1.000	61.	1.000	56.	1.000	93.	1.000	62.	1.475	832.	1.021
36 TELEPHONE AND TELEGRAPH	6062.	1.000	924.	1.000	2512.	1.000	2135.	.998	4736.	1.011	16359.	1.003
37 RADIO AND TELEVISION BROADCASTING	972.	1.000	89.	1.000	46.	1.000	178.	.984	296.	1.008	1581.	1.000
38 ELECTRIC, GAS, AND SANITARY SERVICES	5144.	1.000	768.	1.000	2365.	1.006	3658.	.974	6677.	.973	18612.	.990
39 WHOLESALE TRADE	25115.	1.000	1610.	1.000	12102.	1.000	2195.	1.000	7401.	.715	48474.	.972
40 RETAIL TRADE	42747.	1.000	3205.	1.000	9748.	1.000	4431.	1.002	16612.	1.048	76743.	1.011
41 BANKING AND CREDIT AGENCIES	9246.	1.000	1279.	1.000	894.	1.000	1001.	.988	2325.	.944	14745.	.990
42 INSURANCE AGENTS AND BROKERS	8010.	1.000	956.	1.000	1132.	.998	444.	1.000	1742.	1.020	12284.	1.003
43 REAL ESTATE AND COMBINATION OFFICES	3215.	1.611	350.	1.557	18207.	1.003	15449.	1.104	46455.	1.013	83675.	1.036
44 HOTELS AND OTHER LODGING PLACES	2668.	1.000	188.	1.000	294.	1.000	700.	1.000	853.	.748	4784.	.943
45 PERSONAL SERVICES	4489.	1.000	312.	1.000	214.	1.000	669.	1.000	2712.	1.106	8594.	1.034
46 MISC. BUSINESS SERVICES	13302.	1.000	791.	1.000	295.	1.000	1477.	1.000	8901.	1.043	24876.	1.015
47 AUTOMOBILE REPAIR AND GARAGES	1694.	1.000	108.	1.000	118.	1.000	957.	1.000	1030.	.866	3908.	.965
48 AMUSEMENT AND RECREATION SERVICES	3073.	1.000	292.	1.000	920.	1.000	619.	1.000	650.	1.000	5465.	.987
49 MEDICAL AND OTHER HEALTH SERVICES	10192.	1.000	565.	1.000	131.	1.000	553.	1.000	9714.	.992	21165.	.998
50 EDUCATIONAL SERVICES	12301.	1.000	815.	1.000	185.	1.000	832.	1.000	290.	.943	13622.	.978

*LF = Link Factor = Table Value Added/GPO

SOURCE: BUREAU OF ECONOMIC ANALYSIS GPO FILE AND INPUT OUTPUT WORKSHEET DATA offices in trade, and space rental imputations; and so the GPO figures have been adjusted to reflect these. The first four pairs of columns are straightforward, showing the difference between the value added component going into the table controls and the component in the GPO file. The table illustrates clearly that the controls for nonmanufacturing came with practically no change from GPO.[9] The rather large difference in the wage supplements figures indicates a company-establishment problem with the current (as of 1975) GPO source. Apparently the 1972 Benchmark NIA revisions incorporate Census data in manufacturing to derive the GPO wage supplements figure.

Other profit income in the I/O table is taken as a residual, i.e. it equals published value added minus redefinitions minus the sum of the components listed at the left: (1) wages, (2) wage supplements, (3) indirect business taxes, and (4) capital consumption allowances. This estimate of "other profit income" is compared to the sum of net interest, corporate profits, proprietor income, business transfer payments, subsidies, and IVA from the GPO data file. The I/O table/GPO ratios outside of manufacturing, mining, and trade indicate that the table was balanced to maintain approximately the given value added control. For these sectors, less confidence could be placed in the data for intermediate inputs than could be put in the value added.

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[9] In the INFORUM aggregation of the 484-level table all but two maintenance and repair sectors are put back with their primary activity. This causes several distortions in Table II-2. First, the components for the real estate sector do not match when they really should. The same sort of problem exists in the treatment of maintenance and repair construction for oil and gas well drilling in sector 5.

In manufacturing, however, Census establishment data for materials consumed proved to be relatively immutable for some industries.[10] Thus, the independent estimate for value added gave way substantially in some industries, notably in petroleum refining, primary metals, and automobiles. We have assumed in Table II-2 that the discrepancy is borne by profit-income, since it stems originally from company data and the labor compensation and indirect business tax estimates have more of an establishment basis. Strictly speaking, CCA should also absorb some of this discrepancy since it too is reallocated from company data. In addition, it may be that certain redefinitions are a source of some of the problem since the redefined output (not shown here) may not be consistent with the redefined value added.

There are clearly substantial problems in arriving at some concept of "pure" industry profits even in a relatively "normal" year such as 1967. Table II-2 is not presented as a criticism of the BEA balancing procedure, but rather to show that exact industry measures of value added, especially profit income, are not possible for all industries within currently available statistical sources in the U.S.

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[10]The ratios in column 10 should be taken as only an approximate indication of how far the residual element differs from the independent estimate of profit income. First, there are small differences between the GPO profit data in manufacturing and the actual controls estimated for the table. Second, the GPO magnitude includes IVA whereas the controls do not. Subtracting the (negative) IVA would cause the GPO profit entry to increase in the following three industries: retail trade, 574 million; wholesale trade, 197 million; nonelectrical machinery, 227 million.

2.3 Value Added in the Updated INFORUM Table

Sources of Information

As was pointed out at the beginning of the last section, the detailed reconciliation is an important aid in updating the INFORUM table. We now turn directly to laying out the F transformation to which we alluded at the beginning of the previous section. The 1967 200-order table is moved up to the current base year (at present, 1972) by a modified RAS procedure.[11]

Formerly the "column controls" (i.e. gross outputs minus value added) for this procedure were estimated in a somewhat casual manner. In nonmanufacturing total material and service inputs were assumed to move proportionately to total (current dollar) output. In manufacturing, Census data on cost of materials were used to move forward the intermediate input sum from the 1967 table. These data, taken on four-digit SIC basis, were adjusted by the Census specialization and coverage ratios to be made consistent with the INFORUM activity base, rather than an establishment level. This establishment-activity problem will be discussed a bit later.

In using the information derived from the 1967 value added study, at least two alternative approaches to updating can be devised. The first may be thought as a "bottom up" procedure; the second, a "top down."

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[11]See 1985: Interindustry Forecasts of the American Economy, pp 154-157.

In the first, the GPO component data are used separately to move up the corresponding value added control figure made up for the 1967 table. That is, the first step involves creating two-digit subcontrols by multiplying the 1972 (or any other year for the new table) GPO figure for (1) wages and salaries, (2) wage supplements, (3) indirect business taxes, (4) CCA, and (5) profit income by the appropriate link factor as shown in Table II-2. Since the extrapolated values for each component will not sum to the economy totals, a second scaling forces consistency for each component across the economy or within certain broad industry groups. The value added control for each industry is taken to be the sum of the components after scaling.

The "top down" procedure treats value added as a lump sum for each industry. The scaling at a two-digit basis is done first on total value added and then a scaling applied to make consistent totals for broad groups. The differences in the results of the two procedures are dependent on the extent to which the value added components change from the base year and the size of the scaling factors as shown in Table II-2. One might expect to find noticeable differences in two methods in an industry like Motor Vehicles where the profit scaling factor is much different from 1.0.

The INFORUM research group has been currently engaged in updating the 1967 table to 1972 with the incorporation of as much information from the 1972 Census of Manufactures as feasible. Most notably, this effort is designed to use information for individual coefficient change within a general RAS balance.

At this writing, most of the column controls for this balance were derived from application of the "bottom up" approach as described above. To obtain controls at the INFORUM 200-sector disaggregation, a two-stage scaling procedure was followed. First, values for wage and salary payments were assembled for each of the INFORUM sectors for 1967 and 1972 using data from the Unemployment Insurance (UI) program.[12] The wage and salary components underlying the 1967 table were then moved forward by the UI wage indexes at the 200-order detail. The resulting wage and salary figures were aggregated to five groups--agriculture, construction, manufacturing, nonmanufacturing, and government--and then scaled to match the growth in total wage and salaries for these groups as shown in the GPO data file.

No data were available for wage supplements below the two-digit SIC basis. Accordingly, the wage indexes created above were used to move the 1967 wage supplement estimates, again at the 200-order detail. Since the GPO file does have wage supplements at the two-digit SIC level, the more detailed values were aggregated and forced to have the same <u>growth</u> as the GPO value. A second scaling was made for the five broad industry groups as before.

A similar treatment as for wage supplements was applied to indirect business taxes, CCA, and profit type income (corporate profits + proprietor income + net interest + IVA + business transfer payments). The detailed "mover" indexes used here were simply value

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[12]See Chapter 6 for a discussion of the Unemployment Insurance program as a source for this data.

of shipments. Scaling was then applied at the two-digit and sectoral level as previously.

The components were then summed for each 200-order industry and then a final scaling was made to match total GNP. The resulting value added estimates were then taken to be consistent with BEA table value added on a Census-SIC establishment basis. The next step was to make an estimate of the redefinitions in order to be consistent with BEA methods. The 1967 values for the redefinitions were simply moved forward by the appropriate industry value added or in some cases, to gross output.[13]

Problems Caused by the Product-to-Product Table

After adding and subtracting the redefinitions, the resulting value added by sector is then consistent with the BEA establishment I/O table. The INFORUM group, however, has used the published information for secondary products by establishments in the 1967 table to create a "product-by-product" table. At the 484-industry level of detail, a matrix, M, was constructed for which each element M_{ij} shows the proportion of product j produced by industry i.

An explicit discussion of the method employed to create the product table may be found in Chapter 8 of 1985: Interindustry Forecasts of the American Economy. We may briefly summarize here. The underlying assumption in constructing the product-to-product table

[13]Chapter III contains a more explicit discussion of how the redefinitions were handled.

is that each product is made by the same process, no matter what kind of establishment makes it. Let f_i be the vector of purchase of product i which would exist if each establishment specialized only in the product with its same classification. In other words, f_i is the transpose of i^{th} row of the BEA primary flow matrix, (f_{ij} = purchase of product i by establishments in industry j); and p_i is the transpose of the i^{th} row in a pure product-to-product flow matrix.

The assumption of a fixed bill of inputs for each product means that the amount of any input for each establishment, as shown in the primary flow table, is a weighted average of the outputs it produces. explicitly,

$$f_i = Mp_i$$

The vector p_i, of course, may be obtained by simply inverting the M matrix.

$$(2.1) \quad p_i = M^{-1} f_i$$

The trouble with this technique is that the resulting p_i vectors will generally have some small negative elements and many small positive entries. The negative entries are nonsense and must be removed. The procedure developed by Almon employs an iterative solution to (2.1) which continually checks to see if a negative entry (for say industry k) is about to be produced. If so, the claims of those industries, which, on the basis of the product mix matrix, require more of input i than establishment k uses, are all scaled down. Establishment k "gives up" no more of the input than it already is using, and so negative entries are averted. We may illustrate by considering a simple four-by-four product-to-establishment matrix.

Establishment 1 makes both product 1 and product 2; establishment 2 makes only product 2. The primary flow table might look like that shown in Table II-3.

TABLE II-3

Product-by-Establishment Table for Four-Industry Example

	Establishment					Product
	(1)	(2)	(3)	(4)	FD	Output
Product 1	0	0	0	0	106	106
Product 2	0	0	0	0	175	175
Product 3	1	8	0	9	0	18
Product 4	40	52	10	0	0	102
Value Added	100	80	8	93		
Establishment Output	141	140	18	102		

Note that since this is a product-by-establishment matrix, the sum of outputs and inputs for each classification do not have to agree. However, total outputs for all industries are computed from both the sum of inputs and the sum of sales do match. The secondary products matrix for our example is:

$$M = \begin{pmatrix} 1.0 & .2 & 0 & 0 \\ 0 & .8 & 0 & 0 \\ 0 & 0 & 1.0 & 0 \\ 0 & 0 & 0 & 1.0 \end{pmatrix}$$

In this simple case, we have only one instance of an establishment producing a secondary product, so we need not explicitly invert M.

Instead, we only have to recognize that establishment 2 produces only product 2 and thus the input structure for product 2 can be observed directly. Since 20 percent of product 2 is produced in establishment 1 all we have to do is subtract from each input cell in establishment 1, 25 percent of the corresponding figure for estabsihment 2. The resulting input columns for product 1 and 2 in a product-to-product table would be as in column A Table II-4.

TABLE II-4

Columns of Product-to-Product Table for Four-Industry Example

	A		B		C	
	1	2	1	2	1	2
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	-1	10	0	9	0	9
4	27	65	27	65	27	65
VA	80	100	80	100	79	101
Output	106	175	107	174	106	175

However, we observe here the empirically relevant case of a small negative entry for product 3 to product 1. The Almon iterative method prevents this from occurring, and if it were applied to all rows, including value added, the results would be as in column B in Table II-4. The problem with this approach is that the sum of inputs for product 1 is now computed to be 107, whereas, we know from the product-establishment table that the total output of product 1 is 106 (and vice versa for product 2). In fact, the Almon procedure in the past has been applied to only intermediate inputs. The results of this procedure are shown in the column under C in Table II-4; here the discrepancy is taken up in the value added entries. The value added under this procedure may be termed the "value added of the purified matrix." This is distinguished from the "purified value added" shown in columns A and B of Table II-4.

The extent of the difference between these two measures of a "product value added" is a measure of how good is the assumption of unique input structures for each product. In our simple example above, the value added per unit of output 2 is 16/35 in establishment 2, in establishment 1 the value added content of the same product is 17/35 in the INFORUM purified matrix. Of course, one may also assume that other intermediate inputs rather than value added may be substituting for the limiting input. The problem here is choosing whether all inputs may be substitutable, or just a few determined a priori. Furthermore, the empirical application would become unmanageable, as all rows would have to be considered simultaneously. For now, we may simply assume that reaching the zero minimum for an input means that, on balance, the value added content of the secondary product is different from that of the same products produced in their primary establishments.

Fortunately, the difference between the value added of the 1967 purified matrix and the 1967 purified value added were small, except for a handful of industries. As a result, we simply use the elements of the purified value added vectors as extrapolators of the 1967 value added vectors of the INFORUM table. Once an estimate of the value added vector is made, the "column controls" for the RAS balancing algorithm are obtained simply by substracting it from the vector of product outputs. However, one should not get the impression that the resulting numbers are immutable, especially not at the first industry detail of the INFORUM model. The reader will note some restrictive assumptions made in the allocation of nonwage income below the two-digit SIC level and also in the use of a constant 1967 product-mix table. As a result, there is always a need for using some judgment when actually balancing a table as large as the INFORUM table.

In hindsight, it seems preferable to pursue the "top down" approach in constructing the value-added controls for the INFORUM table. This treats value added for each industry as a lump sum and makes the reconciliation with the known BEA table much easier to understand. More importantly, however, it is consistent with the only manageable method of forecasting GPO from the complete model, as we shall see in the next chapter.

In future work, it is hoped that four-digit Census value added data may be used for allocations below the two-digit controls provided by the GPO series. In the "top down" approach, the GPO series would then serve as indexes of total value added at the two digit level, thus preserving their known relationship with the 1967 table at this level of aggregation. In the next chapter we assume that such a table has already been produced. The current 1972 table — balanced to the "bottom up" value added controls — is probably not very different from this preferred table, since the value added controls under the two schemes would differ only in those industries where the component scaling factors as shown in Table II-2 were significantly different from unity.

APPENDIX 2A

DETAILED SOURCES FOR HISTORICAL OUTPUT AND PRICE SERIES

This appendix describes the current and constant dollar output indexes of the standard INFORUM model. The documentation here contain a number of revisions to the sources as shown in Appendix 8A, (pp 166-169) of 1985: Interindustry Forecasts of the American Economy. Each industry's output, as defined in the 1967 I/O table, has been extrapolated by the series described here.

In constructing the output controls for the U.S. input-output table, BEA has the benefit of a complete economic census as well as cooperation by other government agencies. Even with the more recent census data at hand (for 1972), the amount of effort to duplicate the BEA procedures would be prohibitive. We must be content with using more accessible data sources for constructing our annual output and price series.

Our primary data is compiled in two of any three categories: (1) Value current dollar production or revenue, (2) Quantity--any index of real output, and (3) Price--a published price index or actual commodity price. For certain sectors (e.g., agriculture and mining) output series are constructed from more disaggregated data for individual commodities. In these cases, a Laspeyre quantity series is computed having the same base year as the current version of the model.

For some series we have been unable to construct completely independent measures of output. In these cases, we have made some simplifying assumptions as to the behavior of intermediate inputs or intermediate sales to supplement other data. For most service sectors, personal consumption expenditure comprise the dominant proportion of total output. In the few Service sectors where no independent gross output measure is available, output is assumed to move proportionately to personal consumption expenditures. For the "dummy" sectors—Business travel, Office supplies, and Unimportant industries—gross output is distributed among intermediate users only. The output is computed by summing up the sales to intermediate buyers, assuming constant 1967 I/O coefficients (in value terms) for all buying industries (using those industries known outputs).

For a handful of other sectors we turn directly to the Gross Product Originating (GPO) data compiled annually by BEA. By using current dollar GPO to extrapolate industry output we, of course, are assuming that the sum of intermediate inputs is approximately a constant share of output. We use, as well, the GPO deflator to construct a constant dollar series.

In addition to direct use of the GPO series, we have also made use of intermediate data compiled by BEA. We have examined the information in the GPO worksheets to determine whether the GPO deflator is a direct output deflator (in which case, constant dollar GPO is a derived figure), or whether it is an implicit deflator obtained by dividing current dollar GPO by an extrapolator of real output. We use either the direct output deflator or output extrapolator (i.e., ton-miles of freight) in making up some of our constant dollar output series. In some cases, BEA compiles total revenue data as well, and this provides directly our current dollar output index.

Below are the detailed source descriptions by major industry groups.

Agriculture (1-7) — Statistical Abstract of the U.S. 1973 (SAUS 73)

Table 1001, "Farm Income - Case Receipts from Farm Marketings."

Sector	Current Dollar Source	Quantity of Deflator Source
1. Dairy Products	SAUS 73 T.1001 - Dairy Products	Wholesale Price Index (WPI) - Fluid Milk
2. Poultry & Eggs	SAUS 73 T.1001 - Eggs, Broilers Turkeys & other Poultry	Prices received by farmers in Survey of Current Business (SCB) - Poultry and eggs
3. Livestock	SAUS 73 T.1001 - Hogs, Cattle Sheep, Wool, Other Livestock products	WPI - Livestock
4. Cotton	SAUS 73 T.1020 - Principal Crops - Acreage, Production, and Value" (or Agricultural Statistics - individual commodity chapters) Farm value of production for cotton	SAUS 73 T.1020 - Total Cotton production in pounds
5. Grains	SAUS 73 T.1020 - Farm Value of production for barley, sorghum, corn, oats, wheat, rye, and rice	SAUS 73 T.1020 - Quantity measure (bushels) of farm production for commodities listed at left
6. Tobacco	SAUS 73 T.1020 - Farm value of production - Tobacco	SAUS 73 T.1020 - production in pounds
7. Other Crops	SAUS 73 T.1001 - Oil bearing crops, Vegetables, Fruits, and tree nuts, Other Crops, + value of production for Hay T.1020	WPI - Fruits and vegetables - fresh and dried

Sector	Current Dollar Source	Quantity of Deflator Source
Agricultural Services, Forestry, Fisheries (8, 10)		
8. Forestry Products	Forestry - Cost of Stumpage[1]	Weighted Price for Stumpage & logs: Douglas Fir, Southern pine, ponderosa pine, western hemlock, oak, maple. (SAUS 76 T.1160, "Selected Species-Stumpage & logs) 1972 weights estimated from Census of Manufactures
9. Fishery Products	"Fisheries - Value of Catch SAUS 73 T.1072, "Fisheries - Quantity and Value of Catch"	Average price per pound from same source as quantity
10. Agricultural Services	GPO - Agricultural Services, Forestry, Fisheries	GPO - Output extrapolator employment for forestry, deflated value of catch for fisheries

Mining (11-18)

All of the current and constant dollar series for mining were constructed by aggregating the individual commodity value and quantity values reported by the Bureau of Mines. This data is found in the Minerals Yearbook (Table 2 of "Statistical Summary" chapter) or in the Statistical Abstract of the U.S.

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[1]Cost of Stumpage for any year t is estimated by

$$\text{Cost of Stumpage}_{tt} = \frac{\text{Cost of Stumpage}}{\text{Total Cost of Materials}} \times \text{Cost of Materials}$$

Where s is the latest Census of Manufactures data for SIC's 2411, 2421, 2426, 2429, and t is a given year's data taken from the Annual Survey of Manufactures.

Below are listed only the individual commodities used in the aggregation for each sector.

Sector	Value	Quantity
11. Iron Ore	Iron Ore	Iron Ore
12. Copper Ore	Copper Ore	Copper Ore
13. Other Nonferrous Metals	Bauxite, gold, lead, mercury, molybdenum, silver, titanium, tungsten, uranium, vanadium, zinc	Same as for value
14. Coal Mining	Bituminous and Lignite, Anthractie	Same as for value
15. Crude Petroleum & Natural Gas	Crude Petroleum, natural gas, natural gas liquids, liquified petroleum	Same as for value
16. Empty		
17. Stone & Clay Mining	Sand and Gravel, Stone, Talc, Jermiculite, Asphalt, Peat abrasive stones, Asbestos, Cement, Clays, Feldspar, Gypsum, Lime, Perlite, Pumice, Salt	Same as for value
18. Chemical & Fertilizer Mining	Sodium Carbonate, Sodium Sulfate, Sulfur Barite, Boron, Fluorspar, Phosphate Rock, Potassium Salts	Same as for value

Construction (19, 20)

Sector	Current Dollar Source	Quantity or Deflator Source
19. New Construction	GPO	BEA worksheet (Value-added deflator for new construction)
20 Maintenance & Repair Construction	Intermediate via constant coefficients	BEA worksheet (CPI for home repairs)

Manufacturing (21-166)

The source for current dollar output is the Annual Survey of Manufactures data for 5-digit SIC product shipments. Unpublished 4-digit deflators from BEA are used to create constant dollar series. These deflators are primarily derived from the WPI indexes, although BEA uses a variety of other sources where WPI coverage is weak.

Sector	Current Dollar Source	Quantity or Deflator Source
Transportation (167-173)		
167. Railroads	Current dollar revenue - BEA worksheet	Implicit Output deflator for freight & Passenger - BEA worksheet
168. Local Transit, Intercity Busses	(a) "Intercity Bus Lines - Summary of Operations" - Operating Revenue SAUS 73 T.918	Intercity Busses - millions of passenger miles BEA worksheet
	(b) Local transit total operating revenue (public & private) - BEA worksheet	CPI - transit fares - BEA worksheet
	(c) Taxis - Current dollar operating revenue - BEA worksheet	PCE deflator - BEA worksheet
169. Trucking	SAUS 73 T.883 "Operating Revenue by Type of Transport" - Motor Carriers of Property	GPO deflator (Output deflator--revenue per ton-mile for Class I carriers from ICC)
170. Waterlines	SAUS 73 T.883 Waterlines - operating revenues	GPO in constant dollars [1972 Laspeyre output index of ton-miles (and tons)]
171. Airlines	SAUS 73 T.918 Revenues of U.S. Domestic & International Scheduled Air Carriers, plus Supplemental Air Carriers	GPO in constant dollars

Sector	Current Dollar Source	Quantity or Deflator Source
172. Pipelines	SAUS 73 T.918 - Pipelines	GPO in constant dollars (index of ton-miles)
173. Transportation Services	GPO	GPO in constant dollars
Communications (174-175)		
174. Telephone & Telegraph	SAUS 73 T.803 "Telephone & Telegraph Systems - Operating revenues, domestic telephones & telegraph	GPO deflator (implicit deflator-Interstate rate index + CPI for local rates + telegraph minus ocean cable rate)
175. Radio & TV Broadcasting	SAUS 73 T.810 "Commercial Broadcast Stations, Number and Revenues" - total revenues	GPO in constant dollars (1972 base Laspeyre index of Bales audience trends)
Utilities (176-179)		
176. Electric Utilities	SAUS 73 T.836 "Electric Utilities - Balance Sheet and Income Account of Privately Owned Companies" - Electric Operating revenues	BEA worksheet (implicit deflator for gross output-industrial residential, commercial - 1972 weights)
178. Natural Gas	SAUS 73 T.845 "Gas Utility Industry - Summary" - Revenues	BEA worksheet (implicit deflator for gross output, transmission, distribution - 1972 weights)
179. Water & Sever Services	SAUS 73 T.668 "Summary of State & Local Government Finances" - Water Supply Revenue	CPI - Residential Water & Sewer Services

Sector	Current Dollar Source	Quantity or Deflator Source
Trade (170-171)		
180. Wholesale Trade	GPO	GPO - Constant dollar (weighted average of constant dollar sales)
181. Retail Trade	GPO	GPO - Constant dollar (Constructed same as wholesale trade)
Finance, Insurance, & Real Estate (182-185)		
182. Banking	GPO - SIC's 60, 61, 67	GPO - Constant dollar
183. Insurance	GPO - SIC's 63, 64	GPO - Constant dollar (base year "net ratio" (premiums paid less benefits written) times constant dollar value of premiums.
184. Owner-Occupied Housing	PCE - Table 2.6 of SCB "Personal Consumption Expenditures + .75 x Rental Value of Farm Dwellings	SCB T.2.7 Constant dollar PCE
185. Real Estate	GPO less PCE for Owner-Occupied housing	GPO - deflator
Services (176-194)		
186. Hotel & Lodging Places	SIC 70 - "Total Rooms & Meals" - Revenue, BEA worksheet	Constant dollar Rooms & meals from same worksheet
187. Personal & Repair Services	PCE	Derived from Table 2.6 SCB

Sector	Current Dollar Source	Quantity or Deflator Source
188. Business Services	GPO - SIC 73	GPO - Constant dollar (moved by employment)
189. Advertising	SAUS 73 T.1265 "Advertising - Estimated Expenditures"	GPO deflator, SIC 73
190. Auto Repairs	BEA worksheet - receipts of auto repair and rental establishments (from U.S. Bureau of Census)	GPO deflator
191. Movies & Amusements	PCE	PCE deflator
192. Medical Services	PCE	PCE deflator
193. Private Schools + NPO	PCE	PCE deflator
194. Post Office	SAUS 73 T.796 "U.S. Postal Service - Summary" Total Revenues	PCE deflator "Postage"

Government Enterprises and Dummy Sectors

Outputs for these sectors are obtained by using interindustry coefficients to estimate intermediate flows.

195. Government Enterprise

197. Business Travel

198. Office Supplies

199. Unimportant Industries.

CHAPTER III

GPO DETERMINATION BY INDUSTRY

This chapter treats in more detail the method for forecasting total gross product originating by industry from projected input-output flow tables in current dollars. That is, we are concerned with the conceptual problems and empirical foundation for the F^{-1} transformation we discussed at the beginning of section two of the last chapter. We first provide some overview as to how this problem is handled in several similar large-scale input-output models.

3.1 Treatment in the CANDIDE and Wharton Models

To motivate our discussion, we shall first examine how CANDIDE, an econometric model of the Canadian economy with substantial industrial disaggregation, handled this problem. The CANDIDE project was initiated in 1970 by an interdepartmental group in the Canadian government. The model was estimated entirely with annual data and seeks to make medium-term forecasts of most of the major statistical aggregates published by Statistics Canada.[1]

The process of industry output determination is best illustrated by a chart appearing in the project papers on the CANDIDE model.[2] It is reproduced here as Chart III-1. The first step of this process is the

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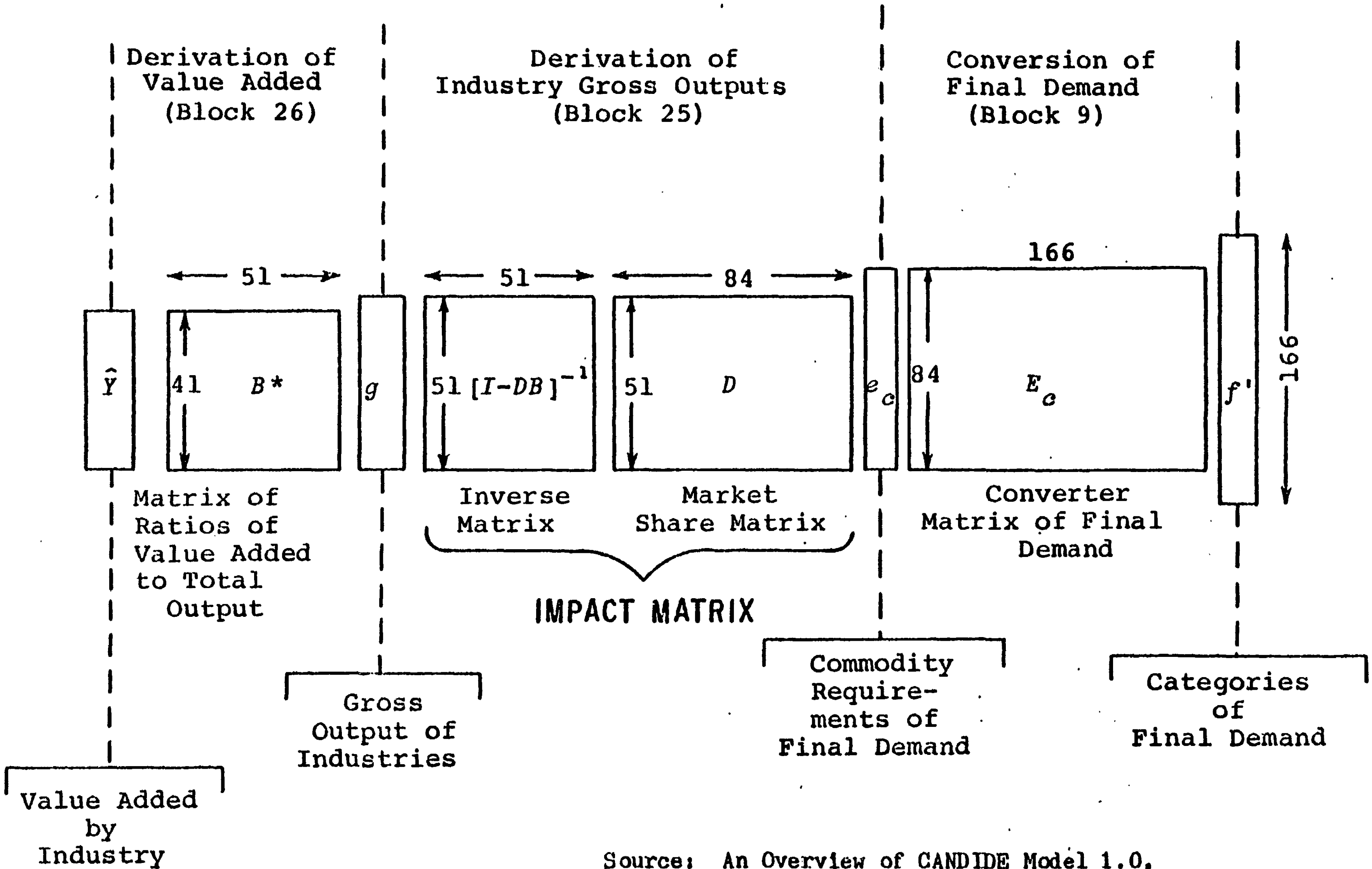
[1] M.C. McCraken, An Overview of CANDIDE Model I/O, CANDIDE Project Paper No. 1, Economic Council of Canada, for the Interdepartmental Committee (Ottawa, Information Canada, 1973).

[2] L. Auer and D. Vallet, CANDIDE Model I/0: Industry Output Determination, ed. Ronald G. Bodkin and Barbara A. M. Young, CANDIDE Project Paper No. 8, Economic Council of Canada, for the Interdepartmental Committee (Ottawa, Information Canada, 1974). pp. 5.

CHART III-1

Industry Output Determination in the CANDIDE model



Source: <u>An Overview of CANDIDE Model 1.0</u>, M.C. McCracken, Economic Council of Canada, 1973.

conversion of 166 mutually exclusive series of final demands by the E matrix into 84 final commodity demands. The E matrix is termed an expenditure converter matrix in that it converts final demands from a functional classification (i.e. household goods, amusements, food, etc.) to a classification showing specific commodity demands. The CANDIDE model differs from the INFORUM and Wharton input-output models in that it employs a rectangular rather than a square input-output table. Thus, the CANDIDE model adheres to the industry technology assumption; that is, a heterogeneous industry output is taken to be a stable function of commodity inputs, as represented in matrix B. This assumption is combined with the notion that the market shares maintained by selling industries for a given commodity are likely to be more stable than the product-mix of the selling industries. These two assumptions combine to provide a link between final demands and gross industry outputs as represented by the matrix $[I-DB]^{-1}$.

The initial estimate of real industry value added is obtained by taking a constant share of gross industry product. A regression adjustment is then made to handle in one fell swoop the problem of changing coefficients. This procedure is similar to that originally developed for the Brookings model and later expanded by Ross Preston in the Wharton industry model.[3] Over time, the coefficients of the industry technology matrix, (B), may change because of new technology, shifts in product-mix, or price-induced input substitution. Furthermore, in the

[3] Ross S. Preston, The Wharton Annual and Industry Forecasting Model. (Philadelphia: Economics Research Unit, University of Pennsylvania, 1972), pp. 14-21

CANDIDE framework, errors in industry outputs may also originate from shifts in the market shares matrix (B) or the expenditure converter matrix E. A reduced form approach is undertaken (as in the earlier Brookings and Wharton models) in lieu of the more ambitious task of explicitly modeling coefficient changes. Specifically, an autoregressive adjustment is made to each preliminary estimate of real GPO (Y_{it}) which takes the form:

$$(3.1)\quad Y_{it} - \bar{Y}_{it} = B_o + B_1 \cdot \text{Time} + B_2\,(Y_i - \bar{Y}_i)_{t-1} + B_3\,(Y_i - \bar{Y}_i)_{t-2}$$

Y_{it} is the National Accounts figure of real gross product originating for industry i and $\bar{Y}_{it}$ is an estimate arrived at by feeding series of final demands (f in Chart III-1) through the observed base year (1961 for CANDIDE, as of 1974) matrices--E, D, and B--for each period t. The B_1 coefficient in Chart III-1 is, of course, intended to account for secular shifts, and the autoregressive parameters are designed to pick up cyclical effects. Bodkin labels the results of the procedure as "reasonably satisfactory," but goes on to say that in some instances ad hoc solutions are required.[4]

A scheme, as that presented above, to translate final demand components of GNP into industry outputs has come to be known as a "bridge" model. A notable contribution in this area as been made recently by V. Sundararajan.[5] He begins with basic conversion relation $X_t = C_1\, g_t$

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[4] Ronald G. Bodkin, "The Use of Input-Output Techniques in a Large Scale Econometric Model of the Canadian Economy, (CANDIDE)," 1974, mimeo pp. 21

[5] V. Sundararajan, "A Flexible Coefficient Bridge Mode: Trend-Cycle Adjustments in Input-Output Analysis," Discussion Paper No. 4: Program of Research on Prices, Costs, and Wages, Harvard University, 1971.

where

g_t = m x 1 vector of GNP components,

X_t = n x 1 vector of GPO by industry, and

$C_t = [I - DB]^{-1}$ DE (in terms of the CANDIDE matrices).

The approach follows naturally from the assumptions that there may be a set of K economic variables--$w_1(t)$, $w_2(t)$, ... $w_k(t)$--which cause variations in the elements of matrices together comprising C.
Thus,

$$(3.2)\ C_{ij}(t) = f_{ij}\ (w_1(t),\ w_2(t),\ \ldots\ w_k(t) + u_{ij}(t)$$

where

$u_{ij}(t)$ is a random disturbance term with expected value zero.

Substituting this expression into the basic conversion relation we obtain

$$(3.3)\ X_i(t) = \sum_{j=1}^{m} f_{ij}\ [w_1(t),\ w_2(t),\ \ldots\ w_k(t)] \cdot g_j(t) + u_i(t).$$

The procedure is to estimate the parameters of (3.3) subject to certain <u>a priori</u> constraints on the conversion coefficients C_{ij}:

$$(1) C_{ij}(t_o) = f_{ij}(w_1(t_o),\ w_2(t_o)\ \ldots\ w_k(t_o)\ ) + U_{ij}(t_o)$$

where

t_o is period for which I/O tables are compiled, i.e. $C_{ij}(t_o)$ are known numbers.

(2) $C_{ij}(t) \geq 0$ [6]

In several of the CANDIDE adjustment equations, for which the simple autoregressive scheme produced poor results, the Sundararajan approach was followed by adding additional explanatory variables. Sundararajan considers a number of variables such as the inventory-sales ratio, capacity utilization rate, the ratio of defense expenditures to total federal expenditures, as well as linear and quadratic functions of time, in his regressions of (3.3). Thus, the estimating form is similar to that used by Preston (1972), but is derived from a more explicit economic model.

A notable feature of the bridge models considered above is that, rather than I/O coefficients being adjusted directly, the _results_ of the I/O computations are adjusted. This would make estimation of adjustment equations for our purposes a precarious exercise. Somehow the trends embodied in the INFORUM coefficient change parameters would have to be purged from the historical period, and to do so would call for some sort of _ad hoc_ "backcasting" of I/O matrices from the current base, and the use of these adjusted matrices as a basis of computing predicted GPO. But as these matrices are still not the "true" matrices, the adjustment equations would still incorporate coefficient changes as well as changes in the market shares matrix, and the effects of mismatched industry definitions of prices and outputs.

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[6]Sundararajan points out the entries in the columns of C corresponding to change in business inventories and to private fixed investment may be negative. _op. cit._, pp. 16-17.

Furthermore, in light of the recent sharp rises in energy prices, we find it increasingly important not to let future coefficients be dictated on the basis of historical trends. A substantial effort has been made to allow coefficients to be changed easily by the model user or to specify a priori price elasticities. Given the substantial changes in structure that the coefficient matrix may undergo, the use of the GPO adjustment approach, especially the simple autoregressive scheme, is inappropriate.

The CANDIDE and Wharton Models emphasize real gross product originating. That is, the sequence from final demand to industry profits is:

(3.4) FD $\overset{(1)}{\Rightarrow}$ constant dollar gross output $\overset{(2)}{\Rightarrow}$ constant dollar GPO $\overset{(3)}{\Rightarrow}$ current dollar GPO

$\overset{(4)}{\Rightarrow}$ less wage and non-factor payments = industry profits

Step (2) is made on the assumption that, as a first approximation, real gross production originating is a constant share of real gross output. Empirical study with these "real" magnitudes must pay some attention to how they were derived. Assume that real GPO for a given industry is derived by dividing an independent estimate of current dollar value added (VA), by some value added deflator (PVA). Then, with unchanging input requirements step (2) takes the form:

(3.5) $VA^t/PVA^t = V^t/P^t \cdot B^o$.

where V is industry gross output in current dollars, P is the output price, and B_o is the ratio of value added to output in the base period. If the industry's production requirements (A_{ij}) do indeed remain constant, the

$$(3.6)\, VA_j^t \equiv V_j^t - \sum_i a_{ij}^o P_i^t Q_j = Q_j\, [P_j^t - \Sigma\, a_{ij} P_i^t]$$

In addition, if the value-added deflator is derived by the "double deflation" method the equality in (3.5) is assured for

$$PVA_t = \frac{P_j^t - \sum_i a_{ij}^t P_i^t}{P_j^o - \sum_i a_{ij} P_i^o} \qquad \text{and } B^o = [\, P_j^o - \Sigma\, a_{ij} P_i^o]$$

The relationship in (3.5) may not hold because of the mere fact that the value-added deflator may not be based on a comprehensive set of inputs. This is the case in the U.S. national income statistics where the service inputs are excluded in making up the value-added deflator in manufacturing.

On the other hand, (3.5) may always hold regardless of changing coefficients. This would be the case for example in a number of nonmanufacturing industries in the U.S. national accounts where "output extrapolation" is used to obtain real GPO. Here the GPO deflator is an implicit deflator, for which no direct price data is used.

Our point is that the methods of construction and statistical quality of the data going into the construction of "real gross product originating" is important as well as the fundamental coefficient change.

In using the real GPO constraint, as do the CANDIDE and Wharton models, a value-added deflator is then required to convert to current-dollar magnitudes as step 3 in equation (3.4) shows. An additional transformation is required in the case of the CANDIDE model to move from the

VA deflator, a construct of the national accounts, to observed industry selling prices and final demand deflators. Thus, the decomposition of gross selling price is made very explicit.

3.2 GPO Determination with the INFORUM Model

Our procedure, as compared to that above, is more straightforward in that it entirely neglects real gross product originating. In effect, we construct a table in current dollars from the forecasts of both real flows and output prices. Value added is then simply output in current dollars less the value of intermediate inputs.

We defer a discussion of the output price equations until later. For now, let us assume that a complete vector of output (or selling) prices exists for each product. Our F^{-1} transformation to industry GPO begins by computing annual value added for each of the approximately 180 products in the INFORUM table:

$$(3.7)\quad VAP_j = (P_j - \sum_i P_i\, a_{ij}) \cdot Q_j$$

The input-output matrix changes from year to year as it incorporates trends in coefficients and any other outside information. We then invoke the "market shares" assumption as used in the CANDIDE model. As we stated in the previous chapter, element M_{ij} in our secondary products matrix shows the proportion of product j produced by industry i. Thus, we arrive at a vector of industry value added at our detailed sectoring level by

$$(3.8)\quad VAI' = M \cdot VAP$$

The M matrix is aggregated from the more detailed 484-level secondary products matrix that was used in "purifying" the 1967 INFORUM table. The use of a constant 1967 secondary products matrix introduces some element of error into the forecast, but should not be significant when looking at results at a two-digit SIC level.[7] The updating of the table would involve a considerable effort in itself and one that leads to little new economic insight. The updating of the M matrix should not precede obtaining reasonable value-added results at the two-digit level.

In the next step, we "undo" the various redefinitions that were incorporated in the activity base table. Although this step involves a "secondary products" problem as in (3.8) above, we maintain it separate for two reasons. First, the redefinitions are not separately identified in the published table as are the transfers which make up the M matrix. Second, the "market shares" assumption may not be appropriate for handling all of the redefinitions. That is, value of amusement receipts by hotels and lodging places (HO) for example is probably more logically handled by assuming that it has some (constant) relation to the primary activity, hotels and lodging places, not some constant share of total value added of movies and amusements (MA). On the other hand, we may wish to invoke the market shares assumption for handling, say, auto repair (AR). It appears more reasonable to assume that auto repair performed in service stations may have a more stable relationship to total auto repair, than to all of retail trade (RT).

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[7]This does not mean that the results would be unchanged if the secondary products matrix were collapsed to a two-digit level. The <u>distribution</u> of the 200-order outputs will still have some effect on the computed value added by two-digit industry.

Our procedure is, in effect, to construct a matrix of pairwise redefinitions. We illustrate by reference to the two cases cited just above. These would be represented by the following simple equations.

$$VAI'_{HO} = VAI_{HO} - \alpha_1 VAI_{HO}$$

$$VAI'_{AM} = VAI_{AM} + \alpha_1 VAI_{HO}$$

$$VAI'_{RT} = VAI_{RT} - \alpha_2 VAI_{AR}$$

$$VAI'_{AR} = VAI_{AR} + \alpha_2 VAI_{AR}$$

Of course, this is represented in matrix fashion by

$$(3.9)\quad \begin{matrix} VAI'_{HO} = \\ VAI'_{AM} = \\ VAI'_{RT} = \\ VAI'_{AR} = \end{matrix} \begin{bmatrix} 1-\alpha_1 & -.30 & 0.0 & 0.0 \\ \alpha_1 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & -\alpha_2 \\ 0.0 & 0.0 & 0.0 & 1+\alpha_2 \end{bmatrix} \begin{matrix} VAI_{HO} \\ VAI_{AM} \\ VAI_{RT} \\ VAI_{AR} \end{matrix}$$

The primed terms represent value added as defined by BEA in the I/O tables; the unprimed terms represent the ordinary SIC definitions.

For the forecast period we assume that the model produced values (VAI' in equation (3.8)) are those on the left in equations (3.9). Thus, we have simply a case of solving the simultaneous system for the unprimed terms on the right. We may represent this by:

$$(3.10)\quad VAI = R \cdot VAI'$$

It is only this vector of value added on the left of (3.10) for which our series of wage and non-factor payments is consistent. Equation (3.10) is solved, in reality, by a Seidel iterative scheme using the "redefined" value added as a starting point. In our simple example above, there is no need for a simultaneous solution since the two redefinitions are independent. In the model, however, there are a number of industries such as wholesale and retail trade which are subject to more than one redefinition.

If there is a stable distribution of industry outputs and value added, the results of going through this procedure will differ little from absorbing the redefintions into a scalar factor for each industry. Our treatment here is maintained to handle any possible simulations in which the product distribution might change significantly and to remind us of one source of the discrepancy between the I/O table and SIC definitions of value added.

In the final step, we apply the set of scalar factors at the two-digit level which we developed in our analysis of value added in the 1967 I/O table. These are shown in the last column of Table II-2. If the table has been balanced consistent with the two-digit controls (and all prices in (3.7) equal to 1.0), the resulting magnitudes by industry should agree exactly in the base year with the published GPO figure for industry GPO. The scalars may be represented by a diagonal matrix, $\hat{C}$, and

$$(3.11)\quad GPO = \hat{C} \cdot VAI$$

The use of the scalars is an unattractive procedure but, as in the Wharton and CANDIDE models, we have not found any way around their use. Fortunately, our careful study in the previous chapter reveals that, in reality, many of the unexplained residuals for 1967 table are small. The use of the scalars calls for one other calculation, this is to require

$$(3.12)\ U \cdot GPO = U \cdot VAI \quad \text{where } U = [\ 1,1,\ \ldots.1]$$

This sum is obviously (private) GNP in current dollars on the income side. But note that it is not an independent estimate of GNP as occurs in the statistical reporting of GNP on the product and income accounts. It follows mathematically through the I/O system that a dollar of final expenditures generates a dollar of income. Our task here is to provide a model of the distribution of this income--within a dissaggregated industry setting—which will have a feedback into the level of final demand.

CHAPTER IV

CAPITAL CONSUMPTION ALLOWANCES

In this chapter we develop a scheme for forecasting capital consumption allowances (CCA) by industry.[1] The CCA estimates made here are in terms of original cost; total CCA is used to arrive at the approximate tax base for the corporate income tax. Furthermore, we desire CCA at an industry level for calculations of net business income as a final output from the model. First, we consider the treatment of capital consumption allowances in several previous and existing models.

4.1 CCA in Brookings, Wharton, and CANDIDE Models

In considering related work, attention has been confined to complete models containing some industry detail. The original Brookings quarterly model contained equations for depreciation in three sectors: nondurable and durable manufacturing, and total nonmanufacturing.[2] In all three, an average 20-year lifetime is assumed for capital equipment. In addition, a straight-line accounting method is assumed and so CCA is

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[1] Our purpose is to explain CCA rather than accounting depreciation; the former includes allowances (estimated by BEA) of accidental damage and capital outlays charged to current expense. However, these two items are so small relative to depreciation that we will treat CCA as if it were entirely depreciation.

[2] Gary Fromm and Lawrence Klein, "The Complete Model: A First Approximation," The Brookings Quarterly Econometric Model of the United States, ed. James Duesenberry, G. Fromm, L. Klein, and E. Kuh. (Chicago: Rand McNally, 1965) pp. 706-707.

taken as a linear function of the preceding 80 quarters of gross investment. Dummy variables for both the slope and level were introduced to reflect the accelerated depreciation practices first allowed in 1954. The equation for durable goods manufacturing was[3]

$$(4.1)\quad DPN_{md} = -\underset{(.0081)}{.2165} + \underset{(.0024)}{.02501} \sum_{i=1}^{80} \left[INV_{md} \right]_{t-i}$$

$$+ \underset{(.0147)}{.6404}\ DMY54 - \underset{(.0003)}{.0126} \left\{ (DMY54) \left(\sum_{i=1}^{80} INV_{md} \right)_{t-i} \right\}$$

where

DMY54 = 0, 1948:1 through 1955:1

= 1, thereafter and

DPN and INV are national accounts. CCA and business groww investment in plant and equipment in the durable goods sector.

Apart from the high degree of aggregation for our purposes, the assumption of a twenty year lifetime is restrictive. Morevoer, in the long run, accelerated depreciation is treated just as a decrease in the straight-line rate.

The CANDIDE and Wharton annual models employ both observed values of depreciation and investment in their specificiations. An undepreciated balance (UB) figure is constructed from the identity,

$$UB_t = UB_{t-1} + INV_t - CCA_{t-1}$$

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[3] *Ibid.*, pp. 706

A regression of CCA on this stock (UB) is then performed with the inclusion of constant and slope dummy variables for changes in tax laws. In the derivation of UB for a given year, new investment is included for that year as if it were depreciated during the entire year. The CANDIDE equation for agricultural CCA indicates a depreciation rate of about seven percent.[4]

$$(4.2)\quad AGCCA = \underset{(22.0)}{126.42} + \underset{(20.0)}{.07494}\ AGUB + \underset{(4.0)}{4.4668} \cdot DCCA - \underset{(2.2)}{.00944}\ (DCCA*AGUB)$$

$$\bar{R}^2 = .99 \qquad DW = 2.31$$

where

AGUB = undepreciated balance for agriculture

DCCA = 0 for $t \leq 1956$

= 1 for $t \geq 1956$

This procedure has an obvious advantage of not requiring *a priori* assumptions about effective tax lives.

4.2 Data Problems and Preliminary Approaches

The scheme finally developed to forecast capital consumption allowances in the integrated model is more consistent with the accounting

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[4] H.E.L Waslander, *CANDIDE Model 1.0: Sector Incomes and Government Revenues*, CANDIDE Project Paper No. 13, Economic Council of Canada, for the interdepartmental committee (Ottawa: Information Canada, 1974), pp. 16-22.

features of the U.S. tax laws than either of the approaches above. The industry detail of the INFORUM investment equations is fully utilized to maintain separate equipment and structure stocks for 36 industrial categories. A combination of double declining balance and straight-line practices are used together with assumed equipment and building lives. A set of trend adjustment equations is employed to correct for company-establishment discrepancies and the errors in the assumed lives and accounting practices.

We postpone a more complete discussion of the final method used until Section 4.3. A brief review of two alternative approaches points out the serious problems one encounters when analyzing "industry" CCA.

An attempt to implement the undepreciated balance approach of the Wharton and CANDIDE models gave very poor results. A basic problem is the inconsistency of the sources for industry investment and capital consumption allowances. Although the CCA items in the GPO series purports to be "establishment" CCA, the results of this approach showed that for many two-digit manufacturing sectors the CCA series could not possibly have been generated by the establishment investment stream observed. In several industries, the CCA series was rising at the same time that the undepreciated balance was falling; of course, unreasonable depreciation rates emerged from the regressions. The addition of dummy variables for the introduction of accelerated depreciation methods in 1954 and the shortening of equipment lives in 1962 did nothing to remedy this problem.

This procedure can only be valid if the industry classification is the same for both investment and depreciation series. In our efforts just described, we implicitly assumed that company-to-establishment reallocation adjustment of the CCA item by BEA would be consistent with the establishment investment data used to create the book value capital stocks. Unfortunately, it became obvious that for a number of industries the reallocation of IRS depreciation totals by the company-establishment employment matrix did not succeed in moving the CCA to an establishment basis. We have to temper this criticism by noting that our census investment data for manufacturing applies to operating establishments only and omits plants and equipment expenditures for central administrative offices and auxiliaries (CAO's). The CAO category includes most obviously office buildings, but also central warehouses, and research and laboratory facilities. In 1963, the investment for CAO's (and Auxiliaries) in manufacturing was $457 million, about four percent of the total for operating establishments.[5] However, this is probably not enough to account for the difficulties encountered here.

Tables IV-1 and IV-2 give a rough idea of the classification problems for the investment and CCA series. In Table IV-1 we compare for two-digit penditure (NPE) data of the BEA-SEC survey with the Census and Annual Survey establishment data for 1967 and 1971. The most obvious discrepancy is in petroleum, where the NPE investment expenditures include the various drilling, transportation, and retailing activities of the integrated oil companies in addition to the refining expenditures

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[5]U.S. Bureau of the Census, Enterprise Statistics, 1963. Part 2 Central Adminstrative Offices and Auxiliaries, (Washington: U.S. Government Printing Office), pp. 14.

TABLE IV-1

COMPARISON OF NPE vs. CENSUS INVESTMENT

	1971		1967	
	Annual Survey	NPE	Census	NPE[2]
Total Manufacturing	20947	29990	21503	28510
Food & Kindred Products	2245	2690	1730	2080
Tobacco	94	NP*	53	120
Textile Mill Products	873	610	733	680
Apparel	342	NP	208	230
Lumber & Wood Products	716	NP	426	390
Furniture & Fixtures	196	NP	198	200
Paper & Allied Products	1197	1250	1585	1560
Printing & Publishing	942	NP	788	870
Chemicals & Allied Products	2938	3440	2936	3060
Petroleum Refining	1304	5850	956	5080
Rubber & Misc. Plastics	724	840	677	670
Leather & Leather Products	69	NP	62	90
Stone, Clay & Glass Products	928	850	821	960
Primary Metals	2198	2780	3057	3240
Fabricated Metal Products	1043	NP	1118	1100
Machinery, Except Electrical	1696	2800	1868	2940
Electrical Machinery	1399	2140	1483	1700
Transportation Equipment, Except Motor Vehicles	476	620	952	1170
Motor Vehicles	782	1510	870	1540
Instruments	393	NP	392	530

* NP = Not Published

2 Source: Survey of Current Business, January 1970

TABLE IV-2

Corporate Capital Consumption Allowances on Enterprise vs. Establishment Basis

	1967 Enterprise	1967 Establishment	1971 Enterprise	1971 Establishment
1. Agriculture, Forestry, & Fisheries	365	355	515	515
2. Metal & Mineral Mining	454	595	525	604
3. Crude Petroleum & Natural Gas	618	2305	733	2637
4. Contract Construction	1264	1260	1854	1850
5. Food & Kindred Products	1649	1558	2281	2182
6. Tobacco Manufactures	70	70	175	175
7. Textile Mill Products	534	460	712	707
8. Apparel	184	175	219	185
9. Lumber & Wood Products	362	355	557	509
10. Furniture & Fixtures	119	111	145	135
11. Paper & Allied Products	835	944	1049	1181
12. Printing & Publishing	576	558	830	783
13. Chemicals & Allied Products	2052	2067	2833	2783
14. Petroleum Refining	3219	962	4033	1286
15. Rubber & Misc. Plastics	410	397	652	662
16. Leather & Leather Products	67	58	79	60
17. Stone, Clay, & Glass Products	756	738	931	965
18. Primary Metals	2321	2353	2572	2723
19. Fabricated Metal Products	870	848	1116	1014
20. Machinery Except Electrical	1693	1711	2760	2868
21. Electrical Machinery	1121	1038	1976	1942
22. Transportation Equip. & Ordnance	752	859	1248	1329
23. Motor Vehicles	1384	1148	1597	1133
24. Instruments	441	389	503	346
25. Misc. Manufacturing Industries	158	90	258	244
26. Railroads	1443	1438	1615	1609
27. Trucking & Warehousing	825	825	1193	1193
28. Air Transportation	971	971	1430	1430
29. Other Transportation	938	931	1002	995
30. Communications	2540	2441	4531	4391
31. Electric, Gas & Sanitary Services	3603	3551	5317	5261
32. Wholesale & Retail Trade	3819	4840	5714	7249
33. Real Estate	2219	2172	2527	2476
34. Hotels & Other Lodging Places	424	424	532	532
35. Medical & Educational Services	548	548	754	754
36. Finance & Other Services	3904	3923	7566	6439

included in the Census of Manufacturers. Even aside from this industry, there are substantial differences in the food, primary metals, machinery, and motor vehicles sectors.

Table IV-2 shows the 36 sectors chosen for this study and the capital consumption allowances on an enterprise basis (Table 6.18 of the July issue of the Survey of Current Business) versus the reallocated CCA appearing in GPO by industry. The most drastic revisions take place again in the Petroleum Refining and Crude Petroleum and Natural Gas industries. The most obvious problem that Tables IV-1 and IV-2 might indicate are in the machinery and motor vehicles sectors. The depreciation in a given year is a function of a long lag of previous investment, but a single year comparison at least gives a rough idea of the data inconsistencies. For three industries, enterprise/establishment ratios (EN/ES) for investment and CCA are given below.

Enterprise/Establishment Ratios

	1967		1971	
	INV.	CCA	INV.	CCA
Non-electrical Machinery	1.573	.989	1.651	.962
Electrical Machinery	1.146	1.080	1.530	1.018
Motor Vehicles	1.770	1.205	1.935	1.409

As we mentioned earlier, our investment figures do not include expenditures for CAO's but the ratios for these three industries indicate that the establishment CCA is still too high for a reasonable estimate of establishment investment. In Section 4.3, a more careful analysis is made by generating a CCA series from the historical investment data.

The only consistent method of applying the undepreciated balance procedure would be to use the NPE investment data and the BEA company-classified CCA series. The Wharton model uses the NPE data for its investment equations but appears to be forecasting GPO reallocated capital consumption allowances. If the CCA equations have been estimated using these two sources, there is, of course, a probable bias in the estimated depreciated rates in a number of industries.

This use of company based data may be the most satisfactory for forecasting CCA but has a number of drawbacks in relation to the complete model. The most obvious is that the input-output structure is framed in terms of establishment data and that a rather substantial, and ultimately arbitrary, scheme would have to be devised to generate the appropriate output variable for use in a company-based investment equation. Any future work involving substitution between labor and capital would be ruled out if capital stock were on a company rather than establishment basis. Furthermore, the BEA-SEC survey generally does not sample below the two-digit SIC level, nor does it provide a breakdown between plant and equipment. Finally, a goal of this study is to forecast the components of gross product originating by industry. The CCA item in industry value added may not be the most satisfactory from our point of view or even from that of the people constructing it. Nevertheless, it is a construct, like a number of others in the account, with which we shall have to live. Although our simple accounting scheme for generating an undepreciated balance may not be consistent with the CCA data at hand, there may, none the less, be a reasonably stable functional relationship between the establishment investment and GPO capital consumption allowances.

The Wharton and CANDIDE procedure in its original form immediately points out the data inconsistencies, but in fact, we anticipated such problems at the initiation of this study. As a result, a first effort was made to generalize undepreciated balance procedure to simultaneously estimate the depreciation rate, initial stock, and a bridge factor to reconcile the data series. We define the following symbols:

$Stock_{i,t}$ = Capital stock remaining in year t for investment made in year i.

INV_t = Investment for year t.

DEP_{it} = Depreciation in year t on investment made in year i.

DA_t = Dummy variable for accelerated depreciation practices.

DA = 0 for 1947-1953

= 1 for 1954-1972

$LIFE_t$ = Factor to account for shortening capital tax lives. (= 1 in 1961).

$\hat{CCA}_t$ = Predicted value of CCA in GPO series

B1 = Initial stock (for 1946)

B2 = Depreciation rate for pre-1954 investment.

B3 = Coefficient for accelerated depreciation practices.

B4 = Scale factor to account for data inconsistencies.

R_i = Effective depreciation rate:

$$R_i = (B2 + B3 * DA_i)/LIFE$$

Estimation was made by means of a non-linear (Marquardt) regression routine for which initial guesses for B1 through B4 were required.[6] With

[6]The Marquardt algorithm was taken from <u>Optimization Techniques with Fortran</u>, James L. Kuester and Joe H. Mize (New York: McGraw-Hill, 1973).

a given estimate of the initial 1946 stock, the capital stock and CCA predictions may be represented by the following schematic:

$$Stock_o = B1 \qquad t=o\ (1946)$$

$t = 1, 2..26$ (1947–1972):

$$Stock_{t,t} = INV_t \quad (\text{If } t=1,\ Stock_t = Stock_o + INV_t)$$

$$\text{If } (t = 1962) \quad R_i = 1.15 * R_i \text{ for all } i$$

$$DEP_{i,t} = R_i * Stock_{i,t}$$

$$Stock_{i,t} = Stock_{i,t} - DEP_{i,t} \qquad \text{for } i = 1, 2..t$$

$$\hat{CCA}_t = B4 \cdot \sum_{i=1}^{t} DEP_{i,t}$$

As anyone familiar with FORTRAN may know, this scheme represents a nested pair of DO loops. At the top of the outer loop, the current year's investment is put into the capital stock for that year. Next, the depreciation (DEP) is calculated for all the stocks up to and including that year, each using its own depreciation rate. At the bottom of the outer loop the sum of the depreciation for all vintage stocks is multiplied by a scalar to predict the CCA for that year.

For the Marquardt regression routine, the above simply represents a non linear function:

$$(4.3) \quad \hat{CCA}_t = F\ (B1, B2, B3, B4, INV, LIFE, DA)$$

The program takes initial guesses for B's and improves upon them iteratively using a modified Gauss-Newton algorithm.

The handling of the changes in depreciation practices was inspired by a 1968 BEA study of aggregate corporate depreciation allowances.[7] A major finding of this study was that between $6.5 to $9 billion of the 1966 total corporate CCA of $46 billion was due to the liberalization of depreciation practices since 1940. This study used a perpetual inventory method to sort out the quantitative effects of four changes in depreciation laws and practices: (1) 60-month amortization of defense facilities, (2) introduction of accelerated depreciation formulas, (3) shorter equipment lives promulgated by the 1962 Treasury Guidelines, and (4) a gradual shortening of service lives prior to 1962. The BEA study made a close approximation of reported corporate depreciation by starting with an estimate based on straight-line depreciation Bulletin F (1942) service lives and then adding one-by-one the estimates due to each of the four factors listed above.

The following assumption as to the shortening of service lives gave the best approximation in the BEA Study:

Percentage of Bulletin F Lives

1940	100	1957	75
1945	94	1960	75
1950	88	1961	78
1955	77	1962	64

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[7] Allan H. Young, "Alternative Estimates of Corporate Depreciation and Profits: Part I," Survey of Current Business (Vol. 48, No. 4), April, 1968, pp.17-28.

This schedule was incorporated into our estimates for each industry by rebasing to 1961. The index is $LIFE_t$, which goes into the effective depreciation rate.

The effect of the 1962 Guidelines was approximated in the BEA study by reducing the equipment service lives by about 15 percent. This applied not only to new equipment but also to existing equipment. Rather than introduce a dummy variable for the Guidelines into the estimates, a simple increase of ten percent was made to all the effective depreciation rates, R_i. The index in LIFE was left at its 1962 value for the remainder of the estimation period.

The effect of the liberalized depreciation formulas (double-declining balance and sum-of-the-years-digits) first allowed in 1954 is more difficult to specify _a priori_. Part of the problem is that acceptance of the new method was gradual and undoubtedly differed among industries. For this reason a dummy variable (DA) was used to capture any increase in the effective rate due to the new tax code. Note that the dummy affects only the investment made in 1954 and after.

The 60-month amortization provision for defense facilities was ignored. It was discontinued in 1959 and affects only a few industries.

Results

In spite of providing a good bit of _a priori_ information directly into the estimation procedure, equation (4.3) demanded still too much from the data available. Although extremely good fits were obtained for all but a handful of industries, the parameter values were often not well determined. In the two-digit manufacturing industries whose equipment lives were similar, the depreciation rates may have had a _difference_ of .10 to .15. Some industries insisted on having a zero initial stock while the coefficients on the accelerated depreciaition dummy were arbitrary at best. The scale factors (B4) were most disconcerting. Left unconstrained, some were as high as 4.0 or as low as .10.

It soon became obvious that our specification was subject to the counterpart of severe multicollinearity in a standard linear regression. As a result, an attempt was made to impose more outside information into constraining the parameters. An upper limit of .08 was set for B3 and 3.0 for B4. Lower limits for B2 were set by taking the reciprocal of the 1962 guideline equipment lives used in the INFORUM investment equations. This salvage effort still produced equations which fit the data well, but left the parameters against limits which could not be justified. For 21 manufacturing sector regressions, trials with total investment — and with equipment investment only — produced different scaler factors (B4) but about the same industry variance in depreciation rates in those sectors with similar equipment lives.

A basic problem, of course, was how to specify a priori, a single depreciation rate which would reflect changing depreciation methods, tax lives, and the mix between structures and equipment investment. In addition, the comparision in Tables IV-1 and IV-2 provide only a rough guide as to what limits to set for a scalar to account for the classification problems. As a result we turned to a simpler econometric procedure, described in the next section, but one which demanded far more information on our part.

4.3 Forecasting CCA in the Integrated Model

In view of the results obtained in the previous section, we reluctantly turned to a procedure similar to the 1968 BEA study conducted by Allan Young.[8] This procedure has now become a permanent fixture of the national income accounts in the BEA attempt to measure true economic capital consumption allowances. Our effort here is restricted to forecasting CCA at historical cost (which approximates IRS depreciation allowances) for use in deriving the appropriate tax base for corporate income taxes.

The procedure involves construction of vintage book value stocks and computing a CCA by using a mixture of straight-line and double declining balance methods. The logarithm of the ratio of reported GPO industry CCA to this computed CCA is then regressed on time.

The analysis here differs in a significant respect from the 1968 BEA study. That study was a part of a more comprehensive investigation of corporate profit rates resulting from alternative depreciation measures. As a result, the emphasis was to identify investment by corporations regardless of industry classification. In the INFORUM model no distinction is made between corporate and noncorporate activity, but substantial industrial disaggregation is present in manufacturing. Unfortunately, the paucity of data sources relating to investment by finance, trade, and services made it impossible to preserve the two-digit industry detail of the 50 sector model in these areas. A 36-sector aggregation was chosen which matches as closely as possible the available investment sources to the group of industries for which most of the tax depreciation appears. A full description of the data sources used is shown in Appendix IV-4. A list of titles may be seen in Tables IV-2 or IV-5.

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[8] *Ibid.*

Data for manufacturing are not difficult to find; expenditures (for new equipment and structures) for 21 industries are taken directly from the Census (and Annual Survey) of Manufactures. For a number of nonmanufacturing sectors, — namely Electric and Gas Utilities, Communications, Railroad, and Agriculture — Construction Reports (CR) provides direct data for structures. The remaining construction categories available from the National Accounts or CR are difficult to classify on an industry basis. Rather than make arbitrary splits of the categories, we have aggregated our two-digit CCA sources, and made the most probable match. A similar problem exists for equipment as well. The INFORUM model has a rather large residual category — Finance and Services — to which about ten percent of total equipment purchases is allocated. We take out of this category Hotels, and Medical and Educational Services, on the assumption that the construction expenditures only for these industries may adequately explain CCA.

"Base" tax lives were established for each equipment and structure category. For equipment, we used the average 1962 Guideline Life for each two-digit or broader group. For structures, we used instead the result of a survey taken by the Office of Industrial Economics in the Treasury Department on the depreciation practices of owners of non-farm, non-residential buildings for the 1954-1969 period.[9] Generally, these results showed somewhat shorter lives taken on structures than those in the 1962 Guidelines.

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[9] Business Building Statistics, Office of Industrial Economics, U.S. Department of the Treasury, August 1975.

In the period prior to 1962, the tax lives for equipment were shown gradually shortening according to the BEA schedule used previously. To account for the shortening of equipment lives with the introduction of the ADR (Asset Depreciation Range) system in 1971, equipment lives were shortened by 10 percent in 1971 and 20 percent in 1972. Lives for structures were left at the base figure for the entire period.

Specifying the percentage of new investment depreciated by the accelerated methods is a matter of some uncertainty as well. The IRS collected some data on corporation tax returns in the late 1950's and the early 1960's as to the type of depreciation methods being used. BEA used this data to construct a slowly rising ratio of accelerated-to-straightline for 1954 through 1964. They also found that the double declining balance (DDB) method gave nearly the same approximation as use of sum-of-the-years-digits. Accordingly, we used the double-declining balance method only for all the investment depreciated with the accelerated methods.

The BEA schedule for DDB/total was used for equipment only. Business Building Statistics, the study referred to above for structure lives, indicated that over sixty percent of new office and retail buildings purchased between 1954 and 1969 were depreciated with the straight-line method. With little other firm statistical basis, we used this result for other structures as the standard. The ratio of DDB/total was moved from 10 percent in 1954 to a maximum of 40 percent in 1972. These ratios are shown under the heading "Std" in Table IV-3.

Having made assumptions as to tax lives and depreciation practices, one further problem at this level of industry detail, is obtaining reasonable initial stocks. Equipment presents no difficulty since by about 1960

TABLE IV-3

Accelerated Depreciation Assumptions for CCA Study*

Year	Equipment Std.	Equipment Alt.	Structures Std.	Structures Alt.
1954	.31	.31	.10	.10
55	.43	.43	.12	.10
56	.54	.54	.14	.15
57	.66	.66	.16	.20
58	.71	.71	.18	.25
59	.75	.75	.20	.30
60	.79	.79	.22	.35
61	.84	.80	.24	.40
62	.86	.80	.26	.45
63	.86	.80	.28	.50
64	.87	.80	.30	.50
65	.87	.80	.32	.50
66	.88	.80	.34	.50
67	.88	.80	.36	.50
68	.89	.80	.38	.50
69	.87	.80	.40	.50
70	.90	.80	.40	.50
71	.90	.80	.40	.50
72	.90	.80	.40	.50

* The numbers shown are the percentages of new investment assumed to be depreciated by accelerated methods.

most of the investment made prior to 1947 has been written off. For structures we relied on benchmark totals for manufacturing and non-manufacturing nonresidentual structures computed by BEA. Initial stocks were taken as the 1946 undepreciated book values (gross stocks on books less accumulated depreciation). The manufacturing value was prorated to the two-digit level on the proportion of structure investment made in the years 1947-1949 for each two-digit industry. Prorations for non-manufacturing were made on the basis of the accumulated sums of investment from 1929 through 1946 as reported for each of the major structure categories (i.e. utilities, railroads, telephone and telegraph, etc.) in Table 5.2 of the NIA.

With estimates of initial stocks in hand, estimated CCA was computed for each of the 36 sectors. Depreciation for a given year was calculated on the basis of the previous year's stock plus new investment for the year. Thus, it assumed that investment is made at the beginning of each year. Vintage stocks are, of course, required for treatment of straight-line depreciation. Vintage stocks were maintained as well for <u>equipment</u> investment depreciated by double declining balance. When the computed DDB depreciation on a particular vintage stock fell below that for straight-line, the remainder of the net book value was depreciated by the straight-line method as allowed by IRS. For structures, we approximated a true DDB method, by making the net stock decline exponentially at twice the straight-line rate (2/Life).

Before considering the adjustment equation for the individual sectors, we check the overall consistency of our data and assumptions on the basis of some aggregate calculations. Table IV-4 shows the sum of the depreciation computed from the above procedure for the 36 sectors

TABLE IV-4

Aggregate CCA Simulations

	(1) Actual	(2) (Std.)	(3) Alt.1	(4) Alt.2	(5) Alt.3	(6) Alt.4
1962	50.0	47.1	49.9	48.0	47.8	49.3
1963	52.6	51.0	52.4	52.2	51.9	53.4
1964	56.2	55.1	56.4	56.5	56.0	57.6
1965	59.9	59.1	60.1	60.6	60.0	61.4
1966	64.1	63.8	65.7	65.3	64.7	66.5
1967	69.0	68.7	70.5	70.2	69.5	71.6
1968	74.6	74.1	75.6	75.7	74.8	77.1
1969	81.4	80.1	81.4	81.6	80.6	82.6
1970	87.2	84.6	86.2	85.9	85.0	86.7
1971	93.7	90.3	92.3	91.6	90.7	92.8
1972	102.9	99.3	103.0	100.6	99.6	102.7
AAPE* 1962-1972:		2.8%	.9%	2.0%	2.1%	1.9%

* Average Absolute Percentage Error

Standard (1): Standard lives and assumptions on accelerated depreciation (See Table IV-3)

Alternative (1): All equipment lives reduced by twenty percent.

Alternative (2): Alternative accelerated depreciation assumptions, for for structures, See Table IV-3.

Alternative (3): Same as Alternative (2) but with alternative assumptions for DDB for equipment in Table IV-3.

Alternative (4): Equipment lives reduced by ten percent and alternative DDB assumptions for structures.

with the BEA published values for 1962-1972. Column (2) shows the computed depreciation on the basis of 1962 Guideline lives and the "standard" assumptions regarding the proportion of investment using the accelerated depreciation method. The results indicate that at an aggregate level, at least, our direct approach yields a reasonably satisfactory approximation to actual CCA, although there is some tendency for underprediction in that last few years.

An unsuccessful effort was made to identify the source of the underpredictions from 1969-72. Obviously, behind the aggregate results are a large number of assumptions to which we resorted in lieu of direct evidence. Some alternative runs were made to test the sensitivity of the aggregate results with regard to the depreciation methods and tax lives. Column (3) of Table IV-4 shows that we may achieve a very good fit to the aggregate CCA by simply reducing all equipment lives by 20 percent for every year.

Shortening equipment lives by a full 20 percent seemed drastic; a more logical source for error are the assumptions regarding the proportion of investment depreciated by the accelerated method. Alternative 2 of Table IV-4 shows the total CCA by using the alternative schedule of DDB for structures as seen in Table IV-3. This difference adds on the average a little over a billion dollars a year for the thirteen years in the simulation. Alternative 3 in column 5 is identical to alternative 2, except for the substitution of the second schedule for the DDB proportion for equipment in Table IV-3. This schedule assumes a maximum of only 80 percent being depreciated with DDB, as compared to the standard 90 percent. The net result of alternative DDB schedules together is a CCA stream slightly higher than the standard.

Alternative 4 combines alternatives 1 and 2; it uses the second DDB schedule for structures and reduces all equipment lives by ten percent. The results are shown in column 6 of Table IV-4. The results are still not as good as the straight reduction in equipment lives, but are reasonably satisfactory.

It is obvious that this game may be played ad infinitum. At this juncture, however, our stopping point is alternative 4. Table IV-5 presents the results for the individual adjustment equations on the basis of the assumptions used for alternative 4. For this version of the model, the adjustment mechanism has been restricted to a simple trend. Thus, the specification used is:

$$\log \left(CCA_i / \hat{CCA}_i \right) = a + b \cdot Time \qquad (1960 - 1972)$$

where

CCA_i is actual CCA in industry i in the GPO series, and

$\hat{CCA}_i$ is predicted CCA on the basis of our assumed lives, depreciation schedules, and investment series for alternative 4 above.

Time is set to a value of zero for 1972 so that the scale coefficient (a) indicates the predicted ratio for 1972. The summary statistics (R^2, S.E., and DW) have been recomputed on the basis of the level of CCA, rather than the ratio, $CCA/\hat{CCA}$. The first two columns in Table IV-5 give the 1972 equipment and structure investment used; column 3 is the actual CCA in the sector. The next two columns are the 1962 lives assumed for the sector.

In some sectors, a constant trend adjustment seemed inappropriate for forecasting purposes upon examination of actual-predicted ratios.

TABLE IV-5

CCA ADJUSTMENT EQUATIONS

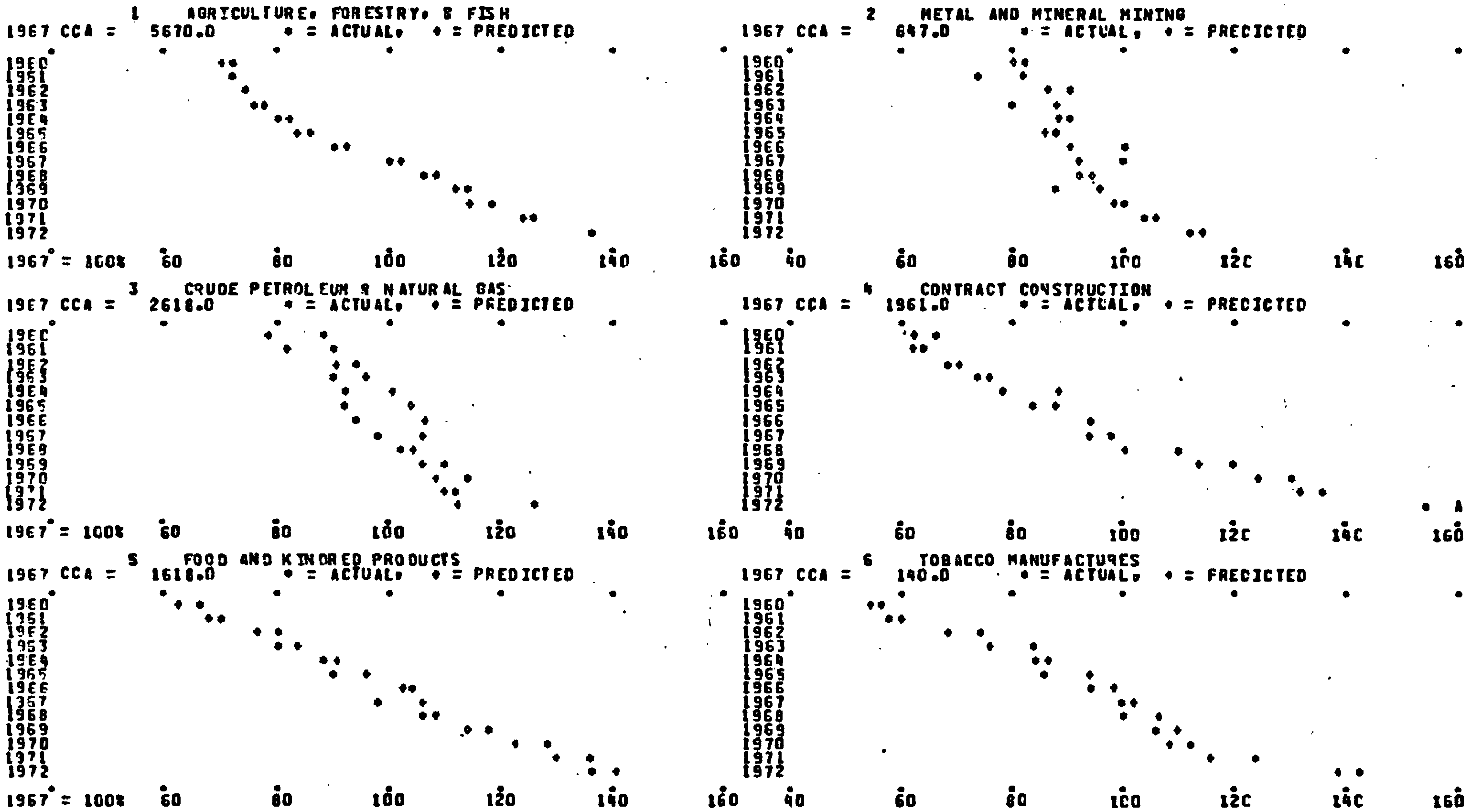
#	SECTOR	72 EQP	72 STR	72 CCA	LIFE	LIFE	SCALE	(T-VAL)	TREND	(T-VAL)	RSQ	S.E.	CW
1	AGRICULTURE, FORESTRY, & FISH	5583.0	1291.0	7754.0	9	25	1.112	(8.49)	.024	(13.45)	.991	124.0	1.437
2	METAL AND MINERAL MINING	1002.5	1397.5	736.0	9	25	.397	(26.67)	-.017	(3.49)	.713	38.4	2.114
3	CRUDE PETROLEUM & NATURAL GAS	1246.5	2151.0	3305.0	12	25	EQUATION REPLACED BY AVE. FOR LAST 4 YEARS					.907	
4	CONTRACT CONSTRUCTION	3355.7	.0	3025.0	4	0	.949	(1.33)	.020	(3.72)	.915	175.4	.910
5	FOOD AND KINDRED PRODUCTS	1752.1	603.0	2219.0	12	35	1.267	(10.09)	-.002	(.50)	.966	74.9	1.316
6	TOBACCO MANUFACTURES	80.3	52.9	199.0	13	35	2.730	(33.79)	.009	(2.19)	.954	7.6	1.083
7	TEXTILE MILL PRODUCTS	909.5	218.0	738.0	12	35	EQUATION REPLACED BY AVE. FOR LAST 4 YEARS					1.037	
8	APPAREL	261.5	102.0	224.0	8	35	EQUATION REPLACED BY AVE. FOR LAST 2 YEARS					.786	
9	LUMBER AND WOOD PRODUCTS	664.8	266.2	784.0	9	35	1.302	(8.65)	.002	(.38)	.962	30.2	1.969
10	FURNITURE AND FIXTURES	200.9	105.1	157.0	9	35	.865	(4.05)	-.032	(6.40)	.880	3.6	2.395
11	PAPER AND ALLIED PRODUCTS	1131.1	203.9	1278.0	14	35	EQUATION REPLACED BY AVE. FOR LAST 4 YEARS					.997	
12	PRINTING AND PUBLISHING	801.1	245.9	827.0	9	35	1.146	(3.87)	.001	(.29)	.944	42.3	1.180
13	CHEMICALS AND ALLIED PRODUCTS	2244.1	483.9	3197.0	9	35	1.076	(2.02)	-.006	(1.22)	.942	143.3	.800
14	PETROLEUM REFINING	529.1	624.9	1277.0	14	35	1.786	(8.48)	.036	(3.76)	.888	109.3	.503
15	RUBBER AND MISC. PLASTICS	788.5	244.0	655.0	12	35	EQUATION REPLACED BY AVE. FOR LAST 4 YEARS					1.036	
16	LEATHER AND LEATHER PRODUCTS	55.9	19.1	62.0	9	35	1.117	(2.06)	-.007	(.95)	.709	5.3	1.587
17	STONE, CLAY, & GLASS PRODUCTS	966.6	229.4	1106.0	13	35	1.180	(3.68)	-.010	(1.61)	.861	70.2	.730
18	PRIMARY METALS	1772.3	388.7	2687.0	15	35	1.118	(3.67)	-.029	(6.73)	.963	102.2	.398
19	FABRICATED METAL PRODUCTS	1227.2	323.0	1078.0	10	35	.964	(1.24)	-.003	(.69)	.948	48.7	1.303
20	MACHINERY, EXCEPT ELECTRICAL	1464.1	441.9	2962.0	10	35	1.808	(16.30)	.023	(4.53)	.961	149.7	1.454
21	ELECTRICAL MACHINERY	1147.5	295.0	2410.0	10	35	1.623	(11.79)	.046	(7.85)	.973	108.1	.486
22	TRANS. EQUIP. & ORDNANCE	376.1	120.0	1070.0	10	35	1.897	(10.51)	.013	(1.50)	.896	110.8	2.095
23	MOTOR VEHICLES	1923.5	172.0	1624.0	10	35	1.330	(5.49)	.010	(1.34)	.881	101.6	1.339
24	INSTRUMENTS	325.7	154.3	392.0	10	35	1.207	(4.19)	-.003	(.45)	.947	22.2	1.534
25	MISC. MANUFACTURING	220.7	96.3	290.0	10	35	1.177	(3.01)	-.012	(1.52)	.771	21.7	.711
26	RAILROADS	1445.0	355.0	1674.0	12	30	.910	(3.85)	.026	(7.58)	.968	52.8	2.376
27	TRUCKING AND WAREHOUSING	794.4	.0	2087.0	9	0	2.677	(23.35)	-.047	(7.88)	.903	119.2	.461
28	AIR TRANSPORTATION	2460.0	.0	1438.0	5	0	EQUATION REPLACED BY AVE. FOR LAST 4 YEARS					.553	
29	OTHER TRANSPORTATION	.0	705.6	1170.0	10	35	1.405	(20.17)	.013	(5.38)	.981	30.4	1.802
30	COMMUNICATIONS	8607.0	2393.0	5564.0	13	35	.676	(14.83)	.023	(6.04)	.980	196.8	.309
31	ELECTRIC, GAS, AND SANITARY	7761.0	9239.0	6225.0	22	35	.825	(21.14)	-.020	(15.64)	.998	60.3	1.563
32	WHOLESALE AND RETAIL TRADE	9351.3	4239.0	10380.0	9	35	.984	(1.01)	-.014	(6.15)	.988	219.8	1.002
33	REAL ESTATE	.0	50275.0	21584.0	9	40	1.299	(42.41)	-.004	(4.13)	.998	181.6	1.106
34	HOTELS & OTHER LODGING PLACES	.0	2134.0	1092.0	9	35	1.236	(5.94)	-.023	(4.52)	.922	53.2	.528
35	MEDICAL & EDUCATIONAL SERVICE	.0	4813.0	2356.0	9	40	1.217	(11.29)	-.043	(17.27)	.981	54.9	.589
36	FINANCE AND OTHER SERVICES	14448.8	11371.0	9291.0	10	40	.548	(24.63)	.024	(7.09)	.983	276.3	.354

In most of these cases the actual-predicted ratios were fairly stable in the last few years of the simulation. For these, a simple average of $CCA/_{CCA}$ for a specified number of years ending in 1972 is substituted for the trend adjustment.

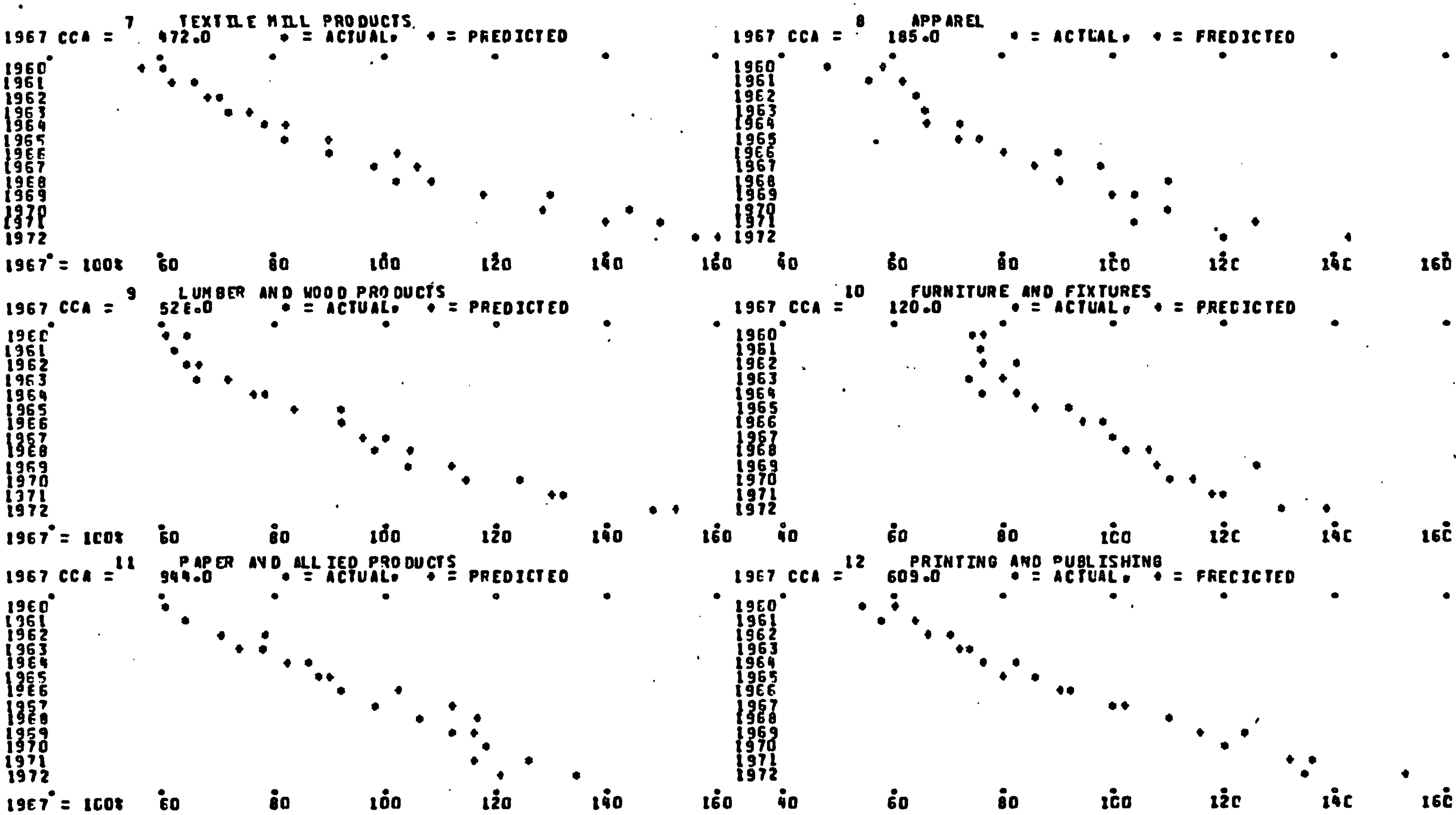
The degree of consistency as measured by the scale parameter is reasonably good, especially compared to that obtained in the regression approach described in Section 4.2. The worst cases in manufacturing are Tobacco, Nonelectrical Machinery, Electrical Machinery, and Transportation Equipment. For the last three of these we could have anticipated such problems on the basis of discussion on measurement errors indicated in Tables IV-1 and IV-2. In nonmanufacturing, the data deteriorate and significant problems are indicated for Mining (a = .397), Trucking (a = 2.99), and Medical and Education Services (a = .57). In many cases the trend parameters are greater than we would have preferred, but in twenty industries the absolute value is less than two percent per year.

An idea of the nature of the data may be obtained by looking at the graphs for each sector on pages 89 to 94. The predicted values denoted by '+' are those from the adjustment equations in Table IV-5. In most cases, our approach is indistinguishable from one using only a simple time trend. However, inspection of the plots for sectors (18) Primary Metals; (22) Transportation Equipment, (26) Railroads, and (28) Air Transportation shows our predicted values catching turning points. Our procedure also tracks an extremely large jump from 1971 to 1972 in the Motor Vehicle industry. In the final six industries comprising utilities, trade, and services, one sees how difficult it is to distinguish among alternative schemes all yielding smooth trends.

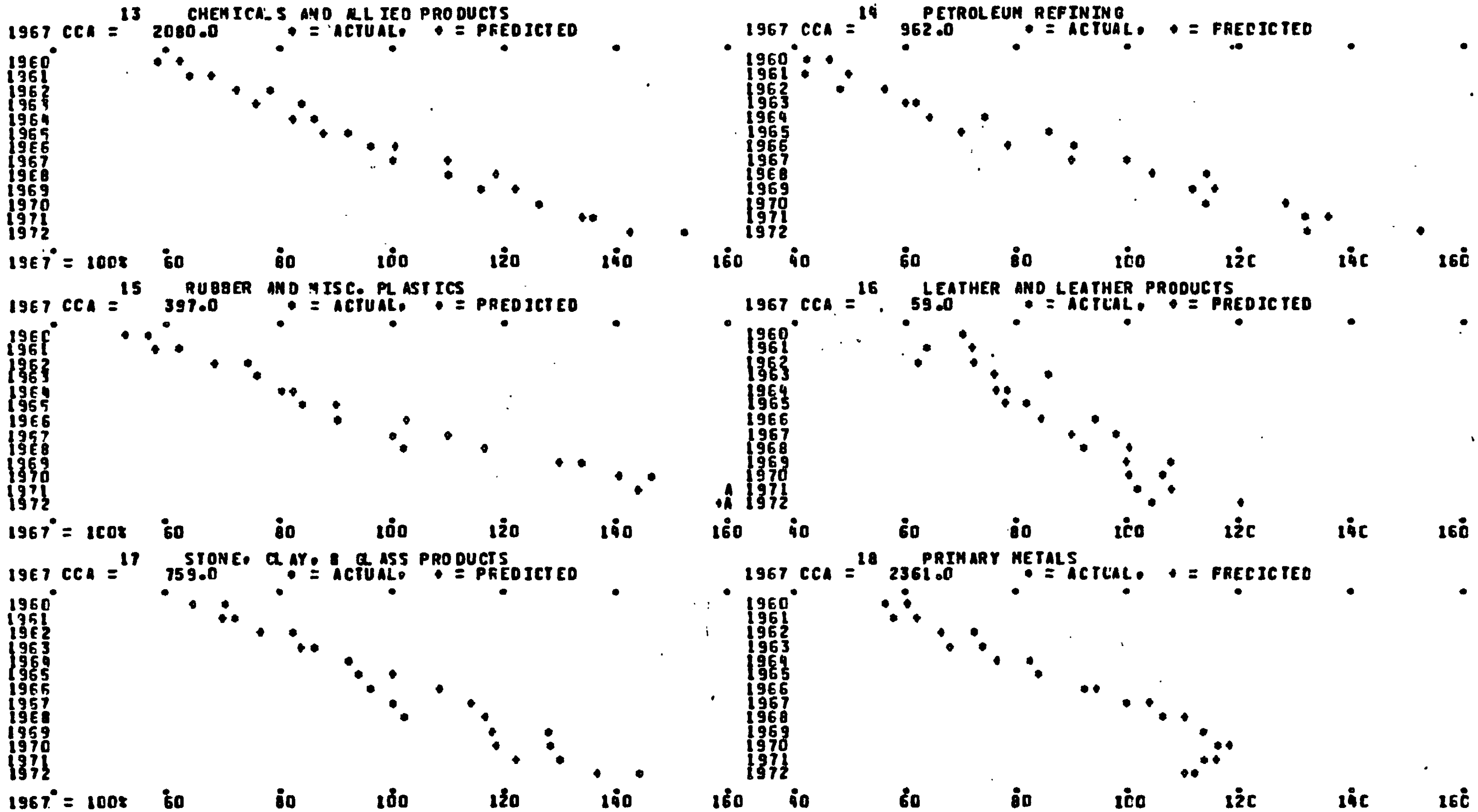
SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL



SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL



SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL



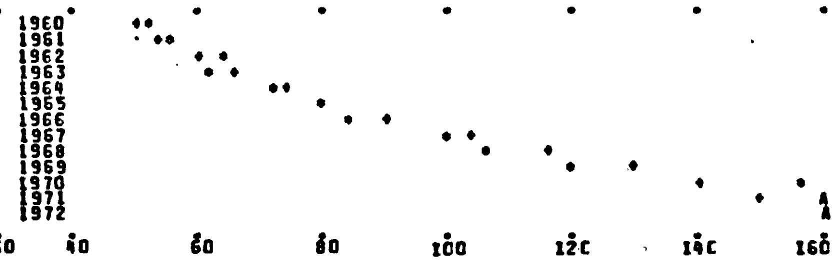
SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL

19 FABRICATED METAL PRODUCTS

1967 CCA = 870.0 • = ACTUAL, + = PREDICTED

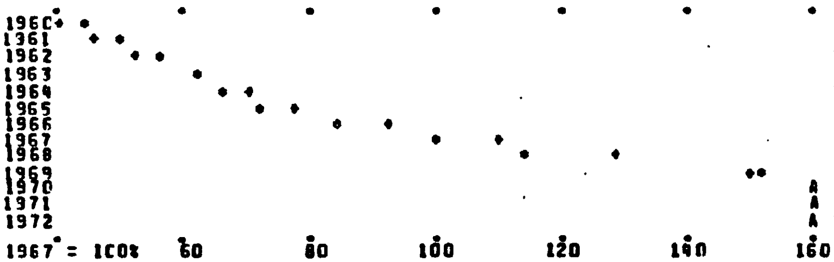
20 MACHINERY, EXCEPT ELECTRICAL

1967 CCA = 1763.0 • = ACTUAL, + = PREDICTED



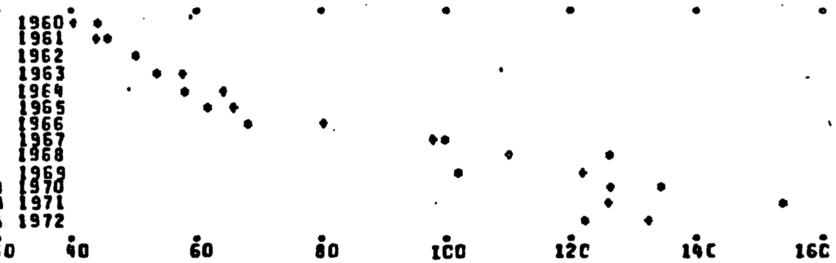
21 ELECTRICAL MACHINERY

1967 CCA = 1042.0 • = ACTUAL, + = PREDICTED



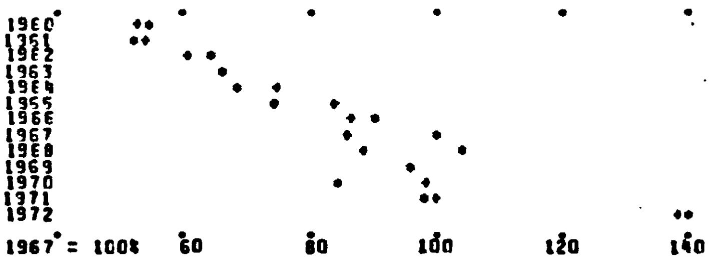
22 TRANS. EQUIP. & ORDNANCE

1967 CCA = 869.0 • = ACTUAL, + = PREDICTED



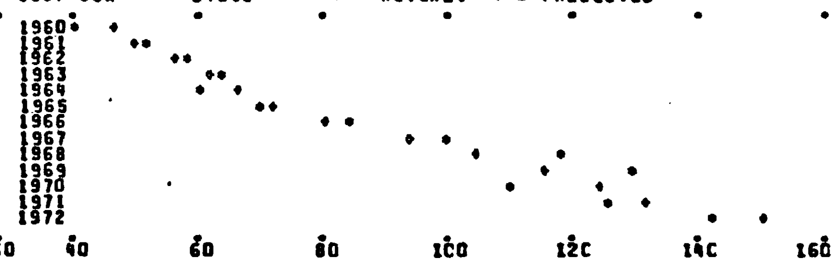
23 MOTOR VEHICLES

1967 CCA = 1148.0 • = ACTUAL, + = PREDICTED



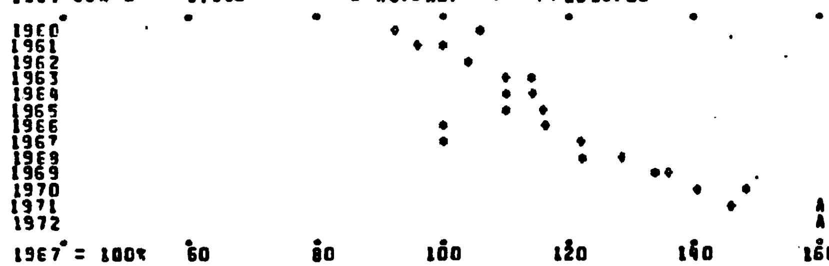
24 INSTRUMENTS

1967 CCA = 272.3 • = ACTUAL, + = PREDICTED

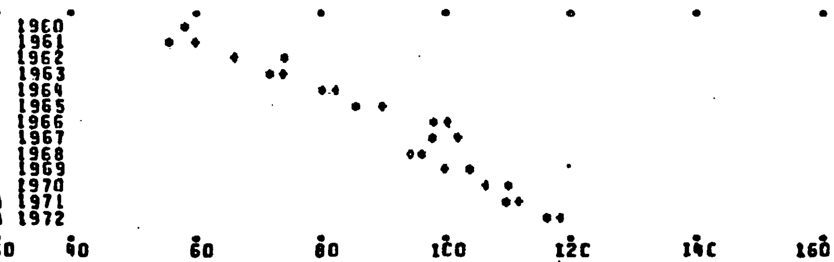


SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL

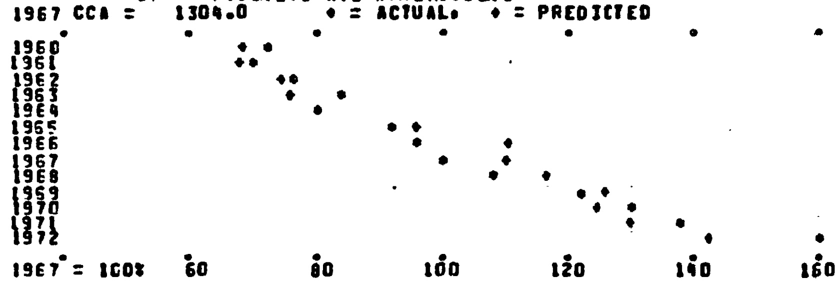
25 MISC. MANUFACTURING
1967 CCA = 171.0 • = ACTUAL, • = PREDICTED



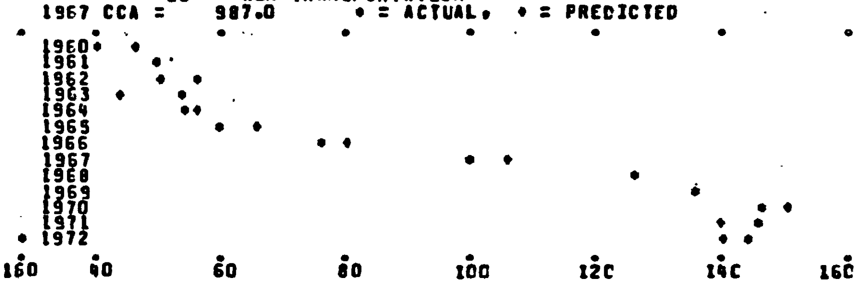
26 RAILROADS
1967 CCA = 1438.0 • = ACTUAL, • = PREDICTED



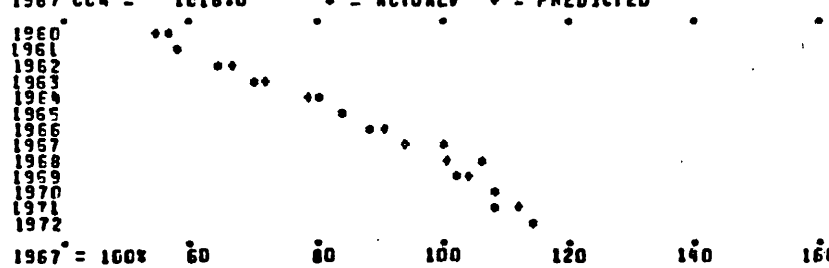
27 TRUCKING AND WAREHOUSING
1967 CCA = 1304.0 • = ACTUAL, • = PREDICTED



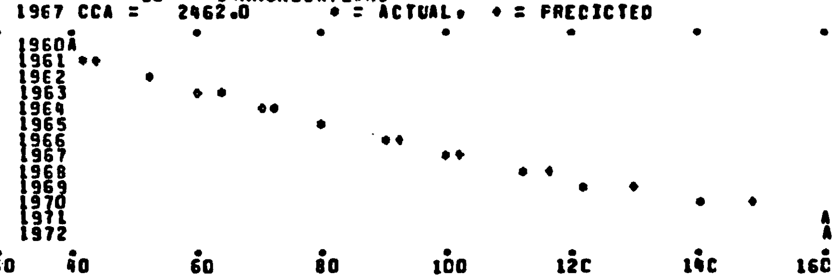
28 AIR TRANSPORTATION
1967 CCA = 987.0 • = ACTUAL, • = PREDICTED



29 OTHER TRANSPORTATION
1967 CCA = 1016.0 • = ACTUAL, • = PREDICTED

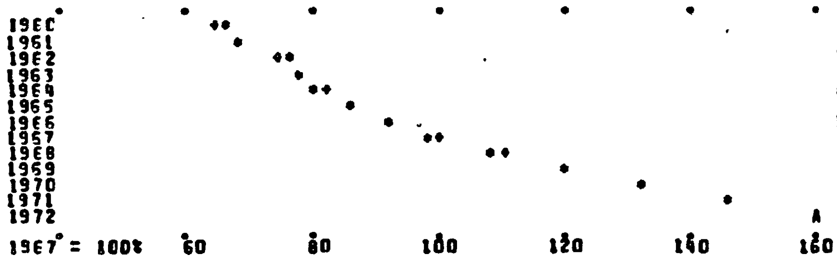


30 COMMUNICATIONS
1967 CCA = 2462.0 • = ACTUAL, • = PREDICTED

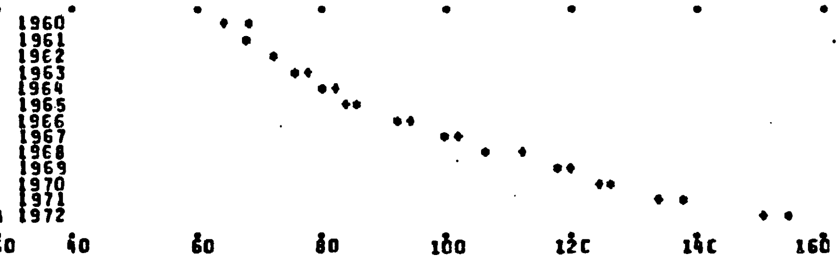


SECTOR PLOTS OF CCA: PREDICTED VS. ACTUAL

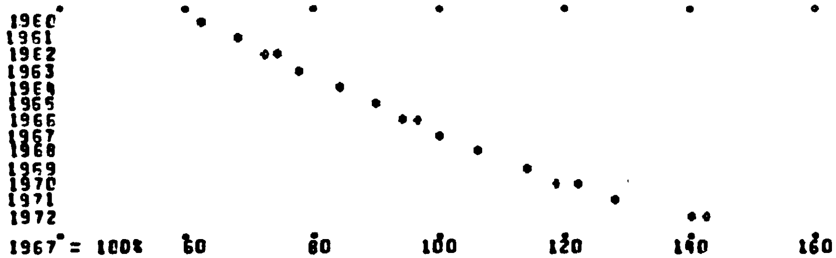
31 ELECTRIC, GAS, AND SANITARY
1967 CCA = 3693.0 • = ACTUAL, + = PREDICTED



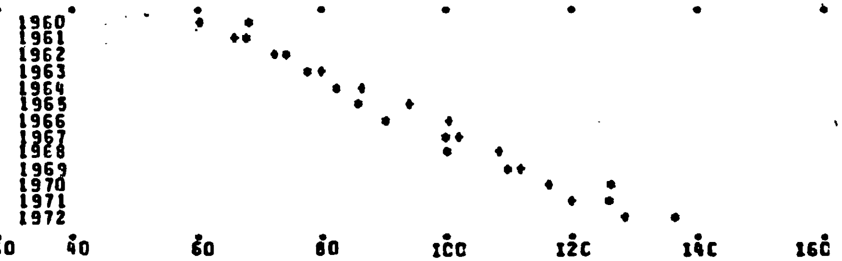
32 WHOLESALE AND RETAIL TRADE
1967 CCA = 6680.0 • = ACTUAL, + = PREDICTED



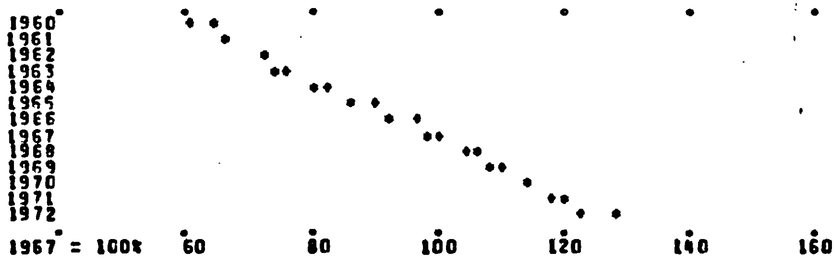
33 REAL ESTATE
1967 CCA = 15258.0 • = ACTUAL, + = PREDICTED



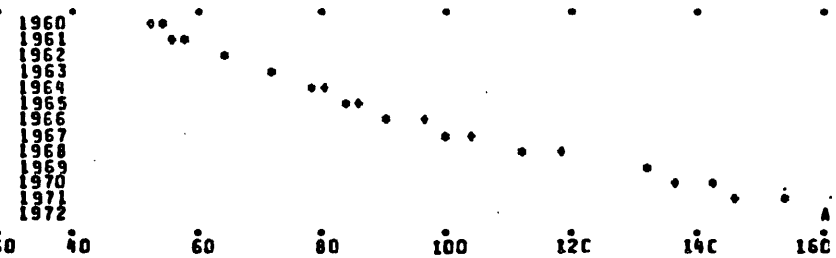
34 HOTELS & OTHER LODGING PLACES
1967 CCA = 798.0 • = ACTUAL, + = PREDICTED



35 MEDICAL & EDUCATIONAL SERVICE
1967 CCA = 1815.8 • = ACTUAL, + = PREDICTED



36 FINANCE AND OTHER SERVICES
1967 CCA = 5298.0 • = ACTUAL, + = PREDICTED



The plots indicate most dramatically misspecification of the adjustment equation for (3) Crude Petroleum and Natural Gas and (11) Paper and Allied Products. These two sectors are among those in which we made exogenous adjustment ratios.

Conclusions

The problems of industry classification, changing depreciation methods, and shortening tax lives makes any industry study of CCA very difficult. It appears from the aggregate simulations that a "brute force" approach using vintage stocks is heading in the right direction. Further refinement of the data, especially in cooperation with BEA, would lead to improvement for aggregate forecasts. For industry studies, especially at the two-digit level considered here, our results should be viewed cautiously. The answer to whether they can be judged satisfactory will have to wait until they are used in a forecasting situation.

APPENDIX IV-A

Sources of Investment Data for CCA Sectors

The following descriptions of the investment data sources are similar to that in Appendix III-A of _1985: Interindustry Forecasts of the American Economy_. The 90 investment sectors there are aggregated to the 36 sector level chosen for the CCA work. V_t denotes gross equipment in year t in current dollars; S^i_t is expendiutres for new structures. NPE_t denotes the new plant and equipment figures for the appropriate industry in the OBE-SEC investment survey.

1. Agriculture

V_t = the sum of farm spending on motor vehicles and other machinery and equipment. Source: Farm Income Situation, U.S. Department of Agriculture.

S_t = Farm residential and non-residential buildings as appearing in TABLE V-2. "Purchases of Structures by Type" July issue of _Survey of Current Business_, (SCB).

2. Mining

V_{tc} = Equipment investment for metal, mineral, and coal mining from the _Census of Mineral Industries_. Out of Census years are obtained by interpolation with shipments of mining machinery, SIC 3532.

Structures for mining are approximated by a residual from NPE survey: $S_t = NPE_t - V_t$.

3. Oil and Gas Extraction

V_{tc} = Investment by oil and gas extraction in the _Census of Mineral Industries_. Out of Census years are obtained by interpolation with shipments (minus exports) of oilfield machinery, SIC 3533.

S_{tc} = Petroleum and natural gas drilling and exploration - Table V-3, _SCB_.

4. Construction

Unpublished NPE data were obtained for 1963-1970. Other years extrapolate with shipments of construction machinery, SIC 3531.

5-25 Manufacturing

Data for both plant and equipment is taken from the Census and Annual Survey of Manufactures.

26. Railroads

The equipment figure is obtained by the formula $V_t = NPE_t - C_t$ where C_t is construction from Table 1 of the U.S. Department of Commerce, Bureau of the Census, Construction Reports (CR), "Value of New Construction Put in Place."

27. Trucking

From Transport Statistics of the U.S., Part 7, Tables 9 and 12, one obtains the figure for Revenue Freight equipment acquired by Class I Common Carriers of General Freight (CICCGF). This figure is adjusted for equipment purchases of non-Class I carriers and other equipment by using the depreciation values shown for each of these categories. (See 1985). No data was available for expenditures for public warehouses, also a part of this two-digit industry.

28. Transportation

$V_t = NPE_t$ (Airlines)

29. Other Transportation

$V_t = NPE_t$ (Other transportation) - Trucking

30. Communication

$V_t = NPE_t$ (Communication) - S_t (Communication)
S_t = Telephone & telegraph from Table V-3 SCB.

31. Electric and Gas Utilities

$V_t = NPE_t$ (Electric & Gas) - S_t (Electric and Gas)
S_t = Electric light and power, gas from Table V-3, SCB

32. Trade

Equipment data are obtained by extrapolation of the Input-Output figures for 1963 and 1967 by shipments of Service industry machinery, SIC's 3581, 3586, and 3589.

S_t = Commercial minus Offices and warehouses from CR. The Census Bureau discontinued its disaggregation of the Commercial category in 1966, we have maintained the two series by using the 1966 split.

33. Real Estate

S_t = New dwelling units from Table V-3, SCB

34. Hotels and Lodging Places

S_t = Non-housekeeping units from Table V-3, SCB.

35. Medical and Educational Services

S_t = Educational, Hospitals and Institutions from Table V-3, SCB.

36. Finance and Other Services

V_t = a residual category obtained by substracting all other equipment investment from total PDE (National Accounts basis).

$$V_t = PDE_t - \sum_{i=1}^{35} V_{t,1}$$

S_t = Offices and warehouses from CR (See Trade above.)

CHAPTER V

LABOR COMPENSATION

5.1 Overview of Chapter

The development of a satisfactory procedure for forecasting labor compensation by industry is crucial to the model's overall performance. Accordingly, one element determining total labor compensation — namely, average compensation per manhour — has been the subject of intensive investigation for this thesis. The behavior of wage changes by industry not only has an impact on the aggregate rates of inflation and aggregate income levels but also influences relative prices.

The process of obtaining labor compensation at the two-digit SIC detail of the income model is a three-tiered procedure as illustrated in Chart V-1. On the first tier, we estimate Phillips-type equations for four fixed-weight indexes of hourly earnings. The industry detail is as follows: (1) "Industrial" (Mining, Manufacturing, Transportation, Communications, and Utilities), (2) Contract Construction, (3) Trade and Finance, (4) Services. Unpublished quarterly data provided by BEA have been used to adjust each of the series for fringe benefits and employer payroll taxes. The resulting indexes are probably the best available measures of underlying wage rates changes at this level of aggregation.

In the second tier, we explain gross compensation (i.e., including overtime payment) for 100 sectors; 70 are in manufacturing. The dependent variables in these equations are indexes of <u>relative</u> wages; that is, all average earnings measures in the "industrial" group are relative to the

CHART V-1

Determination of Labor Compensation by Industry

TIER 1

Hourly earnings indexes for four industry sectors (excluding overtime, adjusted for fringe benefits) estimated quarterly.

(Production Workers)

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TIER 2

Indexes of gross hourly earnings for 100 industry sectors (adjusted for fringe benefits from two-digit NIA data). Estimated annually and in terms of the <u>relative</u> wage level.

100-sector detail used in quarterly price-wage model. (A method of quarterly interpolation described in Chapter IX.)

(Production Workers)

↓

TIER 3

Labor compensation per manhour for 49 private non-farm industries using results of Tier 2 via estimated "bridge" equations. Farm and government average earnings related to the aggregate wage rate. Total labor compensation by two-digit industry obtained by simple multiplication of manhours.

(Production and Nonproduction workers)

first fixed-weight index from tier one. These equations thus must pick up the short-run effects of overtime payments, cyclical fluctuations in labor supply peculiar to detailed industries, and general trend effects.

Reconciliation of the BLS and National Income Accounts (NIA) data for compensation per employee is achieved in tier three. The major discrepancies are that NIA data includes earnings of nonproduction workers and any irregular bonuses paid to all employees. Regression equations, estimated at the two-digit SIC level, explain average compensation per employee on the basis of a fixed-weight index (at a two-digit level) of compensation from tier two, the change in employment, a variable representing interindustry employment mix shifts, and a trend factor. The change in employment is included as a proxy for cyclical variations in intra-firm employment mix, for average earnings per manhour often fall as employment increases because lower paid, mostly nonsupervisory workers are hired. A complete description of each of the variables is given in Section 5.4.

The contents of the remainder of the chapter are as follows: in Section 5.2, the theoretical specification and estimation results for the tier one aggregate equations are reported. In addition to the four-sector breakdown described above, a number of experiments are made with a single aggregate wage equation similar to ones recently made in the literature.

In Section 5.3, we develop a specification for the tier 2 relative wage equations and report the estimation results. The BLS-BEA reconciliation equations are then discussed in Section 5.4. Appendices V-A and V-B describe the methodology behind the construction of the aggregate and industry wage series. If the reader is not satiated with the problems of wage determination in Sections 5.2 through 5.4, he may wish to look at Appendix V-C. There, I report on some attempts to specify quarterly wage-change equations by industry; attention is given to the long-run implications for the relative wage structure.

Before turning to the estimation results of the tier 1 equations, some rationale behind the general approach chosen may be useful. In fact, I would have been happy to report that the approach just described for forecasting labor income by industry was the one originally planned at the outset of this study. However, as may be common in model-building projects of this sort, one's initial specifications, when empirically estimated, may lead to a set of equations that may be dismissed immediately as an unreliable forecasting tool.

The original plan was inspired by a maxim near and dear to every input-output researcher's heart—the common sense notion that an economic aggregate is nothing more than the sum of its parts. The "aggregate wage," of course, is the simple average (be it fixed-weight or otherwise) of wage rates in individual industries. Since our ultimate aim is to explain wage rates by industry, as well as the aggregate wage, a perfectly natural course would be to explain changes in earnings at the most detailed sectoring level feasible for the complete model. At an early stage it was clear that the full 123 sector detail in manufacturing as found in the standard INFORUM model would be unnecessarily burdensome. However, I did not feel a full retreat to a two-digit SIC level was optimal. There are many cases of rather heterogenous industries within two-digit industries classifications, for instance, tires and tubes versus miscellaneous plastic products in SIC 30. As a result, we moved to a more manageable scale of 100 separate industries in the private economy.

In attempting to explain wage changes for this number of industries, one consideration is paramount. That is the fact that while one is developing equations which, taken together, forecast changes in the aggregate wage, one is also implicitly forecasting the wage structure. This simple point is often overlooked by builders of industry wage models, as Michael Wachter points out.[1] That is, if one uses Phillips-type specification for separate industries with the key variables of an unemployment rate and past change in prices, structural differences in short-run wage behavior (as well as the statistical consideration of insufficiently lengthy sample periods) will yield unique pairs of coefficient estimates for each sector. With different price coefficients, Wachter notes that such a model, in effect, explains relative wages by the absolute price level. However, the problem here is not the difference among sectors in the relative influence of tight labor markets versus prices changes, but rather that one may plan to use such a model to forecast a future quite unlike the estimation period. An often-used procedure (in calibrating long-run (five to ten years) forecasts within the econometric model) is to solve the model so as to achieve some target level of the unemployment rate. With an assumed path of unemployment that eventually stablizes around a particular level, our set of estimate industry wage equations will obviously predict ever widening wage differentials. This prediction runs counter to competitive theory; but arises as soon as we run the model under sustained conditions never experienced during the estimation period. The estimation period, at

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[1]Michael Wachter, "Cyclical Variations in the Interindustry Wage Structure," American Economics Review, Vol. IX, No. 1 (March 1970), p. 272.

least for the U.S. post-war period, is characterized by cyclical fluctuations in unemployment rates. This experience yields short-run differences in wage changes among industries, but when averaged over the full period, trends in wage levels that are very similar for most industries.

In summary, the Wachter criticism applies mainly to the length of forecast horizon and its assumed cyclical characteristics. For purposes of forecasting the next four or eight quarters, the usual short run specifications would ordinarily be appropriate.

In spite of understanding the nature of the problem, there still remains the difficulty of implementing a solution in order to use the model for both "long run" (for our purposes, five or more years into the future) and short run simulations. One device for ensuring some "long run" stability of the wage structure is to include the lagged value of the relative wage level in a Phillips specification for the detailed industries. That device was employed in estimating equations of the following form:

$$(5.1)\quad \frac{\Delta W_j}{W_j} = f[\Delta P/P,\ UR,\ \Delta EMP_j,\ \left(\frac{W_j}{\bar{W}}\right)_{-1}].$$

where

P = an index of consumer prices

UR = unemployment rate

EMP = employment in sector i

$\bar{w}$ = a fixed-weight index of the aggregate wage

The relative wage variable is rooted solidly in competitive theory (by shifting the labor supply curve to an industry) as well as reflecting institutional spillover effects. An industry whose relative wage has fallen below its average for the sample period would be expected, *ceteris paribus*, to have larger increases in its own wage.

Some details of the empirical results for a specification similar to (5.1) are given in Appendix V-C. For now, we note two unsatisfactory aspects of the results. First, collinearity between the price variable and the relative wage lead to coefficients in the former being unstable and, in many industries, implausible. This phenomenon occurs largely as a result of the buildup of inflation in the late 1960's, with the effect that in slower price-reacting sectors (i.e., industries characterized by long-term contracts), the regression cannot distinguish between the effects of past declines of real wages versus declines in relative wages. In a number of sectors, negative price coefficients were obtained.

Second, the dependent variable in the equations was the quarterly percentage change in an index of hourly earnings. The quarterly change was adapted in order to circumvent autocorrelation introduced by using overlapping four-quarter changes but, as Black and Kelejian show,[2] we still must assume that equal numbers of workers receive a wage increase in each quarter. This assumption obviously becomes more and more suspect as finer levels of industry detail are examined. Where the assumption does not hold, equation (5.1) produces a spurious correlation between the dependent variable and the relative wage. In quarters where larger-than-average numbers of workers receive increases, the relative wage is likely to be above its mean value. In subsequent quarters, the probability is greater that *fewer* than average workers receive increases, which leads to smaller increases in the overall earnings index. Obviously, the smaller increases in the subsequent

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[2] S. W. Black and H. H. Kelejian, "The Formulation of the Dependent Variable in the Wage Equation," *Review of Economic Studies*, Vol. XXIX, No. 117, (January, 1972), pp. 55-59.

quarters are now roughly (negatively) related to the existing level of the relative wage. The theory would be more appropriate in the analysis of a series of negotiated wage rates for which the relative wage would be relevant only in periods immediately prior to the occurrence of the negotiations.

With these and other problems confronting us in the direct estimation of wage-change functions by industry, I turned to the "two-stage" approach as described earlier. On the positive side, this approach has several important advantages given the limited resources of the model-builder. First, the increased ability to test more elaborate specifications with four equations versus a hundred is obvious. Experimenting with a single aggregate equation in addition to those for the broad industry groups also gives us a basis for comparing our results with others in the literature. We also gain a significant practical advantage by greatly reducing the updating costs.

Second, the two-stage approach, in proposing wage-change equations for broad groups, also lessens the likelihood of violating the assumption that equal numbers of workers receive wage increases in each quarter. For those two sub-aggregates in which this may not be true, we may take advantage of published BLS data on the numbers of workers in collective bargaining units receiving increases in newly negotiated contracts. The availabilty of other independent variables is also enhanced at this level of aggregation as compared to a two-digit and three-digit SIC basis.

A final point relates specifically to the nature of the data base originally available for this thesis. With substantial effort, a set of seasonally adjusted gross earnings indexes were constructed for 99

(100 minus agriculture) sectors and for a uniform sample period 1958:1-1974:2. Many sectors (including a large number of manufacturing) had no separate data before 1958:1 and others required interpolation of annual data to get back to 1958. At a later stage of work on the aggregate equations, it became apparent that the omission of the 1955-1957 period had a substantial influence on the coefficient values. Indeed, the inclusion of the earlier data improved the predictive performance for the 1975-1976 period. Thus, it seems the trade of the original disaggregation for more reliable aggregate equations is well worth making.

As any input-output researcher knows, the question of the appropriate industry disaggregation is a vexing one, especially when he may not anticipate all the uses to which the model will be put. The scheme chosen here for modeling wage determination by industry, I believe, has the best chance of leading to reliable aggregate forecasts while still offering the potential flexibility of allowing the model user to insert his own outside projections of wage changes for detailed industries. We now turn to our empirical results for the aggregate wage equations in tier one.

5.2 Aggregate Wage Equations

In this section we develop Phillips-type wage equations for a single aggregate wage index and for the four sub-sections cited in section 5.1. We focus first on the estimation of a single aggregate equation for the private non-farm economy: we apply the results derived from this work in the subsequent estimation of sub-sectors. The development of a satisfactory aggregate equation is also important in its own right. As we shall indicate in Chapter X, for long-run forecasts we slowly merge the results of the sub-sector equations to that of the aggregate.

The subject of wage determination is one area of economics that has to be analyzed within particular historical circumstances. An intensive effort to develop a satisfactory aggregate wage equation grew out of the failure of an early version of the INFORUM price-wage model to track adequately the deceleration of prices and wages in 1975 and the first part of 1976. There was strong evidence that the specification of the wage equations (estimated for four sub-aggregates, but different than these used in the present model) was the source of the problem. Accordingly, the first part of this section examines several standard wage equation specifications of recent vintage in the literature in an attempt to sort out quantitatively the factors leading to the 1975-early 1976 deceleration. In particular, we focus on the impact that the 1975 "light" bargaining year in the collective bargaining sector may have had on the hourly earnings index. In addition, on the basis of historical relationships, could the personal income tax cut enacted in early 1975 have had a significant moderating effect on wage behavior? Finally, from both a methodological and theoretical point of view, does the 1972-76 experience aid in distinguishing what sort of price should be in the wage function: the CPI, the GNP personal consumption deflator, and/or the private nonfarm business GNP deflator?

The finding of a specification that reasonably explains the 1972-76 experience (and especially 1975-76), of course, is not a sufficient condition that such a specification will be satisfactory for forecasting purposes. However, given the extraordinary movements of prices and unemployment rates in the latter part of this period, we can have some degree of confidence in our wage function if its estimated coefficients are reasonably stable after including 1972-76 data in the regression.

Three main conclusions may be stated at the outset with regard to our analysis of this aggregate series. First, the level of bargaining activity has a significant and reasonably stable influence on quarterly rates of change of the private nonfarm hourly earnings index. The decline in the number of workers negotiating new contracts in major bargaining units contributed about two-thirds of a point drop (at annual rates) in growth of the index from mid-1974 to the end of 1975.

Second, no empirical support is found for a moderating influence of the personal income tax cut made in early 1975. The results of previous studies which have found a role for personal tax rates in the wage equation may be biased by their use of <u>effective</u> tax rate constructs, rather than measures more insensitive to the business cycle.

Finally, it appears that a rather "old fashioned" Phillips-type equation, containing a simple distributed lag of the Consumer Price Index, does the best job of forecasting the 1974-1976 experience. The GNP consumer expenditure and private nonfarm business deflators both overpredict changes in the earnings index for 1975 in some specifications by as much as three percentage points.

Equation Specification and Variable Definitions

The statistical equations explaining money wage changes used here are similar in basic form to others in the current literature in that excess demand for labor and price changes are the principal explanatory variables. As a proxy for excess labor demand, the unemployment rate for men twenty-five and older and its first difference are used. Other variables tested derive largely from the recent work of Robert J. Gordon.[3] Gordon has paid special attention to personal and employer taxes and to the type of price variable and associated lags.[4] In particular, Gordon has argued for the inclusion of both consumer and producer prices in the wage equation, the latter on grounds that a rise in product prices increases the demand for labor by increasing the value of labor's marginal product.

New Wage Measure

The wage-change equations developed here employ a slight refinement of the Gordon wage variable adjusted for fringe benefits. Using unpublished quarterly data from the Bureau of Economic Analysis for both total compensation and wages and salary payments, the major component indexes of the

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[3]Robert J. Gordon, "Inflation in Recession and Recovery," Brookings Papers on Economic Activity, (1971:1), pp. 105-169.

[4]Gordon also carefully evaluated alternative measures of labor market tightness, i.e., unemployment rate for hours, unemployment dispersion, hidden unemployment -- in his Brookings Papers article (see footnote 3). This paper does not consider these more sophisticated excess demand measures.

BLS private nonfarm aggregate hourly earnings index are adjusted to include employer payroll taxes and fringe benefits. That is, the sector earnings index is multiplied by the ratio of total compensation of employees to wage and salary income in the corresponding sector. The series are then renormalized to a 1967 base and aggregated with 1967 payroll weights. This procedure eliminates some small movements in the adjusted aggregate indexes which may be caused simply by shifts between sectors with high and low ratios of fringe benefits to wages. The wage variable thus constructed extends from 1954:1 through 1976:1. Details of this procedure are described in Appendix V-A. The dependent variable in all equations is the quarterly percentage change of the wage index expressed as an annual rate.

Negotiations Variable

A principal new independent variable considered in this study is the number of workers in major collective bargaining units (1,000 workers or more) for which contracts are negotiated in the current quarter (labeled NG). The data is tabulated on a quarterly basis by BLS and published in Current Wage Developments.[5] Presumably, the possible

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[5]Separate quarterly totals have been published by BLS only for years since 1968. Prior to 1968, cumulative summaries for three-month, six-month, nine-month, and annual periods were used to infer quarterly magnitudes. These earlier data were not always published in Current Wage Developments; BLS press releases and the Monthly Labor Review were used as supplementary sources. The variable itself is defined as the number of workers affected by wage-rate actions; this includes some workers whose wages may not have been increased in the quarter (although whose supplemental benefits may have been increased). In 1966, BLS extended coverage to include contracts in construction and finance, insurance, and real estate. Since construction is the predominant portion of this addition, and separate data for it are published since 1968; the more recent aggregate data are defined to exclude construction.

effect of discontinuous numbers of workers affected by major union settlements has not gained attention in aggregate wage research because usually no more than five million workers out of a total private nonfarm workforce (production and nonsupervisory workers) of fifty million (in 1973) renegotiate contracts in any calendar year. However, at least one previously published study incorporated such a variable for a slightly less aggregative purpose. George deMenil and Jared Enzler reported moderate success with a negotiations term in a 1970 wage equation explaining compensation per manhour in a sector comprising mining, manufacturing, transportation, communications, and utilities.[6]

Employer and Employee Taxes

One of the new features introduced by Gordon, at least in terms of U.S. wage research, was the symmetric treatment of employer payroll taxes and personal employee taxes as elements that may raise before-tax wage rates in the short run. The short-run impact of social security tax rates is obvious, since the Gordon wage measure was inclusive of employer taxes. However, the Gordon hypothesis is that much of the employer tax may be shifted backward by employers onto employees in subsequent quarters, as employers seek to re-establish wage costs that they would have incurred before the rise in payroll tax rates.

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[6]deMenil, George and Jared Enzler, "Prices and Wages in the FR-MIT-PENN Econometric Model," in Otto Eckstein (ed.), The Econometrics of Price Determination, a conference sponsored by the Board of Governors of the Federal Reserve System and the Social Science Research Council, (Board of Governors, 1972), pp. 277-308. deMenil and Enzler report that their negotiations variable was the number of employees covered by union contracts comprising 10,000 employees whose contract was negotiated in the quarter. Since their variable covered larger bargaining units than the one for this study, its quarter-to-quarter variation is much greater.

The influence of employee social security and personal income taxes upon wage rates is contingent on a positive elasticity of labor supply with respect to after-tax rates. For any given level of gross earnings, an increase in the tax rate workers pay drives a wedge between net and gross wage rates. The consequence of a tax rise will be an upward shift in the supply schedule which will result in increases in gross wage rates. In the 1971 Gordon paper, "employee" and "employer" tax variables are constructed so as to permit interpretation of the amount of tax-shifting. That is, both variables are expressed as growth rates of 1/1-T), in which T is defined as the average tax rate.

A possible bias may exist in empirical implementation of these tax variables since they are defined as effective rates computed from aggregate data rather than statutory rates. For the employer payroll tax this may not be as serious a problem as the effective rate is defined as the ratio of one-half of federal plus state and local social security tax revenue divided by total wage and salary payments. Generally, this would respond only to changes in the social security contribution rate and level of maximum earings. However, there may be spurious changes due to increasing coverage of the work force and cyclical employment mix as workers in high and low wage sectors are taxed at different effective rates.

On the other hand, one must seriously question the Gordon personal tax rate series since it incorporates the cyclical effects of the progressive income tax and transfer payments as well as underlying changes in legal rates. It is defined as the average of the employer rate (as discussed above, but now refers to the employee portion of the social security tax payments) and a ratio computed by dividing federal plus state and local personal and nontax payments by personal income.

The complexity of the current individual income tax law makes the identification of a statutory tax rate practically impossible. However, for this study we argue that the effective rate for a "typical" worker may be relevant in the aggregate wage equation. Such data is prepared by the Bureau of Labor Statistics in its series for gross and spendable weekly earnings for production or nonsupervisory workers. BLS computes the social security and Federal withholding taxes for two typical workers. The series employed here applies to a worker in the private nonfarm economy with average earnings and three dependents.

To illustrate the relationship between the effective (PERTAXF) tax rate and the "statutory" rate taken from the BLS source (PERTAX), the following simple regression on quarterly data was estimated:

$$\log PERTAXF = \underset{(14.3)}{.0692} + \underset{(3.3)}{.515} \log PERTAX$$

$$+ \underset{(1.0)}{.204}\ PERTAX_{-1} + \underset{(.8)}{.124}\ PERTAX_{-2}$$

$$+ \underset{(11.0)}{.0875}\ (1/UNEM20) \qquad 1954:2\text{-}1971:2$$

$$\bar{R}^2 = .937, \quad S.E. = .0065, \quad D.W. = .65$$

Both tax rates were expressed in the form 1/(1-T), the form in which they are entered into the wage equation.

The regression clearly shows the presence of cyclical influence in the expected direction on the effective series with the unemployment term. In addition, the long-run elasticity of the effective series with respect to the rate is near unity. The presence of the lags may be attributed to personal tax payments that are made on the basis of quarterly declarations rather than through withholding.

Prices

The preceding two variables are plausible refinements to a standard wage equation, but any modern empirical study of wages fails or succeeds on the basis of its treatment of prices. The array of price variables employed in the literature is seemingly endless: threshold variables, prices interacting with other variables, prices whose lags vary from one quarter to six years, survey measures of expected prices, consumer prices, producer prices, etc. And, of course, the items in the list above are not mutually exclusive. We have restricted our attention to standard specifications involving the CPI, the GNP personal consumption deflators, and a fixed weight private nonfarm output deflator.[7] This most popular current method of entering price terms in the wage equation is by use of distributed lags and we shall follow that approach here.[8] The basic specification is a twelve-quarter polynomial lag of degree 3,

[7]The fixed-weight private nonfarm deflator was constructed with 1963 expenditure weights (and 1972 benchmark National Accounts deflators) similar to the manner described by Gordon (footnote 3) p. 154. The empirical differences by using the published implicit private nonfarm deflator versus the fixed weight specification were significant. The published version produced a lag shape whose maximum weight did not occur until quarter t-5; the fixed-weight specification gave a reasonable pattern of monotonically declining weights.

[8]From available evidence involving survey measures of expected prices, there appears to be both expectational and "catch-up" elements of feedback from prices to wages. As such, our interpretation of the distributed lags of past prices is that such lags do not serve solely as proxies for expected price change.

with zero weight assigned to quarter "t-13." In addition, several equations investigating the significance of both consumer price index (CPI) and the private nonfarm deflator (PNFD), employ shorter lags constructed with fixed weights of .4, .3, .2, and .1. In all cases the current quarter's inflation rate is excluded from the regression.

Sample Period

Although regressions may be run over many alternative sample periods, in this paper we follow a common, recent practice of ending one sample period immediately before the 1971 wage-price controls. A major test in differentiating among various specifications is the stability of the coefficient estimates when the period is extended through 1976:1. The initial period is generally 1954:1, although several equations are estimated from 1958:1 to test their sensitivity to omission of the 1955-1957 inflation.

Empirical Results

The results of regression analysis for five specifications employing distributed lags of consumer prices are shown in Table V-1. For each equation (except equation 4) estimated, the line marked "a" refers to a 1954:2-1971:2 sample period. The subsequent line marked "b" shows the estimates for an extended sample period to 1976:1.

Equation 1a uses a twelve-quarter distributed lag for the total Consumer Price Index: the sum of weights is shown under the column labeled PRICE. SSRATE is the tax-multiplier form of the OASDHI employer contribution rate (i.e., percent change in 1/1-T). It was originally estimated by entering the current and four lagged quarterly values, but

TABLE V-1

Wage Equations for Private Nonfarm Economy Using Consumer Prices[a]

	Constant	Sum of Weights or Price	SSRATE	Personal Tax Rate PERTAX	UNEM25	UNEMCHG	GUIDE	NC	CONPER	$\bar{R}^2$	S.E.	D.W.
1a	.037	.676	.743	.002[b]	-.0046	-.0051	-.0060	.131[d]		.799	.0072	2.07
	(4.4)	(7.4)	(4.6)		(4.3)	(1.7)	(2.1)					
1b	.039	.750	.806	.001[c]	-.0049	-.0039	-.0067	.119	-.0006	.855	.0079	1.81
	(5.9)	(5.6)			(5.2)	(1.4)	(2.5)		(.3)			
2a	.039	.671	.668		-.0046	-.0051	-.0064	.115		.796	.0073	2.09
	(4.9)	(6.7)	(4.7)	(4.3)	(1.7)	(2.6)	(2.6)					
2b	.040	.732	.773		-.0051	-.0027	-.0069	.120	-.0004	.856	.0079	1.80
	(6.5)	(13.2)	(5.5)		(5.4)	(1.0)	(2.8)		(.2)			
3a	.053	.560	.756		-.0048	-.0059	-.0093			.776	.0076	1.72
	(9.6)	(5.9)	(5.3)		(4.3)	(1.9)	(4.1)					
3b	.053	.645	.754		-.0046	-.0038	-.0093		-.0010	.842	.0083	1.51
	(12.2)	(12.5)	(5.6)		(4.8)	(1.3)	(3.9)		(.5)			
4a	.029	.925	.596		-.0028	-.0077	-.0023	.113		.869	.0061	2.38
	(3.8)	(8.5)	(4.5)		(2.8)	(2.4)	(1.0)					
4b	.035	.802	.757		-.0060	.0020	.0050	.128	-.0015	.878	.0076	1.80
	(6.7)	(13.3)	(5.5)		(5.0)	(.7)	(1.9)		(.9)			
5a	.026	1.038	.689		-.0039	-.0073	-.0036	.119		.800	.0072	2.13
	(2.7)	(7.4)	(4.3)		(3.9)	(1.4)	(1.5)					
5b	.040	.847	.793		-.0055	-.0035	-.0065	.092		.855	.0079	1.82
	(6.6)	(11.3)	(6.1)		(5.7)	(1.2)	(2.6)					
				THRESH								
6a	.041	.445	.614	.368	-.0040	-.0028	-.0054	.115		.796	.0071	2.01
	(5.3)	(2.5)	(4.3)	(1.8)	(4.1)	(1.0)	(2.3)					
6b	.041	.706	.738	.093	-.0046	-.0006	-.0064	.116	-.0001	.846	.0081	1.69
	(5.2)	(4.5)	(5.5)	(.6)	(4.9)	(.2)	(2.5)		(.1)			

Footnotes - TABLE V-1

[a]For all specifications (except 4) the line marked "a" refers to a 1954:2-1971:2 sample period. The subsequent line marked "b" uses an extended sample to 1976:1. Equation 4 begins in 1958:1.

[b]Sum of coefficients for current and three lagged quarters. Individual coefficients and t-statistics are as follows: PERTAX (t-0): -.067 (12); (t-1): .037 (.6); (t-2): -.0660 (1.0); (t-3): .098 (1.4).

[c]Same as note b, but for full same period. Individual coefficients and t-statistics are: (t-0): -.0559 (1.1); (t-1): .0097 (.2); (t-2): -.0019 (.1); (t-3): .0491 (1.0).

[d]Sum of coefficients for current and two lagged periods. See Table 3 for individual coefficients and t-statistics.

the same difficulty as reported by Gordon,[9] was encountered. That is, the sum of the weights for the lagged terms invariably implied that employers shifted more of an increase in the social security tax onto employees than the initial change in the tax. As a result, the Gordon procedure was followed by imposing the following lag patterm: 1.0, -.4, -.3, -.2, -.1. That is, the SSRATE variable in Table V-1 is

$$SSRATE_t = 1.0R_t - .4R_{t-1} - .3R_{t-2} - .2R_{t-3} - .1R_{t-4}$$

where R_t is the annualized percentage change in 1/(1-T).

Some may question why the coefficients on SSRATE uniformaly fall significantly below one in Table V-1. On the basis of supplementary regressions, it appears that significant shifting onto employees ("backward" shifting) takes place in the same quarter as the tax increase. The current change in the tax rate in an equation explaining <u>only</u> the hourly earnings index (i.e., not including employer taxes and fringes), takes on a value of approximately -.20. There is also some evidence that the growth rates of other labor income (fringes) is also retarded in quarters of increases in the social security tax. Gordon constrained the coefficient of his employer tax rates to unity on the premise that hourly earnings are fixed in the short run. However, increases in social security tax have usually been announced well in advance of their implementation and workers whose wages would be adjusted in the quarter of the tax increase may be affected adversely by backward shifting (in addition

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[9]Gordon, op. cit.

to the reduced net wage due to the higher employee portion of the tax).[10]

The results of the personal tax variable were disappointing. Without knowing the precise lag through which such taxes may influence wage decisions, the contemporaneous and three lagged coefficients were freely estimated. The sum of the weights is slightly positive, but as footnote b to table V-1 displays, there is no plausible lag pattern. The F-statistic for the four coefficients taken together is 1.27, falling below the five percent significance level of 2.55.

Since the theoretical case for the employee tax variable rests substantially on the same ground as that for including consumer prices, one cannot definitely conclude that changes in personal income taxes will never ultimately affect gross wages rates. However, the evidence here is that there is no stable short-run relationship that may be useful in a policy-making context, contrary to what Gordon found.

The remaining columns of Table V-1 are fairly self-explanatory (with the exception of the one labeled CONPER). UNEM25 and UEMCHG are the level and first difference of the employement rate for men twenty-five and older. The first difference term is only marginally

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[10] In addition to the statutory social security tax rate, an effective rate series was also tried. The effective rate was computed by making quarterly estimates of the employeee and employer contributions for federal government employees and deducting the estimates from quarterly receipts for federal social insurance contributions. (Survey of Current Business, Table 3.1). The effective rate was defined as one-half the resulting series divided by total wages and salaries for the private economy. The constrained-lag tax variable using the statutory rather than the effective rate was used since it produced slightly higher coefficients and regression fits.

significant in 1a; its best performance is in an equation substituting the GNP personal consumption deflator for the CPI (4a). The GUIDE variable is a dummy for the Kennedy-Johnson guidepost period.[11] It is statistically significant in nearly all equations although its numerical magnitude is sensitive to the exclusion of the negotiations variable and the choice of price index.

The values in the column headed NG are the sum of the coefficients on the number of employees negotiating in the current and two previous quarters (actually, number of employees x .0001). The three coefficients are shown separately in Table V-3. All three are retained even though only the one quarter lagged term is significant at the five percent level. The joint F is 4.40 versus a five-percent critical value of 2.78. The implications of the size of the negotiations coefficient on the 1972-1976:1 wage history will be discussed after reviewing all of the estimated specifications.

The reader may be wondering at our neglect of any discussion as to the appropriate normalization of the negotiations variable. That is, the effect on an aggregate wage index in a particular quarter by those employees negotiating in that quarter depends on the proportion of total wages that they represent as well as the magnitude of general wage settlements at the time.[12] For our particular sample, the secular effect

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[11]The guidpost dummy takes the values of 1.0 for 1962:2 through 1966:2, .5 for 1966:3, and 0.0 elsewhere.

[12]Several crude attempts to adjust thebargaining variable were to multiply it by: (1) a simple 12-quarter average of previous price changes and (2) the reciprocal of a four-quarter moving average of the unemployment rate. Both these multiplicative variables produced inferior statistical results than simply NG entered alone.

of these two influences are in opposing directions. The absolute number of employees bargaining in major units (1,000 or more) if anything, shows a negative trend from 1954-1976; their relative share, of course, would drop even more rapidly. On the other hand, the secular trend in wage inflation rates is positive, with the 1974 period observing wage increases nearly double of any other in the sample period. One could presumably try to adjust for these factors, but no rigorous attempt was made here. A first reason is that one cannot be completely sure that patterns of union bargaining have remained constant over the sample period. That is, if there is a tendency toward more local (and smaller) bargaining arrangements — but whose timing may follow that of major national agreements -- then although the number of workers in major national agreements may decline, their effective influence on an aggregate wage index has not. Secondly, the adjustments to account for the prevailing inflation rate would be highly tenuous. Much of the impact of price increastes in the collective bargaining sector is through escalator clauses, for which the impact on the wage index is much more continuous than that from negotiated increases.

One aspect of the empirical results suggests that no gross bias is caused by simply entering the number of employees. The coefficients estimates for NG are reasonably stable after the 1971:3-1976:1 period is added with its sharply higher rates of inflation.[13]

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[13]See J. Johnston and M. Timbrell, "Empirical Tests of a Bargaining Theory of Wage Rate Determination," Manchester School of Economic and Social Studies, June, 1973, pp. 141-167, for a discussion of why the simple proportion of workers negotiating in the period may be an appropriate regressor in explaining a wage index for workers with different contract lengths.

In addition to the negotiations coefficients, the remaining estimates in equation 1a are reasonably stable as the sample is extended to 1976:1. The price coefficient rises by about 14 percent and the social security tax coefficient increases slightly as the 1973:1 increase in the OASDHI contribution rate is added to the sample. In spite of the fact that the unemployment term is entered linearly, its coefficient still falls slightly as the regression attempts to explain the 1975-1976 deceleration. The phenomenon is more pronounced in specifications not using the CPI.

Two additional variables to account for the effects of the 1971-1974 wage price control program were also included in the extended sample period regressions. The first is a dummy variable with values 1 and -1 for the wage freeze and wage release quarters of 1971:4 and 1972:1. The coefficients are not displayed in Table V-1 since the estimates were all highly insensitive to alternative specifications. The estimates were all near -.045 with a standard error of .006. That is the freeze retarded wage growth by 4.5 percent per year for one quarter. The second variable is also a dummy designed to pick up the transitory effects of Phases 1-lV, and the decontrol period. Since the control phases were very brief, any attempt to measure the impact for each would be futile. As a result, the dummy variable constructed is akin to that used by Wachter in which the effect of the entire controls period is assumed to be essentially transitory.[14] The variable used here, CONPER (for control period) takes on the following values:

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[14]Michael Wachter, "The Changing Cyclical Responsiveness of Wage Inflation", Brookings Papers on Economic Activity, (1976:1), pp. 115-168. Wachter did not publish the values of his dummy variable; the values used here assume Phase I was more restrictive than the succeeding phases of controls.

CONPER	Value		Number of Quarters	
1971:3	.67	*	1	.67
1971:4-1972:4	1.0	*	5	5.00
1973:1-1974:1	.50	*	5	2.50
1974:2	-4.0	*	1	-4.0
1974:3	-2.5	*	1	-2.5
Net effect				1.67

However, in spite of this elaborate construction, the coefficient on CONPER is not significant. In terms of specification 1, the bulk of the 1974:1 to 1974:4 acceleration in wages can be explained in terms of the rapid prices increases occurring and a heavy schedule of bargaining in the union sector. Later we look more closely at quarter-to-quarter movements in the 1973-1975 period and the problems with modeling the effects of controls.

The remaining equations in Table V-1, except for 6a and 6b, may be discussed straightforwardly. Equation (2) drops the insignificant personal tax variable. The only coefficient that is much affected is that on the employer tax variable, which drops about ten percent from equation (1a).

In equation (3), the negotiations terms are deleted. Reassuringly, the unemployment rate coefficient is unaffected; however, the price term falls by a little over 15 percent upon the omission of NG. The guide-post dummy coefficient increases about 40 percent; since the guidepost period encompasses at least one full three year bargaining cycle, it is perplexing that the guidepost coefficient should be this sensitive. In terms of both regression fit and serial correlation criteria, equation (3) is inferior to equation (2).

As those familiar with the postwar history of the collective bargaining sector may be aware, the 1955-56 period was one of intense bargaining activity. Over seven million workers negotiated new contracts in 1955 alone. In an effort to determine whether the bargaining variable derives its life solely from that experience, equation (2) was rerun with a new starting period of 1958:1. The results are shown as equation (4) in Tables V-1 and V-3. Inexplicably, the current NG term assumed a negative sign (with t-statistic of .8), but the one-quarter lag remained highly significant with approximately the same level obtained previously for the current and one-period lag (see Table 3, line 5). Other aspects of equation (4a), however, point to more disturbing instabilities. The price coefficient rises from .671 to .925, and the effect of current unemployment is reduced by about a third.

The GNP personal consumption deflator (PCD) is substituted for the CPI in equation (5) (again with 1954:2 starting period). As other researchers have noted, the price coefficient jumps substantially. However, the much maligned CPI holds its own when the $\bar{R}^2$ of 2a is compared to 5a. The most disturbing feature of the PCD specification is the greater instability for the price and unemployment terms as the sample period is lengthened. However, as Table 3 shows, the negotiations coefficients are reasonably insensitive to change in the sample period or price variable.

Equation (6) indicates the difficulty of modeling a stable threshold effect in an aggregate wage equation. Many economists have argued that both the feedback will be greater and the lags will be shorter, as rates of inflation rise above some threshold level. In addition, some have stated that variability of past price changes will influence the current expected change. This latter idea has been crudely represented by Vanderkamp in a variable Z, which measures the number of quarters during the past four years in which the rate of price increase has exceeded two percent on an annual basis.[15] Entering this variable alone allows a threshold effect to shift the intercept of the equation, but it seems more plausible that the slope (with respect to prices) should be increased at the threshold level. Accordingly, the following variable, ZS, is constructed.

$$ZS = Z \cdot S$$

where

$$S = \sum_{i=1}^{4} w_i \cdot [\Delta p/p_{t-i} - .02]$$

w_i $(i = 1,4) = .4, .3, .2, .1$

if $S \leq 0.0$ then set $S = 0.0$

Basically, this threshold variable puts a kink in the function relating wages to prices, but takes on its full effect only after four years of price increases greater than two percent. ZS is entered in addition to a 12-quarter distributed lag on the CPI in equation (6).

The results for the period ending 1971:2 are encouraging. Both the standard distributed lag and the threshold term enter at the ten percent confidence level. The remaining coefficients are little changed

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[15] John Vanderkamp, "Wage Adjustment, Productivity, and Price Changes Expectiations," Review of Economic Studies, Vol. XXXLX, No. 117, (January, 1972), pp. 61-72.

from equation (2a). However, to this author's surprise, the threshold variable is almost completely eliminated as the sample period is extended, and the fixed distributed lag assumes the same general pattern as in equation (2b). Experiments with different threshold levels and more conventional threshold constructs indicated the same sort of instability as more recent data is added.

Equations with Producer and Consumer Prices

On a theoretical level, there is a strong argument for a role of producer prices as well as consumer prices in affecting rates of changes of wages. In most elementary terms, reference to a standard labor supply-and-demand diagram indicates that equilibrium wage rates are influenced by consumer prices shifting the labor supply curve and producer prices shifting the labor demand curve. In the noncompetitive case, rates of changes of producer prices may (in excess of unit labor cost changes) serve as proxies for an exployers's ability to pay. As Robert Gordon states in his 1971 paper:[16]

> "In a period of excess commodity demand, when firms raise the price level relative to labor cost, their demand for labor increases and they are willing to pay a higher wage. The same result occurs, even if firms do not take the initiative in raising wages, when union leaders respond to a firm's increased profits by demanding higher wage increase than they would otherwise."

In the same 1971 article, Gordon uses distributed lags of both a fixed-weight private nonfarm deflator (PNFD) and the GNP personal consumption deflator (PCD) in his aggregate wage equations. More recently

[16]Gordon, op. cit., p. 112.

Perry[17] and Wachter[18] have estimated wage equations using only producer prices as the price variable.

Table V-2 presents the regression estimates for five equations using the fixed (1963)-weight private nonfarm deflator and the Consumer Price Index (CPI). Equation (7) uses only PNFD, in a 12-quarter distributed lag on the CPI and a fixed 4-3-2-1 weighting for the private nonfarm deflator. Equation (9) drops the negotiations variable and equation (10) begins the sample period in 1958:1. Equation (11) uses 4-3-2-1 fixed lag weights for both PNFD and CPI, and starts in 1954:2. Table 3, as before, displays the individual lag coefficients for the bargaining variable.

If one compares equations estimated from 1954:2-1971:2 using only the CPI (2a), only the PCD (5a), or only the PNFD (7a), one can only conclude that they all perform about equally well. The PCD, and PNFD specification are both accelerationist in that their price coefficients exceed one, but the difference in the $\bar{R}^2$ between any two of the three is less than .01. However, equation (7) with PNFD shows even more instability than did equation (5) using the PCD when the sample period is extended to 1976:1. The unemployment coefficient jumps by 80 percent, and the control dummy assumes the a priori incorrect sign. The implications for the post-sample predictions of equation (7a) are that, given the actual course of prices, wage increases would never have fallen below 11 percent in 1975.

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[17]George Perry, "Determinants of Wage Inflation Around the World," BPEA (1975:2), pp. 403-448.

[18]Michael Wachter, "The Wage Process: An Analysis of the Early 1970's," BPEA, (1974:2), pp. 507-525.

TABLE V-2

Wage Equations for Private Nonfarm Economy Using Producer and Consumer Prices

	Constant	PNFD	CPI	SSRATE	UNEM20	UEMCHG	GUIDE	NG	CONPER	$\bar{R}^2$	S.E.	D.W.
7a	.031	1.054		.672	-.0033	-.0056	0.0	.061		.781	.0075	1.38
	(3.8)	(8.8)		(4.7)	(2.9)	(2.0)	(.1)					
7b	.043	.990		.706	-.0052	-.0006	-.002	.040	.0040	.811	.0090	1.66
	(7.6)	(10.7)		(4.9)	(5.7)	(.2)	(.7)		(1.6)			
8a	.031	.295	.554	.605	-.0031	-.0037	-.0036	.109		.796	.0071	2.15
	(3.9)	(1.8)	(4.3)	(4.3)	(2.8)	(1.3)	(1.4)					
8b	.039	.113	.697	.719	-.0043	-.0016	-.0061	.105	.00	.849	.0081	1.74
	(6.7)	(1.3)	(7.1)	(5.4)	(4.8)	(.6)	(2.4)		(.0)			
9a	.037	.469	.403	.699	-.0021	-.0056	-.0041			.759	.0078	1.97
	(5.7)	(3.2)	(3.4)	(4.8)	(1.8)	(1.9)	(1.5)					
9b	.0458	.218	.558	.725	-.0034	-.0032	-.0060		.0003	.828	.0086	1.58
	(11.0)	(2.6)	(6.6)	(5.3)	(3.6)	(1.1)	(2.2)		(.1)			
10a	.0314	-.222	1.096	.541	-.0037	-.0024	-.0021	.111		.872	.0059	2.46
	(4.0)	(1.1)	(5.9)	(4.5)	(3.2)	(.9)	(.9)					
10b	.0314	.003	.852	.697	-.0040	.0007	-.0045	.110	-.0015	.872	.0077	1.67
	(6.6)	(.1)	(7.6)	(5.4)	(4.7)	(.3)	(1.7)		(.8)			
11a	.0322	.295	.462	.593	-.0021	-.0065	-.0052	.074		.774	.0075	1.85
		(1.7)	(3.7)	(4.0)	(1.9)	(2.4)	(2.0)					
11b	.0428	.134	.509	.714	-.0030	-.0069	-.0088	.049	-.0010	.820	.0088	1.56
	(6.9)	(1.5)	(5.5)	(5.0)	(3.9)	(2.8)	(3.3)		(.5)			

TABLE V-3

Coefficient Estimates and T-Statistics for Lagged Negotiations Terms

Equation	Descriptions	NG(t-0)	(T-value)	NG(t-1)	(T value)	NG(t-2)	(T-value)
1a	CPI, tax var., 1954-71	.0392	(1.5)	.0698	(2.9)	.0385	(1.7)
1b	" " " 1954-76	.0308	(1.3)	.0597	(2.5)	.0356	(1.6)
2a	CPI, 1954-71	.0217	(.9)	.0768	(3.2)	.0343	(1.5)
2b	" 1954-76	.0266	(1.1)	.0643	(2.7)	.0355	(1.6)
4a	CPI, 1958-71	.0[a]		.0943	(3.6)	.0183	(.7)
4b	" 1958-76	.0[a]		.0848	(3.1)	.0255	(1.0)
5a	PCD, 1954-71	.0153	(.6)	.0861	(3.6)	.295	(1.3)
5b	" 1954-76	.0134	(.6)	.0600	(2.6)	.0212	(1.0)
6a	CPI, threshold, 1954-71	.0152	(.6)	.0714	(3.0)	.0285	(1.3)
6b	" " 1954-76	.0236	(1.0)	.0610	(2.5)	.0312	(1.3)
7a	PNFD, 1954-71	0.[a]		.0610	(2.6)	0.[a]	
7b	" 1954-76	0.[a]		.0410	(1.6)	0.[a]	
8a	CPI, PNFD (4-3-2-1), 1954-71	.0148	(.6)	.0752	(3.2)	.0186	(.8)
8b	" " " 1954-76	.0206	(.9)	.0583	(2.5)	.0261	(1.1)
10a	CPI, PNFD (4-3-2-1), 1958-71	0.		.0929	(3.5)	.0176	(.7)
10b	" " " 1958-76	0.		.0846	(3.0)	.0254	(1.0)
11a	CPI (4-3-2-1), PNFD (4-3-2-1)	.0063	(.3)	.0610	(2.5)	.0064	(.3)
11b	" " " "	.0110	(.4)	.0339	(1.4)	.0036	(.2)

Footnotes:

[a]Lag term deleted since coefficient negative a t-statistic less than .5.

There appears to be some collinearity between the distributed lag on the PNFD and the bargining variable. As Table V-3 shows, the one-quarter lag of NG is still statistically significant at the five percent level, but the magnitude (for the sum of the three coefficients) is only about half that found in equations (1) - (6). This result is also dependent on the sample period chosen. When the sample period begins from 1958:1, the NG coefficient jumps to .088, much closer to that found in the equation using the CPI (4a).

On the basis of the empirical results thus far, and the theoretical case that consumer prices should not be excluded, equations (8) - (11) used both the PNFD and the CPI. As mentioned previously, the CPI assumes a 12-quarter freely estimated lag, and a fixed-weight four-quarter lag is imposed on the output deflator. The shorter lag is used for the PNFD to keep in the spirit of Gordon's original specifiication, and also as it seems likely that any significant labor demand effect from producer prices should work with a fairly short lag (within one year).

The reader may study for himself the specific results of equations (8) - (10). but the main conclusion to emerge is this: the hypothesis that producer prices are a significant independent factor in affecting aggregate wage change as represented by the private nonfarm deflator gets its most support in a specification omitting the negotiations variable and estimated from 1954 to 1971. In all cases, the significance of PNFD is reduced as the 1972-76 experience is added. Furthermore, the omission of the 1954-57 period results even in an incorrect sign on the output prices (equation (10a)).[19]

The interaction between the negotiations variable and PNFD is the trickest to sort out. It is apparent that both the significance and the magnitude of the output price is significantly reduced when the bargaining variable is added (equation (9a) to (8a)). However, it would be overstating our case to say that difference in the PNFD coefficient represents fully the bias in omitting NG. Undoubtedly the extremely high level of bargaining activity in 1955-56 was not independent of prevailing economic conditions. This author has made no attempt to determine to what extent the number of employees negotiating new wage settlements in 1955-56, were either those (1) under regularly expiring three-year contracts, (2) under shorter contract lengths resulting from the Korean War experience, or (3) negotiating from wage reopener provisions. However, an attempt to explain formally the number of employees negotiating in a given quarter was made by regressing NG on the unemployment rate and various lags of the CPI and PNFD. This effort was not successful in terms of regression fits, although one specification using PNFD (with an implausible lag distribution) predicted a slight rise in employees bargaining in 1955-56 over 1954 (but still substantially underpredicting actual NG for the latter two years).

On balance, however, the evidence would seem to be in favor of still a significant bias in the output price coeffcient by the omission of the

[19]Gordon himself would not be surprised by this result. He notes that the major divergence between the PCD and PNFD occurs prior to 1957.

negotiations variable. Comparing equations (8a) and (10a), one sees that the negotiations coefficients, at least for the one-quarter lag, are reasonably stable while the more recent sample period completely destroys any separate short-run influence of the producer price.

Finally, equation (11) was run using fixed 4-3-2-1 lags on both prices variables to offer, in effect, a head-to-head contest between the PNFD and CPI. The effect of the bargaining variable is muted with the shorter lags on both price terms, but again the CPI dominates the short-run impact of the output price.

Post-Sample Period Simulations

Table V-4 presents on a quarter-by-quarter basis the results of simulating four selected equations from 1972:1 through 1976:1. Columns 1 and 2 display the number of employees bargaining in major units (NG) and the actual wage changes for the wage index constructed for this study. The four additional pairs of columns display the predicted wage behavior (taking all other variables at their historical values) and the contribution of the negotiations term(s) to the predicted wage change. The contribution of the negotiations variable has been normalized to a 1971 base; that is, the values shown are minus the average contributions for the four calendar quarters of 1971.

It was never the intent here to attempt to measure the impact of the Economic Stabilization Program on wage behavior, but several comments may be in order. First, the results illustrate the danger of relying on any single specification to provide an unambiguous answer as to the

TABLE V-4

Post-Sample Predictions and Contribution of Negotiations Variable

	NG	Actual	Eq. 2a, Distrib. Lag CPI		Equ. 5a, Distrib. Lag PCD		Eq. 7a, Distrib. Lag PNFD		Eq. 11a, Distrib. Lag, CPI, 4-Qtr. Lag. PNFD	
			Pred.	NG Contrib.	Pred.	NG Contrib.	Pred.	NG. Contrib.	Pred.	NG Contrib.
1972:1	402	.111	.057	-.0051	.064	-.0058	.063	-.0048	.053	-.0047
2	550	.061	.053	-.0083	.061	-.0085	.064	-.0045	.053	-.0051
3	511	.053	.053	-.0071	.059	-.0072	.062	-.0036	.052	-.0042
4	498	.073	.054	-.0069	.059	-.0071	.056	-.0027	.050	.0043
1973:1	1048	.096	.073	-.0060	.078	-.0065	.078	-.0039	.072	-.0041
2	1523	.066	.057	-.0008	.061	-.0011	.051	-.0006	.055	-.0004
3	698	.076	.070	.0030	.075	.0034	.056	.0023	.070	.0023
4	1123	.073	.074	-.0008	.076	-.0017	.053	-.0027	.074	-.0022
1974:1	578	.073	.079	-.0016	.087	-.0013	.071	-.0001	.091	-.0005
2	1276	.101	.088	-.0028	.100	-.0037	.082	-.0034	.103	-.0031
3	1555	.103	.096	.0013	.114	.0012	.107	.0008	.119	.0010
4	591	.100	.100	.0038	.121	.0042	.115	.0025	.122	.0026
1975:1	646	.096	.091	-.0026	.113	-.0032	.112	-.0034	.110	-.0031
2	466	.076	.084	-.0056	.107	-.0059	.119	-.0030	.100	-.0035
3	636	.085	.081	-.0067	.101	-.0070	.114	-.0041	.084	-.0045
4	290	.078	.080	-.0067	.099	-.0066	.111	-.0031	.078	-.0038
1976:1	228	.066	.082	-.0089	.100	-.0092	.112	-.0052	.080	-.0058

controls' quantitative influence on wage behavior.[20] For the two "pure" quarters of Phase I: 1972:2 and :3 (in terms of hourly earnings data) the CPI specifications imply wage increases slightly above those expected the PCD and PNFD versions imply the opposite. A more dramatic difference occurs in 1973, where the PNFD equation underpredicts actual wage increases about 1.5 percent at annual rate whereas the other equations predict nearly the observed increases.

Secondly, the results show that evaluating the controls <u>in terms of hourly earnings data</u> is made particularly difficult by the coincidence of the bargaining cycle and the controls period phases. If we take the estimates of equation (2a) as an upper limit as to the possible impact from negotiations timing, and those from (7a) as a lower limit, the results imply that a decline of -.4 to -.7 percent in 1972 relative to 1971 would have occurred regardless of the imposition of controls. An obvious caveat is that, again, this magnitude is somewhat dependent on the average level of wage settlements during the estimation period (as embodied in the coefficient of NG), but even the reduced level of first-year increases in the collective bargaining sector in 1972 is above the sample period average. This influence on the earnings index changes for 1972 due to the bargaining cycle implied by the estimates here is certainly significant relative to the range of predicted values resulting from specifications using alternative price variables and unemployment rates that are commonly tested.

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[20] This point is made strongly by Susan and Wayne Vroman in a recent paper assessing the impact of controls on wage behavior in manufacturing: "Money Wage Changes: Before, During and After Controls," mimeograph.

Putting aside the problems of the controls period, we turn next to investigate the influence of the negotiations variable on the 1974-1976:1 deceleration. Although the reader may choose for himself any grouping of quarters that he desires, for our purpose we choose two four-quarter intervals; 1974:2-1975:1 and 1975:2-1976:1. Actual wage increases in the first interval average 10.0 percent at annual rates and fall to 7.6 percent in the latter period. Again, using equations (2a) and (11a) as upper and lower limits, the light bargaining in 1975 accounts for between 29 and 13 percent of the difference (i.e., -.7 and -.3 percent of annual rates). Since first year negotiated increases in the collective bargaining sector in 1975 actually exceed those for 1974, it is probable that the effect of the 1975 light bargaining is nearer the upper limit than the lower.

Concluding Remarks

An important conclusion to emerge from this study is that the timing of collective bargaining by major unions has a statistically significant influence on the behavior of an aggregate hourly earnings index. On the face of it, this fact would seem apparent; but the effort here represents one of the few to test it formally in an aggregate wage specification. The impact of negotiations shows clearly in the variety of specification testing alternative sample periods, price variables, and lag patterns. This finding suggest the danger in too zealously evaluating residuals for equations estimated without consideration of contract timing for period as short as a year or less.

If our aggregate wage study succeeds partially on a methodological basis, it certainly fails to resolve an important issue in the theory of wage determination. A major problem is the inconsistency between the strong evidence of consumer prices as an important influence on wage behavior and negative findings as to the effect of personal taxes. If wage behavior is, indeed, amenable to conventional economic theory, then one would expect both influences to show up. Regarding the independent effect of producer as opposed to consumer prices, the evidence here is that the impact of producer prices (as represented by private nonfarm business deflator) is highly sensitive to the sample period and equation specification. Obviously, the consumer price index may serve as proxy for expected producer prices, but results which could clearly define the underlying structure would be preferred. The enthusiasm of those who thought the 1973-1975 divergence of producer and consumer prices would give clear answers should be tempered by the unfortunate timing of the removal of controls and the collective bargaining cycle and the imprecision as to our knowledge of the lags linking wages to prices.

Equations for Sub-Aggregates*

The wage equations for the four sub-aggregates are similar in their basic specification to equation (2) above. That is, the principal explanatory variables are the unemployment rate for men 25 and over, the first difference of the unemployment rate, and a distributed lag on changes in the consumer price index.

The estimation results for the final specifications only are given here. However, a wide variety of alternative specifications were tested for each equation, and a summary of the major findings is in order before

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*With four aggregate wage equations, rather than one, in the first stage of our "two-stage" approach, the reader will note that we still are subject to the Wachter criticism that divergent wage levels may be produced by the model. Unfortunately, for long-term forecasting applications we are forced to implement some ad hoc adjustments. Each sub-aggregate equation is allowed to operate independently for a specified interval (usually around four years). After that we take a weighted average of the percentage change in the earnings index supplied by each of the sub-aggregates and the change in an aggregate index constructed from all four equations. The weights for each separate equation are gradually reduced to zero.

turning to the regression results proper. Some of this testing was done at the eight-sector breakdown of the aggregate nonfarm index (i.e. durable manufactuing, nondurable manufacturing, wholesale and retail trade, etc: see Appendix V-A). A number of the conclusions at this more disaggregated level were assumed to hold at the four-sector aggregation finally chosen.

No published quarterly series exists for a "value-added" deflator below the private nonfarm level of aggregation. As such, we cannot test explicitly for the role of producer prices in the sub-aggregate equations. However, movement in producer prices relative to wages are highly correlated with corporate profit rates. Quarterly estimates of national income originating by industry division are made by BEA and the separate components of labor compensation and gross corporate profits are available. To test for the impact of producer prices/profits in the sub-aggregate equations the rate of corporate profits to national income was constructed for each industry division. Both a four-quarter moving average of this variable and a four-quarter difference were tested (both lagged one quarter). Our results were consistent with a number of other recent studies which have found no important role for profits in ("recent", i.e, post 1965) wage behavior. In only one sector, wholesale and retail trade, was the lagged change in profit share statistically significant with the correct sign.

Extensive testing was made to construct (or find) more industry-specific measures of excess demand. First, unemployment rates by industry (of last employment) were available from BLS for each of the eight sectors in private nonfarm hourly earnings index. In all but contract construction, the primary unemployment rate (UNEM25) provided as good or better fit of the data. Apparently, outside of construction, there is sufficient labor mobility to allow a single aggregate rate to represent demand conditions as well as do the specific rates.

In an effort to determine whether recent past conditions in the labor market were helpful in explaining wage behavior, various fixed weight distributed lags of the UNEM25 were tested (e.g. .5, .5, .5, .333, .167). In nearly all cases the current period value provided the best fit, a result which is consistent with a competitive model.

An available and possible supplementary measure of demand conditions, the change in sector employment, is generated within the complete model. Four-quarter and one-quarter changes in manhours were tested, but only in wholesale and retail trade was this variable significant with correct sign. Even this result was achieved only by dropping the ΔUNEM25 variable, a variable which is highly correlated with the change in employment in this sector (and in other sectors, too, almost by definition). In durable manufacturing a fixed-weight index of gross hourly earnings was constructed at an early stage of this project. The manhours change variable is higly significant in explaining such an index which includes short-run fluctuations due to overtime premiums. However, there is no role for the change in manhours when the published BLS series excluding overtime is substituted as the dependent variable. One may suspect that the significance of the change in unemployment term is overstated in those wage studies which use compensation per manhour or gross hourly earnings.

Final Equation Results

Since the more elaborate specifications produced generally negligible improvements over the basic specification, the basic specfication was modified only slightly for the final sub-aggregate equations. The regression coefficients for each sector are shown in Table V-5 and

TABLE V-5

Wage Equations for Sub-Aggregates[a]

	Constant	CPI[b]	SRATE	UNEM25[c]	UFMCHG	GUIDE	NG[d]	MW[e]	CONPER	$\bar{R}^2$	S.E.	D.W.
Industrial												
12a	.0161	.781	.628	-.0034		-.0059	.252			.687	.0115	2.13
	(1.7)	(6.7)	(3.1)	(2.5)		(1.7)	(3.2)					
12b	.0231	.895	.751	-.0048		-.0069	.218			.805	.0110	1.57
	(3.3)	(12.7)	(4.2)	(4.1)		(1.9)	(3.1)					
Construction												
13a	.0652	.818	.365	-.0082	-.0088	-.0061				.429	.0203	2.05
	(4.9)	(3.9)	(.9)	(2.7)	(1.2)	(.9)						
13b	.0883	.489	.847	-.0126	-.0017	-.0067			-.0134	.414	.0209	1.905
	(9.3)	(4.4)	(2.5)	(5.0)	(.3)	(1.0)			(2.4)			
Wholesale and Retail Trade, Finance												
14a	.0488	.506	.641	-.0038	-.0121			.0126		.568	.0104	2.05
	(7.3)	(5.3)	(3.3)	(2.5)	(2.9)			(1.0)				
14b	.0482	.493	.717	-.0035	-.0089			.0192		.687	.0108	1.76
	(10.2)	(10.2)	(4.2)	(2.9)	(2.5)			(1.8)				
Services												
15a	.0536	.721	.749	-.0055	-.0078			.0080		.644	.0112	2.03
	(8.3)	(6.6)	(3.5)	(3.7)	(1.7)			(.9)				
15b	.0602	.680	.533	-.0069	-.0076			.010		.673	.0127	2.04
	(11.9)	(10.6)	(2.6)	(5.3)	(1.8)			(1.0)				

Footnotes:

[a] As in Tables V-1 and V-2, the equations sufficed by "a" are estimated through 1971:2, those with "b" run through 1976:1.

[b] The individual lag weights for the full sample equations are shown below.

[c] The unemployment term for the Industrial sector is the average of the current rate only.

[d] The coefficient displayed for NG is the sum of the current and two lagged terms. The t-value is that for the most significant coefficient.

[e] MW refers to the minimum wage variable as described in the text.

Footnotes (Table V-5 con't)

Addendum: Individual lag weights for full-sample regressions

Lag	Industrial	Construction	Trade & Finance	Services
1	.127	-.035	.116	.100
2	.119	-.005	.100	.093
3	.111	.021	.085	.085
4	.102	.041	.070	.078
5	.092	.057	.055	.070
6	.083	.067	.040	.062
7	.072	.073	.027	.054
8	.061	.073	.013	.045
9	.050	.069		.037
10	.038	.059		.028
11	.026	.044		.019
12	.013	.025		.009

the footnotes indicate the modifications that were made for several of the sectors. As in the aggregate equation, in each of the equations a FREEZE dummy variable was included in the 1954:2-1976:1 sample period regression.

Industrial

The equation for the Industrial sector (manufacturing, mining, transportation, and utilitites) is very good in terms of overall fit and satisfactory with regard to the stability of the coefficients. Both the price and unemployment rate responses increase as the data for 1972-76 period is added. As expected, the magnitude and statistical significance of the negotiations variable is greater than in the aggregate equation.

Construction

A satisfactory specification for the construction sector was not found. A wide variety of alternative variables and lag structures were tested in an effort to find some stable specification, but to no avail. A national effort to control accelerating construction wages was instituted in the spring of 1971 and a dummy variable to capture the impact of this program was highly significant. However, this variable (as well as alternative, more flexible dummy variable specifications) was not sufficient in rendering a stable structure. Apparently, the effect of the controls program was not simply to shift the intercept of the wage equation, but to alter the marginal responses to the explanatory variables. One further conjecture is that the existence of wage spirals in the construction industry may account for the very loose relationshp of money wage changes to market variables.[21] Spirals may have been prevalent in the 1969-71 period. First-year negotiated wage increases in 1969 were 14 percent, compared to 7 percent in manufacturing; and during the first half of 1970, the rate of increase in construction accelerated to 17 percent. The effect of these increases was to generate a substantial disequilibrium between union and nonunion segments of the industry. The process of restoring traditional differentials may require many years to be worked out; this process will involve slow growth in union wage increases as nonunion workers find they can more effectively compete for jobs, especially in periods of slack demand. The period 1972-76 may be characterized as such a disequilibrium period and may help to explain the large differences in coefficient estimates as compared to the 1954-71 sample period estimates.

Wholesale and Retail Trade, Finance

The equation for Wholesale and Retail Trade and Finance was very good in terms of stability criteria. An eight-quarter distributed lag on the CPI produced a more reasonable lag structure than did the longer three year lag of the basic specification. This reflects the fact that expectational and catch-up behavior involving consumer prices are not prevalent in this basically competitive sector. Both the level and the change in unemployment rate appear to serve as joint proxies for excess labor demands conditions in this sector. Replacing the change in the

[21] For a discussion of wage spirals in the construction industry, see D.Q. Mills, "Wage Determination in Contract Construction," Industrial and Labor Relations Review.

aggregate unemployment rate by that for only wholesale and retail trade increased the $\bar{R}^2$ of the equation by approximately .03. However, such an unemployment rate cannot be generated by the full model. Surprisingly, attempts to substitute the change in employment in the sector for the change in the sector's unemployment rate were not successful. Apparently, changes in (primarily secondary) participation rates are so cyclically sensitive as to make the employment change variable by itself a poor measure of labor market conditions.

The quarterly change in the minimum wage was statistically significant in the full-sample regression.[22] The largest percentage change in the minimum wage occurred in May, 1974 in which the minimum wage increased by 92 percent at annual rates. According to equation (14b), the impact from this change on the average wage in trade and finance was about 1.8 percent, again expressed at an annual rate. Some economists have advanced the notion that the rise in the minimum wage was largely responsible for a spurt in the aggregate wage indexes that occurred in the second and third quarters of 1974. The evidence here does not support such a conjecture.

Services

The equation for services was basically stable and the fit was good for both sample periods. An interesting result is that the price coefficient is higher than that for trade and finance, while on the other

[22] An "effective" minimum wage for trade and services was computed by weighting the statutory minimum wages under the 1961 and 1966 Amendments to the original 1938 Act. The (employment) weights were taken from BLS data for 1970-71.

hand, the unemployment rate coefficient is (algebraically) lower. We also found the longer 12-quarter lag on the CPI to perform better than the shorter lag used in trade. We may speculate that the CPI is picking up some structural shift in the demand-supply relationships for workers in the health-related areas in the latter part of the 1960's. Many economists have argued that the introduction of the Medicare program in 1966 was responsible for a large increase in demand for medical services which, in turn, fostered the growth of union organization in hospital staffs. Such a development could affect the estimated coefficients in equation (15) since health-related workers comprise about a quarter of the weight in the hourly earnings index for services. Further work will be required to model this shift, if indeed it is a significant factor. The basically competitive structure of most service industry labor markets shows up in the large unemployment rate coefficient. The minimum wage variable has been retained in the equation although its standard error is only about equal to the value of the coefficient.

5.3 Relative Wages by Industry

In this section we develop the second tier of our scheme for forecasting labor compensation -- relative wage equations for 99 sectors in the private economy. In the present version of the mdoel these equations have been estimated on an annual basis. For the quarterly price-wage model to be described in Chapter IX, we need quarterly wage levels. We postpone a discussion of how these equations are "quarterized" until Chapter IX (section 9.6). Before turning to our own empirical results, we review briefly some recent literature and develop the theoretical rationale behind our equations.

Background and Theory

Although the study of wage differentials (one either an industry or occupational basis) has a long history in economics, it has usually been in a static context. That is, a large number of authors have attempted to determine the factors behind interindustry wage differentials that exist at a specific point in time. Many of these have been concerned with measuring the extent to which unions have affected differentials across industry and occupational boundaries.

The focus here is upon explaining the changes over time in relative wages by industry. Our sample period covers the most recent post-war period on which there was little union growth in the U.S. private sector. To the extent that a union's ability to achieve a permanently higher relative wage is indexed by its membership, (as some previous studies have argued) we can generally ignore union effects on "long-run" relative wages for our particular sample period. Rather we shall be mostly concerned with the cyclical variation by industry of relative wages.

Empirical work dealing with relative wage determination is sparse as compared to vast literature on the subject of the setting of money wages. The first formal estimation of relative wage equations to appear in the literature was a study by Michael Wachter in 1970.[23] The basic hypothesis behind Wachter's work was that two-digit manufacturing sectors could be divided into a high wage, primarily noncompetitive sector and a low wage, primarily competititve sector. The high wage industries were

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[23] Michael L. Wachter, "Relative Wage Equations for United States Manufacturing, 1947-67," Review of Economics and Statistics (Vol. III, No. 4), November 1970.

hypothesized to consciously attempt to maintain a wage premium over the competitive wage paid by the low-wage sector. To the extent that this policy is successful, employers in the high-wage industries may hire from a labor queue. As the unemployment rate falls, wages in the low-wage industries will rise; but high-wage firms may not raise their wages unless the size of the labor queue declines to a unsatisfactory level. Thus, one of the major hypotheses of the Wachter study is that high levels of unemployment hold down relative wages in the low-wage industries, while the opposite is true in the high-wage industries. Wachter lists a number of factors that the high-wage industries may consider in this policy; among them, "Contract lags, the interest of trade unions in a certain minimum rate of wage increase during loose labor markets, (even at the expense of a slower rate of growth during tighter markets) and the complementarity between administered prices and an acyclical wage policy."[24]

In deriving a specification for estimation, Wachter begins initially in a totally static framework. "Wages may be viewed as determined in the more competitive industry by an industry supply function that is dependent on the industry wage relative towages paid in other industries and aggregate unemployment and by a demand function derived from a Cobb-Dogulas production function."[25] Wachter's initial equation is for the industry's absolute wage:

$$(5.16) \quad W = B_0 V^{B_1} U^{B_2} W^{*B_3} \qquad B_0, B_1, B_3 > 0, B_2 < 0$$

[24]Ibid. p. 406

[25]Ibid. p. 405

where V is value added, U is aggregate unemployment, and W* is a proxy for wages paid in other industries. Since (5.16) is presumed to hold for all sectors, Wachter rewrites it, after some manipulation,[26] as:

$$(5.17)\quad \log W/W^* = \log \alpha_o + \alpha_1 \log V/V^* + \alpha_2 \log U$$

For the final estimation Wachter adds two dynamic elements to (5.22). First, the rate of change of consumer prices, (in distributed lag form,) is added to account for the possibility that different industries adjust with different speeds to changes in prices. Second, the unemployment rate is converted into a distributed lag. Lags may appear because of long-term contracts and the economic costs associated with frequent changes in wages. In addition to these modifications a time trend is added to the equation.

The final equation is shown as follows, which is estimated for annual data (straight-time average hourly earnings)

$$(5.18)\quad \log W/W^* = \log \alpha_o + \alpha_1 \log V/V^* + \sum_{k=o}^{3} \alpha_2^k \log U_{t-k}$$

$$+ \alpha_3 \text{ Time} + \sum_{k=o}^{3} \alpha_4^k \cdot p_{t-k} + \alpha_5 \text{ KW} + \varepsilon$$

(KW is a Korean War Dummy)

Wachter's basic hypothesis regarding the sign of the unemployment rates received empirical support. The coefficients of U were positively

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[26]Wachter defines W^* as an arithmetic average of wages in the two-digit manufacturing sectors, excluding the sector in question. To arrive at equation (5.42) as reproduced here, he would have required W^* to be a geometric average rather than an arithmetic one.

correlated across industries with measures of concentration and unionization rates. The value added terms were significant in eleven equations which indicated to Wachter that industry specific relative demand or ability to pay factors are important in relative wage determination. The price change variables were generally statistically insignificant; and the time trends, although mostly significant, could not be given a specific economic interpretation.

Wachter's study provides a good point of departure, but there are some serious weaknesses in his approach. First, he finds significant industry-specific demand effects with value added, contradicting the usual negative results of other industry wage studies regarding the roles of profits and employment change variables. Since labor compensation is a large part of value added, it seems likely that the use of nominal value added as an explanatory variable creates a serious identification problem with annual data. Wachter needed to remember that the neoclassical theory upon which his specification is based assumes that the value-added price is exogenous to the firm.

Secondly, Wachter does not estimate directly the distributed lags for unemployment and price change, but rather restricts the lags *a priori* to be identical for e very industry. This seems especially serious in the case of the unemployment rate, since different degrees of unionization (i.e. differing average contract lags) would suggest different speeds of adjustment to changes in labor market conditions.

Finally, there is no attempt to integrate this basically static model of relative wage determination with any model of absolute wages, either for the aggregate wage level or specific industries.

A partial solution to this third deficiency is offered by Ashenfelter, Johnson, and Pencavel, (AJP).[27] They construct an explicit behavioral model which attempts to encompass both relative and absolute wage determination. They simplify their problem by dichotomizing the labor market into a union sector and non-union sector with wage rate W^u and W^n, respectively. From conventional static labor theory,[28] the desired union wage (W*) from the union's point of view is to be proportionately larger than last period nonunion's wage (W*). In logarithms, this is represented as

$$(5.19)\quad W^u_* = \phi(X) + W^n_{-1},\ \phi(X) > 0.$$

Where X is a set of variables which reflect both market forces and union militancy.

From the point of view of the "typical" nonunion employer, the desired wage offer is some proportion (most likely less than one) of last period's union's wage. That is,

$$(5.20)\quad W^n_* = \Psi(Y) + W^u_{-1} \quad \Psi(Y) > 0$$

where Y reflects primarly labor market conditions. The spillover from union to nonunion wages in 5.20 may be motivated by the threat of unionization or moral effects.

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[27] O.C. Ashenfelter, G.E. Johnson, and J.H. Pencavel, Review of Economic Studies, (Vol. XXXIX, No. 117), January 1972, pp. 27-54.

[28] Ibid., p. 30

AJP then invoke a standard theoretical device in proposing that the rate of change of the union wage rate will depend upon the difference between the actual and the equilibrium wage. Thus, they hypothesize that

$$(5.21)\quad \Delta W^u = \alpha[W^u_* - W^u_{-1}] \quad 0<\alpha< 1$$

Likewise, the adjustment mechanism in the nonunion sector may be viewed similarly:

$$(5.22)\quad \Delta W^n = \beta[W^n_* - W^n_{-1}] \quad 0 <\beta< 1$$

The change in the wage differential (D), of course, is equal to $\Delta W^u - \Delta W^n$. Upon substitution of 5.19 and 5.20 into 5.21 and 5.22 the change in the logarithm of the union/nonunion wage differential can be written as

$$(5.23)\quad \Delta D = \alpha\phi(X) - B\Psi(Y) - (\alpha + B)\ D$$

The solution to the difference equation is

$$(5.24)\quad D = D_e\ [1 - (1 - \alpha + B)^t] + p_o\ (1 - \alpha- b)^t$$

where

$$D_e = (\ \alpha\pm B)^{-1}\ [\alpha\phi(X) - B\Psi(Y)]$$

D_e is the steady state union/nonunion relative wage (i.e. when the values of vectors X and Y are left constant for an indefinitely long period) and D_o is the differential in some initial period.

D approaches D_e as long as $(1 -\alpha -B) < 1$, the conditions for stability for this dynamic system. Thus, AJP show that the steady-state rates of growth of union and nonunion wages are the same, since D approaches zero. This implication of the model is consistent with the stylized econometric facts of a relatively stable long term wage structure (for the post-war U.S.).

The important result of the AJP paper from a model builder's viewpoint is that it provides a theoretical rationale for including measures of labor market conditions in both wage-change equations and the relative wage equations. If we are willing to represent excess labor demand by an aggregate unemployment rate (UR), we should expect to find UR as an element of both the X and Y vectors considered above. Thus, the key feature of this model is that higher rates of wage change may be associated with lower rates of unemployment; but if a given level of unemployment can be maintained indefinitely, relative wages will eventually stabilize.

AJP seek to use their model to derive a specification for explaining rates of change of union and nonunion wages. Unfortunately, it is hard to see how their end result follows rigorously their initial assumptions. The empirical specification follows directly from substitution into (5.21) and (5.22). If we consider (5.21), the conventional practice is to substitute for W^u_*, a linear combination of hypothesized variables. In this case one would substitute (5.19) into (5.21) and specifically spell out the function $\Phi(X)$. AJP, instead, simply assume that extent of disequilibrium in both union and nonunion labor markets depends upon the unemployment rate and the rate of change of prices. This procedure leads to a wage change specification for each sector which omits the lagged value of the relative wage and also brings in consumer prices by the back door. Thus, a completely consistent theory explaining both wage changes and wage structure is not achieved by AJP.

Specification for the INFORUM model

I would have been happy to report that such a theoretical integration has been obtained here, but such is not the case. One major problem is that likely encountered by AJP; there is no convenient theoretical method of introducing consumer prices into the analysis. Although it is an established empirical fact that there is a feedback from consumer prices to wages, one would not want to include prices as a determinant of the desired union/nonunion (or vice versa) wage differential. If we conduct the argument in terms of real wages, then we implicitly assume instantaneous adjustment to price change on the part of both union and nonunion sectors. This, too, seems inconsistent with the data.

In spite of these difficulties, I believe that we can postulate an empirical specification for explaining wage changes by sectors that is consistent with general labor market and bargaining theory, although not developed rigorously from maximization principles on the part of firms or unions (or workers in an "atomistic" labor market). From the narrow point of view of employing such equations for forecasting purposes, I prefer such an approach to forcing our empirical specification into a rigid theoretical straightjacket. Accordingly, consider the following general form of a money wage adjustment model for industry i:

$$(5.25)\quad \Delta \log w_i = f_i,(U\ \Delta \log P,\ S) - \alpha\ [\log (w_i/w^R)_{-1} - \log (w_i/w^R)^T]$$

where

w_i = wage in industry i

U = aggregate unemployment rate

P = index of (consumer) prices

S = vector of industry-specific variables

w^R = "reference" wage (to be defined below)

$(w_i/s^R)^T$ = "target" level of relative wage

Each of these terms requires some brief explanation. First, in Section 5.2 we showed rather convincingly that the behavior of average earnings data is consistent with the common hypothesis that workers seek to maintain their real standard of living. Thus, changes in consumer prices obviously are a candidate for inclusion in a wage specification for more disaggregated sectors. However, even the modest degree of disaggregation in Section 5.2 shows that some groups of workers are more successful than others in protecting their real wages. No neat theoretical argument can explain this result; rather, it reflects the notion that unions have sufficient market power to extract nominal wage increases to compensate for all or part of an increase in consumer prices (either by explicit escalator clauses or through negotiated changes). As we disaggregate further by industry, this variance in the quantitative effects of price changes may be expected to persist.

We also expect excess demand for labor to be important in explaining changes in wage rates by industry. As we noted at the outset of this chapter, excess labor demand may not be specific to a particular industry if the industry does not require workers with specialized skills. In this simplest case, if we assumed complete mobility and homogenous labor, a measure of excess demand such as the aggregate unemployment rate would be perfectly appropriate in explaining wage change by industry. However, in this case, industry wage equations would be redundant (ignoring possible other determinants of wage changes) since the unemployment rate would have the same coefficient for each sector.

Relaxing the assumption of homogenous labor, we may expect to find some industries operating in a number of labor markets simultaneously. A single measure useful in explaining an hourly earnings construct would essentially require aggregation of excess demand measures for each market. Trying to construct such a measure lies well beyond our means. Thus, we assume that the unobserved measure of excess demand by industry is a stable function of the aggregate unemployment rate. From the previous section we have evidence that there is sufficient mobility among industry groups to make this assumption a good first approximation. (That is, we found in only one of eight industry sectors where the sectoral unemployment rate outperformed the aggregate primary unemployment in explaining wage changes.)

In unionized industries, the role of the unemployment rate must be interpreted in terms of a bargaining power variable. Higher unemployment might cause union negotiators to moderate their demands because of fears of loss of union security, unwillingness of the workers to strike, and so on. One would expect the impact of a given change in the unemployment rate to differ among unionized sectors, since internal political structures will vary across unions. To illustrate, those unions with more rigid seniority rules might be epected to show less concern for employment losses brought about by wage gains during periods of slack product demand.

The variable S represents our belief that there may be certain industry specific variables such as employment changes or industry productivity that are significant in explaining wage behavior by industry.

A majority of these can be characterized as variables which augment the excess demand or bargaining power interpretations of the unemployment rate. Some of these factors, however, will possibly be required according to the particular nature of the wage data that are employed. If hourly earnings are being studied, wage drift component may have to be explicitly accounted for in addition to the (unmeasured) negotiated rates.

In addition to three factors just listed, wage changes in a particular industry may be influenced by reference to the wage received by workers doing similar work in other industries. This hypothesis is not restricted to union-union interdependencies, but covers spill-overs between unions and nonunion sectors. Such inter-relationships may be tested empirically in a number of ways. For our purposes, we restrict our attention to the deviation in the previous period of the ratio, actual wage/reference wage, to some "target" relative wage.[29] The word target implies an explicit bargaining objective on the part of union negotiators. The target level may, in fact, be established by force of custom. For competitive industries, however, the target wage may simply be that minimum relative wage a firm needs to pay to prevent an excessive quit rate.

Ideally, we would test to find the optimum reference wage for each sector. This approach would be more appropriate if we had available data on negotiated union wages, rather than hourly earnings data. Even with data from individual contracts, a recent study by Robert Flanagan found

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[29]The concept of a "target" relative wage is discussed by Robert J. Flanigan in "Wage Interdependence in Unionized Labor Markets," Brookings Papers on Economic Activity (1976:3), pp. 635-682.

rather meager success in isolating the appropriate reference sectors. He concludes that "many of the wage patterns that develop in collective bargaining appear rather fluid, with drifting channels of influence."[30] As a result, I have simply defined W^R to be a fixed-weight average of earnings for the appropriate aggregate wage sector ($\bar{w}$).

The difficulties in directly estimating an equation similar to (5.25) were discussed in general terms in Section 5.1. However, from (5.25) and our definition of W^R, we may proceed to derive a reduced form for an industry relative wage equation. Let the aggregate wage be explained by simply

$$(5.26) \quad \Delta\log \bar{W} = f \; (\Delta\log P, U)$$

Renaming the proportionate wage differential in the AJP article as RW, and assuming the "target" relative wage in (5.25) is some constant, we have from (5.25) and (5.26)

$$(5.27) \quad \Delta RW = f_1 \; (\Delta \log P, U, S) - f \; (\Delta\log P, U) - \alpha \, RW_{t-1}$$

Since $RW = RW_t - RW_{t-1}$ we can solve for the level of the relative wage

$$(5.28) \quad RW_t = f_1 \; (\Delta\log P, U, W) - f \; (\Delta\log P, U) + (1 - \alpha) RW_{t-1}$$

if the functions f_1 and f are linear, then we can rewrite (5.28)

$$(5.29) \quad RW_t = g \; (\Delta\log P, U, S) + (1 - \alpha) \; RW_{-1}$$

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[30]Flanigan, op.cit., p. 671.

Equation (5.29) thus becomes the starting point for our empirical work. It has properties suitable for long-range forecasting as well as being derived from an explicit behavioral model.

Empirical Results

The industry breakdown of our relative wage equations is presented in Table V-6. For the majority of sectors the estimation period is from 1959 through 1975. The wage series may generally be thought of as indexes of gross average hourly earnings (adjusted for fringes and payroll taxes). A description of the selection of the aggregation scheme and of the sources and methods used in their construction is given in Appendix V-B. The construction sector is one of our aggregate wage sectors and no data were collected for agriculture; therefore, equations were estimated for only 98 out of 100 sectors (The wage index for agriculture for forecasting purposes is extrapolated by the index for trade and finance.)

Our initial empirical specification derived from(5.29) was the following:

$$(5.30)\quad RW_i = a_o + a_1\, \dot{P}/P + a_2\, UNEM25 + a_3\, TIME + a_4\, \Delta\log EMP_i + a_5\, NG + a_6\, RW_{i,t-1}$$

where

RW_i = logarithm of wage index in industry i relative to its group aggregate (See Table V-6)

$\dot{P}/P$ = percentage change in consumer price index.

UNEM25 = unemployment rate for men 25 and older

EMP_i = (constant-hours) employment in sector i (see Appendix V-B for precise definition)

NG = number of employees negotiating contracts in current year variable is the same as NG in section 5.2. NG is only included for those sectors in group 1 - Industrial.

The time trend in (5.30) may be rationalized in the context of the spill-over model by allowing the "target" wage differential to change over time. A more likely cause of gradual changes in relative earnings would be secular shifts of the skill mix of workers within a given indsutry.

The industry-specific variable, change in employment, serves ~~to~~ (1) to account for short-run changes in gross earnings due to the payment of overtime premiums, (2) to reflect short-run labor supply inelasticity to the particular industry, and (3) to represent the effects of intra-industry employment mix changes on "average" earnings in the industry. Unfortunately, (1) and (2) would point a positive sign on the employment term while (3) suggests a negative sign.

The rationale for the NG variable is the following. In the sectors with annual wage adjustment, we might expect their relative earnings to decline in periods of heavy bargaining activity in the union sector given that contracts in the union sector are generally "front-loaded." In periods of "light: bargining, on the other hand, relative earnings in those annually adjusting sectors would rise. In unionized sectors, NG would be significant only if the sector had negotiations in the "light" years of the aggregate bargaining cycle. In general, the contract lengths vary to an extent, that such synchronization would be rare over the full sample for a particular sector. Thus, the NG variable is expected to show up, if at all, in nonunion sectors.

TABLE V-6

Wage Sector Aggregation Key

	Tier 1 Sector	INFORUM Sectors	SIC*
1. Farms	3	1-7	010
2. Agric.Services, Forestry & Fisheries	4	8-10	070-090
3. Iron Ores Mining	1	11	101
4. Non-ferrous Ores Mining	1	12-13	102-109
5. Coal Mining	1	14	11-12
6. Crude Petroleum	1	15	13
7. Non-metallic Mineral Mining	1	17-18	14
8. Contract Construction	2	19-20	15-17
9. Meat Products	1	24	201
10. Dairy Products	1	25	202
11. Canned & Frozen Foods	1	26	203
12. Grain Mill Products	1	27	204
13. Bakery Products	1	28	205
14. Sugar	1	29	206
15. Confectionery Products	1	30	207
16. Alcholic Beverages	1	31	2082, 2085 (pt.)
17. Soft Drinks & Flavorings	1	32	2086, 2089 (pt.)
18. Misc. Food Products	1	33-34	209
19. Tobacco Products	1	35	21
20. Fabric, Yarn & Thread	1	36-37	221, 222, 223, 223, 226, 228
21. Floor Coverings & Misc. Textiles	1	38-39	227, 229
22. Apparel	1	40	230, excl. 239
23. Household Textiles	1	41	239

TABLE V-6, Continued

	Tier 1 Sector	INFORUM Sectors	SIC*
24. Knitting	1	42	225
25. Logging Camps	1	43	241
26. Saw and Planing Mills	1	44	242
27. Plywood & Wood Products	1	45-47	243, 244, 249
28. Furniture	1	48-49	250
29. Pulp & Paper Mills	1	50-51,53	261, 262, 263
30. Paper Products	1	52, 54	264, 265, 266
31. Newspapers & Periodicals	1	55-56	271, 272
32. Books	1	57	273
33. Commercial Printing	1	59	275
34. Other Printing	1	58, 60	274, 276, 277, 278, 279
35. Industrial Chemicals	1	64	281
36. Agric. & Misc. Chemical Products	1	65-67	286, 287, 289
37. Plastics, Synthetic Rubber, Man-made Fibers	1	68-71	282
38. Drugs, Cleaning & Toilet Products	1	72-73	283, 284
39. Paints	1	74	285
40. Petroleum Refining	1	76-77	290
41. Paving & Asphalt	1	78	301
42. Rubber Products	1	80-81	301, 302, 303, 306
43. Misc. Plastic Products	1	82	307
44. Leather & Leather Products	1	83-85	310
45. Glass	1	86	321, 322, 323
46. Stone, Clay, & Pottery	1	87-88,90	324, 327
47. Cement	1	89	325, 326, 328, 329
48. Steel	1	91	331, 332, 339 (pt.)

TABLE V-6, Continued

	Tier 1 Sector	INFORUM Sectors	SIC*
49. Copper	1	92	3331, 3351, 3368 (pt
50. Aluminum	1	95	3334, 3352, 3361
51. Other Non-ferrous Metals	1	93-94 96-99	3332, 3333, 3337,335 3357, 3368, (pt.) 3369 (pt.)
52. Metal Cans	1	100	341
53. Fabricated Structural Metals Products	1	102-104	343, 344
54. Screw Machine Products & Stampings	1	106-107	345, 346
55. Other Fabricated Metal Products	1	101, 105 108, 110	342, 347, 348, 349
56. Farm Machiner	1	112	352
57. Construction, Oil Field Machinery	1	113-114	353
58. Metalworking Machinery	1	115-117	354
59. General Industrial Machinery	1	111,118- 122,126	351, 355, 356, 359
60. Computers & Office Machinery	1	123-124	357
61. Service Industry Machinery	1	125	358
62. Transformers, Motors, & Generators	1	129-131	361, 362 (pt.)
63. Household Appliances, Radio & TV	1	134-137	363, 364, 365
64. Communication Equipment	1	132, 138	366
65. Electronic Components	1	139	367
66. Batteries & Engine Electrical Equip.	1	140-141	369 (pt.)
67. Misc. Electrical Equipment	1	133, 142	362 (pt.) 369 (pt.)
68. Motor Vehicles	1	144-145	371
69. Ordnance	1	21-23	19
70. Aircraft	1	147-149	372
71. Ship & Boat Building	1	150	373

TABLE V-6, Continued

	Tier 1 Sector	INFORUM Sectors	SIC*
72. Railroad Equipment	1	151	374
73. Misc. Transportation Equipment	1	152-153	375, 379
74. Engineering, Scientific Instruments	1	156-157	381, 382
75. Optical & Surgical Instruments	1	158-159	383, 384
76. Photographic Equipment	1	160	386
77. Watches & Clocks	1	162	387
78. Misc. Manufacturing	1	163-166	39
79. Railroads	1	167	40, 474
80. Busses and Local Transit	1	168	41
81. Trucking	1	169	42, 473
82. Water Transportation	1	170	44
83. Airlines	1	171	45
84. Pipelines	1	172	46
85. Frieght Forwarding	1	173	47, excl. 473, 474
86. Telephone & Telegraph	1	174	48, Excl. 483
87. Radio & TV Broadcasting	1	175	483
88. Electric, Gas, & Sanitary Services	1	176-179	49
89. Wholesale Trade	3	180	50
90. Retail Trade	3	181	52-59
91. Banks, Credit Agencies, & Brokers	3	182	60-62
92. Insurance	3	183	63, 64
93. Real Estate	3	184-185	65
94. Hotel & Lodging Places	4	186	70
95. Personal & Repair Services	4	187	72, 76

TABLE V-6, Continued

	Tier 1 Sector	INFORUM Sectors	SIC*
96. Business Services	4	188-189	73, 81
97. Auto Repair	4	190	75
98. Movies & Amusements	4	191	78, 79
99. Medical Services	4	192	80
100. Educational Services	4	193	82, 84

*SIC numbers are truncated to 2- and 3-digit basis; 4-digit SIC's shown where 3-digit group was split.

Direct estimation of equation (5.30) produced unsatisfactory results for a number of sectors. Unsatisfactory in this case meant that many coefficients on the lagged relative wage did not fall into the 0.0-1.0 interval. My only explanation is that the disaggregated data do not fit perfectly the model of continual bargaining that under lies the Ashenfelter, Johnson, and Pencavel model. Our earnings data incorporates escalator clauses, overtime payments, and wage drift components in addition to negotiated changes. Thus, the forcing of the same geometric lag pattern for each of our independent variables may not be appropriate for our data series.

As a result, Equation (5.30) was modified by dropping the lagged relative wage and allowing a more flexible lag on the unemployment rate. The current and previous two year's unemployment rates were estimated freely in the regression. In order to conserve degrees of freedom, the same procedure was not followed for the price term. After some experimentation, a .5, .333, .167 weighting pattern was applied uniformly for all sectors. The current year's inflation rate gets half of the weight in order to capture crudely the effect of strong escalator clauses in some industries.

We did not expect an important role for the bargaining cycle variable, and our expectations were confirmed on the basis of preliminary regressions. The coefficient on NG was significant in less than a dozen sectors, and for some of these, the magnitude of the estimates seemed unreasonable. Apparently, in most sectors the contract timing relationship with respect to the aggregate bargaining cycle has not been sufficiently stable to allow this variable to show up in the regressions. For convenience, however, this variable was dropped for all sectors.

The final specification that is in the present model can now be presented formally:

$$(5.31)\quad RW_i = a_o + \sum_{j=o}^{2} a_1^j \dot{P}/P_{t-j} + \sum_{j=o}^{2} a_2^j \, UNEM25_{t-j} + a_3 \, TIME + a_4 \, \Delta \log EMP_i$$

On balance, I feel this specification maintains the spirt of the original specification, but deals more satisfactorily with our particular empirical data. The results of the revised specification are shown in Table V-7.

Looking first at the price coefficients in column 2, the first conclusion is that short-run changes in the inflation rate have a significant effect on the wage structure. In 34 out of the 86 sectors in group 1 (industrial), the price coefficient is statistically significant at the five percent level. Without detailed knowledge of the extent and nature of escalator clauses in each industry, it is difficult to verify <u>a priori</u> the sign and magnitude of each price coefficient. However, the price coefficients are significantly positive in Sectors 3 (Iron ore), 5 (Coal mining), and 48-52 (Primary metals and metal cans), all sectors with strong escalator provisions. The price coefficient is also positive, but not significantly so, in 69 (Motor vehicles). The problem here may be our ignoring of specific contract timing in this industry. The price coefficients explain a portion of short-run changes in the wage structure in sub-aggregate sector 3(Trade and finance). Both Wholesale and Retail

TABLE V-7

INDUSTRY RELATIVE WAGE EQUATIONS

#	INDUSTRY	CONST	PRICE	UR(0)	UR(-1)	UR(-2)	TIME	EMP	RSQ/RBARSQ	S.E.	D-W
2	AGRICULTURAL SERVICES,FORESTRY	-.2247	4.4284	-.0046	.0290	.0021	-.0078	.1698	.885/.796	.017	1.65
		(5.04)	(5.53)	(.56)	(3.80)	(.34)	(2.64)	(1.85)			
3	IRON ORES	-.0732	.6653	.0086	.0130	-.0064	-.0073	.0036	.949/.913	.012	2.71
		(3.46)	(1.81)	(1.77)	(2.42)	(.92)	(4.37)	(.10)			
4	NON FERROUS ORES	.0104	.1430	.0043	.0012	.0024	.0047	.0743	.916/.863	.010	2.29
		(.63)	(.49)	(1.08)	(.25)	(.70)	(3.43)	(1.80)			
5	COAL MINING	-.0278	1.2898	-.0058	.0059	.0058	-.0048	.0443	.268/****	.028	1.45
		(2.03)	(1.54)	(.51)	(.46)	(.63)	(1.17)	(.27)			
6	CRUDE PETROLEUM & NATURAL GAS	-.0512	1.2113	-.0024	-.0048	-.0071	-.0106	.0830	.779/.648	.015	1.29
		(1.51)	(2.16)	(.38)	(.66)	(1.45)	(5.13)	(.71)			
7	NON METALLIC MINERALS MINING	.0087	.1601	-.0070	.0058	-.0045	.0020	-.3083	.770/.631	.012	2.27
		(.35)	(.45)	(1.38)	(1.05)	(1.14)	(1.19)	(2.34)			
9	MEAT PRODUCTS	.0022	-.1194	.0025	-.0044	-.0035	-.0048	.0922	.915/.867	.009	1.78
		(.15)	(.41)	(.69)	(1.06)	(1.26)	(3.04)	(.49)			
10	DAIRY PRODUCTS	.0589	-.9902	-.0028	-.0074	-.0047	-.0003	-.4238	.828/.737	.011	1.15
		(2.89)	(2.78)	(.58)	(1.49)	(1.28)	(.17)	(1.46)			
11	CANNED & FROZEN FOODS	-.0144	.3818	.0041	-.0054	-.0018	-.0026	.0034	.438/.101	.010	1.39
		(.80)	(1.08)	(.75)	(1.32)	(.52)	(1.70)	(.03)			
12	GRAIN MILL PRODUCTS	.0329	-.4572	-.0010	-.0021	-.0012	.0034	.0652	.931/.891	.004	1.60
		(4.45)	(3.61)	(.50)	(1.05)	(.80)	(5.75)	(.71)			
13	BAKERY PRODUCTS	.0783	-1.5648	.0039	-.0052	-.0004	.0064	-.4189	.884/.817	.006	2.10
		(6.53)	(6.56)	(1.64)	(1.94)	(.21)	(6.84)	(3.39)			
14	SUGAR	.0122	-.8391	-.0021	-.0006	-.0092	-.0018	-.2307	.818/.716	.014	1.53
		(.45)	(1.76)	(.29)	(.06)	(1.82)	(.86)	(2.85)			
15	CONFECTIONERY PRODUCTS	.0740	-.9006	.0011	-.0065	-.0027	.0057	-.0387	.935/.898	.006	1.88
		(5.92)	(4.95)	(.40)	(1.66)	(1.34)	(6.80)	(.52)			
16	ALCOHOLIC BEVERAGES	.0264	-.7295	.0020	-.0004	.0040	.0045	.1958	.693/.512	.007	2.20
		(2.07)	(3.00)	(.63)	(.14)	(1.66)	(3.96)	(1.64)			
17	SOFT DRINKS & FLAVORINGS	.0803	-.2127	-.0002	-.0135	-.0071	.0055	.1937	.988/.981	.005	1.50
		(8.33)	(1.29)	(.07)	(5.48)	(3.92)	(7.14)	(2.19)			
18	MISCELLANEOUS FOOD PRODUCTS	.0435	-.3381	-.0061	-.0020	-.0027	.0014	-.1428	.820/.713	.007	.93
		(3.51)	(1.39)	(1.24)	(.40)	(1.05)	(1.23)	(.53)			
19	TOBACCO PRODUCTS	.0717	.3114	.0011	-.0025	.0026	.0139	-.0238	.986/.977	.012	2.33
		(3.39)	(.85)	(.19)	(.46)	(.64)	(8.14)	(.24)			
20	FABRIC & YARN	.0252	.5058	-.0103	-.0151	-.0043	-.0057	.1290	.961/.936	.006	2.32
		(1.81)	(2.07)	(2.55)	(3.01)	(1.71)	(5.64)	(1.38)			
21	FLOOR COVERINGS & MISCELLANEOU	.0039	.4517	-.0131	.0004	-.0079	-.0072	-.0020	.871/.796	.011	1.04
		(.15)	(1.20)	(1.83)	(.05)	(1.79)	(4.53)	(.02)			
22	KNITTING	.0505	.3207	-.0152	-.0081	-.0107	-.0048	.0139	.940/.905	.008	1.10
		(2.96)	(1.21)	(3.64)	(1.62)	(3.10)	(4.15)	(.19)			

TABLE V-7

INDUSTRY RELATIVE WAGE EQUATIONS

#	INDUSTRY	CONST	PRICE	UR(0)	UR(-1)	UR(-2)	TIME	EMP	RSQ/RBARSQ	S.E.	D-W
23	APPAREL	.0662	-.4482	-.0129	-.0136	-.0163	-.0107	-.1825	.928/.894	.015	1.30
		(2.55)	(.96)	(1.31)	(1.10)	(2.84)	(5.15)	(.69)			
24	HOUSEHOLD TEXTILES	.0553	.0658	-.0100	-.0158	-.0032	-.0031	.0912	.905/.852	.009	2.17
		(3.20)	(.19)	(2.39)	(2.65)	(.96)	(2.04)	(.85)			
25	LOGGING CAMPS	-.2610	5.1546	.0116	.0134	.0034	-.0131	.0373	.919/.853	.018	2.72
		(5.66)	(6.51)	(1.06)	(1.06)	(.53)	(5.08)	(.24)			
26	SAW & PLANING MILLS	.0654	.3577	-.0017	-.0051	-.0101	.0039	.0538	.945/.914	.012	1.65
		(3.07)	(.95)	(.19)	(.45)	(2.31)	(2.29)	(.49)			
27	WOOD PRODUCTS	.0009	.5395	.0025	-.0101	-.0037	-.0041	.1040	.732/.570	.007	1.96
		(.05)	(1.94)	(.64)	(1.87)	(1.23)	(3.42)	(1.56)			
28	FURNITURE	.0203	-.0419	-.0023	-.0136	-.0068	-.0077	.0855	.960/.938	.008	1.29
		(1.23)	(.15)	(.37)	(1.77)	(2.41)	(5.82)	(.89)			
29	PAPER & PAPERBOARD MILLS	.0355	-.3113	-.0023	.0001	.0000	.0055	.0422	.934/.896	.007	1.95
		(2.56)	(1.16)	(.35)	(.01)	(.01)	(4.48)	(.23)			
30	PAPER PRODUCTS	.0164	-.3597	-.0005	.0008	.0011	.0023	.0186	.482/.171	.007	2.37
		(1.30)	(1.76)	(.12)	(.18)	(.49)	(2.46)	(.17)			
31	NEWSPAPERS & PERIODICALS	.0531	-.7086	-.0079	-.0001	-.0051	-.0010	-.0799	.870/.800	.010	1.09
		(3.08)	(2.47)	(1.79)	(.02)	(1.58)	(.74)	(.31)			
32	BOOKS	.1118	-1.7063	.0020	-.0065	-.0085	-.0016	-.2338	.776/.657	.022	1.02
		(2.47)	(2.32)	(.23)	(.65)	(1.19)	(.53)	(.98)			
33	COMMERCIAL PRINTING	.0081	-.4097	-.0063	-.0021	-.0023	-.0067	-.0812	.993/.990	.004	2.83
		(1.24)	(3.57)	(2.79)	(1.06)	(1.53)	(****)	(1.27)			
34	OTHER PRINTING	.0637	-.8028	-.0069	-.0059	-.0052	-.0027	-.2023	.927/.886	.009	1.57
		(4.12)	(2.21)	(.95)	(1.31)	(1.50)	(1.53)	(.85)			
35	INDUSTRIAL CHEMICALS	-.0104	-.2924	.0048	-.0038	.0002	-.0029	.1440	.951/.921	.006	1.84
		(.95)	(1.30)	(1.17)	(1.35)	(.06)	(2.83)	(.95)			
36	AGRICULTURAL & MISCELLANEOUS C	.0173	-.2682	.0023	-.0089	-.0015	-.0008	.0959	.634/.412	.010	1.18
		(1.01)	(.88)	(.45)	(1.93)	(.42)	(.55)	(1.48)			
37	SYNTHETIC RUBBER FIBERS	-.0011	-.1103	.0076	-.0166	-.0018	-.0053	.0844	.929/.888	.007	1.67
		(.08)	(.49)	(1.61)	(3.69)	(.70)	(5.10)	(.94)			
38	DRUGS,CLEANING & TOILET PRODUC	.0420	-.2573	.0000	-.0096	-.0026	.0005	-.0374	.773/.637	.008	2.15
		(3.00)	(.91)	(.01)	(2.63)	(.88)	(.38)	(.20)			
39	PAINTS	.0076	-.1222	.0007	-.0115	.0004	-.0040	.0641	.866/.786	.009	1.20
		(.48)	(.45)	(.12)	(2.24)	(.13)	(3.28)	(.32)			
40	PETROLEUM REFINING	-.0336	.4266	.0160	-.0085	.0014	-.0067	.0014	.780/.649	.019	1.19
		(1.96)	(.65)	(1.87)	(.81)	(.21)	(2.42)	(.01)			
41	PAVING & ASPHALT	-.0122	-.0489	.0064	-.0088	-.0074	-.0068	-.0876	.819/.723	.014	2.36
		(.42)	(.09)	(1.06)	(1.37)	(1.44)	(3.20)	(1.23)			
42	RUBBER PRODUCTS	.0667	-.9310	-.0021	-.0150	-.0064	-.0045	.0745	.986/.979	.005	1.80
		(5.77)	(5.58)	(.59)	(3.42)	(3.23)	(5.68)	(1.37)			

TABLE V-7

INDUSTRY RELATIVE WAGE EQUATIONS

#	INDUSTRY	CONST	PRICE	UR(0)	UR(-1)	UR(-2)	TIME	EMP	RSQ/RBARSQ	S.E.	D-W
43	MISCELLANEOUS PLASTIC PRODUCTS	.0333 (1.53)	-.4121 (1.27)	.0042 (.52)	-.0107 (1.29)	-.0094 (2.67)	-.0059 (4.02)	-.0202 (.20)	.907/.855	.011	1.04
44	LEATHER & LEATHER PRODUCTS	.1162 (5.46)	-1.3638 (3.45)	-.0087 (1.50)	-.0102 (1.31)	-.0203 (4.25)	-.0058 (3.40)	-.2827 (2.00)	.942/.914	.012	1.72
45	GLASS	-.0230 (2.17)	.1700 (.91)	.0021 (.46)	.0006 (.13)	.0002 (.10)	-.0030 (3.41)	.1479 (2.24)	.921/.874	.006	2.03
46	STONE,CLAY, & POTTERY	.0000 (.01)	-.0893 (.74)	-.0064 (1.61)	-.0016 (.33)	-.0019 (1.50)	-.0044 (8.28)	.0086 (.15)	.981/.970	.004	2.54
47	CEMENT	.0360 (1.75)	-.1367 (.39)	.0061 (.98)	-.0038 (.47)	.0015 (.33)	.0062 (3.99)	.2134 (1.65)	.880/.810	.012	1.44
48	STEEL	-.1713 (3.78)	2.3145 (3.05)	-.0058 (.29)	.0207 (1.14)	.0194 (1.92)	-.0024 (.70)	-.0622 (.24)	.797/.658	.025	1.13
49	COPPER	-.0708 (2.11)	.7769 (1.32)	-.0053 (.49)	-.0006 (.05)	.0123 (1.93)	-.0042 (1.57)	.0227 (.23)	.524/.250	.019	1.07
50	ALUMINUM	-.0982 (4.12)	1.1157 (2.65)	.0036 (.30)	.0055 (.45)	.0101 (2.16)	-.0043 (2.22)	.0708 (.53)	.814/.698	.014	1.68
51	OTHER NON FERROUS METALS	-.0209 (1.01)	.5439 (1.53)	-.0066 (.82)	.0008 (.11)	.0040 (1.01)	-.0004 (.26)	-.0171 (.18)	.518/.231	.012	1.72
52	METAL CANS	-.0532 (2.38)	.7103 (1.78)	.0023 (.29)	.0085 (1.45)	.0093 (2.20)	.0018 (.85)	-.0331 (.28)	.818/.699	.013	1.53
53	PLUMBING,HEATING EQUIPMENT & O	-.0172 (1.54)	.1037 (.53)	-.0022 (.50)	-.0015 (.51)	-.0002 (.06)	-.0047 (5.16)	-.0537 (.51)	.947/.916	.006	2.23
54	STAMPINGS,CUTLERY,HARDWARE	.0286 (2.96)	-.0409 (.24)	.0063 (1.16)	-.0197 (3.29)	-.0004 (.19)	-.0019 (2.33)	.1732 (2.82)	.884/.816	.006	2.88
55	OTHER FABRICATED METAL PRODUCT	.0221 (2.61)	-.3059 (2.07)	.0030 (.68)	-.0115 (2.51)	-.0053 (3.16)	-.0046 (6.50)	.0603 (1.15)	.967/.950	.005	2.25
56	FARM MACHINERY	.0149 (.67)	-.3642 (.95)	.0057 (.75)	-.0053 (.57)	-.0016 (.36)	.0010 (.45)	.0896 (1.17)	.264/****	.013	1.42
57	CONSTRUCTION,OILFIELD MACHINER	-.0278 (1.94)	.0972 (.37)	.0065 (1.25)	-.0059 (1.05)	.0033 (1.21)	-.0022 (1.99)	.1075 (2.02)	.757/.615	.008	1.40
58	METALWORKING MACHINERY	.0501 (2.70)	-.6618 (2.24)	-.0062 (.81)	-.0075 (1.09)	-.0053 (1.20)	-.0035 (2.53)	.0118 (.18)	.921/.882	.010	1.70
59	GENERAL INDUSTRIAL MACHINERY	.0222 (1.76)	-.3651 (1.68)	-.0044 (.78)	-.0006 (.12)	-.0014 (.52)	-.0013 (1.42)	-.0166 (.26)	.864/.790	.007	1.62
60	COMPUTERS & OFFICE MACHINERY	.1545 (4.16)	-1.6049 (2.05)	-.0058 (.43)	-.0212 (2.19)	.0002 (.02)	.0012 (.34)	-.1784 (1.19)	.763/.640	.021	1.65
61	SERVICE INDUSTRY MACHINERY	.0244 (2.95)	-.7237 (4.11)	-.0006 (.11)	-.0039 (1.00)	-.0021 (1.21)	-.0022 (2.96)	.0491 (1.08)	.977/.964	.005	2.16
62	TRANSFORMERS,MOTORS & GENERATO	.0159 (1.52)	-.9761 (5.21)	.0064 (1.43)	-.0030 (2.20)	-.0054 (2.56)	-.0065 (7.42)	.0074 (.22)	.989/.983	.006	1.43

TABLE V-7

INDUSTRY RELATIVE WAGE EQUATIONS

#	INDUSTRY	CONST	PRICE	UR(0)	UR(-1)	UR(-2)	TIME	EMP	RSQ/RBARSQ	S.E.	D-W
63	APPLIANCES,RADIO & TV	-.0126 (.76)	-.2462 (.86)	.0038 (.74)	-.0013 (.22)	-.0031 (1.09)	-.0051 (3.78)	.0628 (.93)	.954/.925	.009	1.23
64	COMMUNICATION EQUIPMENT	-.0008 (.06)	-.0854 (.37)	-.0017 (.58)	.0000 (.01)	-.0038 (1.72)	-.0027 (2.36)	.0249 (.77)	.871/.793	.007	2.57
65	ELECTRICAL COMPONENTS	.0363 (3.88)	-.7568 (4.57)	.0033 (1.04)	-.0114 (3.62)	-.0090 (4.96)	-.0066 (8.70)	-.0355 (1.78)	.986/.979	.005	2.47
66	BATTERIES & ENGINE ELECTRICAL	.0237 (1.86)	-.5794 (2.63)	-.0001 (.03)	.0025 (.55)	.0019 (.73)	.0028 (2.58)	.0903 (2.24)	.770/.632	.008	2.98
67	MISCELLANEOUS ELECTRICAL EQUIP	.0335 (1.67)	-.4573 (1.29)	-.0069 (.81)	-.0026 (.35)	-.0050 (1.29)	-.0021 (1.23)	-.0037 (.17)	.778/.659	.012	1.66
68	MOTOR VEHICLES	.0277 (1.34)	.0743 (.20)	.0060 (.98)	.0005 (.06)	.0000 (.00)	.0077 (4.42)	.0960 (2.00)	.934/.892	.012	1.61
69	ORDNANCE	-.0159 (1.73)	-.3720 (2.38)	.0056 (2.56)	-.0056 (2.79)	-.0018 (1.01)	-.0074 (****)	-.0037 (1.27)	.990/.983	.005	2.32
70	AIRCRAFT & GUIDED MISSILES	.0658 (3.95)	-.6415 (2.21)	.0009 (.21)	-.0134 (3.01)	-.0065 (1.92)	.0013 (.93)	.0062 (.20)	.841/.746	.010	2.01
71	SHIP & BOAT BUILDING	.0362 (1.11)	-1.1854 (2.07)	.0119 (1.45)	-.0241 (2.68)	-.0027 (.42)	-.0055 (1.97)	-.0316 (.32)	.865/.796	.019	1.41
72	RAILROAD EQUIPMENT	.0384 (1.36)	-.5163 (1.06)	.0052 (.77)	.0018 (.24)	-.0046 (.84)	.0045 (1.97)	.0494 (1.22)	.532/.255	.017	2.12
73	OTHER TRANSPORTATION EQUIPMENT	.0322 (.63)	-.2942 (.41)	.0076 (.89)	-.0186 (1.82)	-.0031 (.36)	-.0014 (.49)	.1147 (1.70)	.642/.426	.019	.96
74	ENGINEERING INSTRUMENTS	.0272 (1.48)	-1.0396 (3.28)	-.0038 (.63)	-.0085 (1.34)	-.0042 (1.21)	-.0099 (6.98)	-.0781 (1.08)	.982/.974	.010	1.91
75	OPTICAL GOODS & MEDICAL INSTRU	.0090 (.61)	-.2671 (.77)	-.0035 (.40)	-.0161 (2.09)	-.0048 (1.30)	-.0085 (7.22)	.0596 (.46)	.967/.951	.008	1.28
76	PHOTOGRAPHIC EQUIPMENT	.0167 (1.18)	-.2394 (1.04)	-.0060 (1.48)	-.0015 (.41)	.0001 (.05)	-.0008 (.76)	-.1033 (1.59)	.658/.457	.008	1.87
77	WATCHES & CLOCKS	-.0432 (2.46)	-.0572 (.19)	.0012 (.22)	-.0024 (.35)	-.0058 (1.69)	-.0132 (8.85)	-.0760 (1.19)	.981/.972	.011	1.81
78	MISCELLANEOUS MANUFACTURING	.0365 (2.22)	-.2743 (.96)	-.0086 (1.23)	-.0020 (.26)	-.0111 (3.48)	-.0065 (4.72)	-.1540 (1.05)	.931/.894	.010	1.03
79	RAILROADS	-.0106 (.18)	1.2772 (1.28)	-.0271 (1.11)	.0269 (1.54)	.0148 (1.31)	.0160 (4.23)	-.1091 (.17)	.948/.906	.026	1.59
80	LOCAL,SUBURBAN & HIGHWAY PASSE	.0266 (2.20)	.2009 (.94)	-.0003 (.12)	-.0037 (1.02)	-.0080 (3.26)	-.0006 (.58)	.1193 (.65)	.867/.786	.007	1.63
81	TRUCKING & WAREHOUSING	-.0103 (.32)	.2006 (.37)	-.0183 (1.48)	.0350 (3.21)	.0064 (.92)	.0090 (3.45)	-.1601 (.65)	.836/.725	.019	1.96
82	WATER TRANSPORTATION	.0318 (2.06)	-2.2236 (3.06)	-.0070 (.94)	-.0113 (1.69)	.0121 (2.25)	.0051 (2.23)	-.0129 (.19)	.839/.716	.014	2.43

TABLE V-V

INDUSTRY RELATIVE WAGE EQUATIONS

#	INDUSTRY	CONST	PRICE	UR(0)	UR(-1)	UR(-2)	TIME	EMP	RSQ/RBARSQ	S.E.	D-W
83	AIR TRANSPORTATION	.2538 (5.16)	-2.2297 (2.86)	-.0209 (1.79)	-.0302 (3.65)	-.0171 (2.50)	.0014 (.45)	-.2234 (1.38)	.933/.890	.017	2.13
84	PIPELINE TRANSPORTATION	.0442 (1.15)	-1.6389 (2.25)	.0190 (2.39)	.0007 (.08)	-.0117 (1.81)	.0084 (2.02)	-.7528 (1.74)	.505/.201	.018	2.45
85	TRANSPORTATION SERVICES	.0291 (.77)	-1.5229 (2.06)	-.0091 (1.07)	-.0041 (.60)	-.0014 (.23)	-.0026 (.95)	.1118 (.74)	.861/.760	.014	2.34
86	TELEPHONE & TELEGRAPH	.0027 (.06)	-.3937 (.66)	.0014 (.15)	.0179 (1.92)	.0169 (2.16)	.0198 (7.10)	.2312 (.93)	.952/.923	.021	1.32
87	RADIO & TELEVISION BROADCASTIN	.0167 (.56)	-.5940 (1.94)	-.0100 (2.21)	-.0168 (3.35)	.0083 (2.52)	-.0111 (7.41)	-.5963 (2.43)	.978/.966	.010	1.71
88	ELECTRICAL,GAS & SANITARY SERV	.0629 (5.47)	-.8172 (5.47)	.0005 (.22)	-.0045 (2.07)	-.0018 (1.12)	.0056 (7.90)	.1997 (1.43)	.964/.944	.005	1.92
89	WHOLESALE TRADE	-.0493 (4.02)	.4797 (2.00)	.0011 (.20)	.0083 (1.73)	.0014 (.58)	-.0014 (1.36)	-.1204 (.51)	.825/.718	.007	1.64
90	RETAIL TRADE	-.0329 (2.33)	.5162 (2.33)	.0013 (.38)	.0001 (.02)	-.0014 (.62)	-.0039 (3.76)	.1114 (.60)	.783/.647	.007	1.58
91	BANKING & CREDIT AGENCIES	.0165 (.52)	.0153 (.03)	-.0091 (1.46)	.0040 (.57)	-.0073 (1.44)	-.0047 (2.00)	-.0591 (.38)	.738/.592	.016	1.69
92	INSURANCE	.0222 (.93)	-.9365 (2.18)	-.0030 (.51)	-.0047 (.75)	.0049 (1.05)	-.0006 (.32)	-.0077 (.02)	.862/.785	.013	1.36
93	REAL ESTATE	-.0073 (.13)	-.7881 (.90)	.0030 (.32)	.0215 (2.55)	.0089 (1.02)	.0063 (2.19)	-.1559 (.50)	.813/.681	.019	1.37
94	HOTEL & LODGING PLACES	.0534 (2.93)	-.5094 (1.22)	.0027 (.46)	-.0027 (.35)	-.0106 (2.99)	.0044 (2.69)	-.0629 (.43)	.887/.822	.010	1.26
95	PERSONAL & REPAIR SERVICES	.0279 (.30)	-.1231 (.19)	-.0078 (1.09)	-.0015 (.24)	.0020 (.40)	.0011 (.54)	-.1387 (.86)	.581/.270	.013	1.38
96	MISC. BUSINESS SERVICES	-.0008 (.03)	-.6853 (1.69)	.0023 (.32)	-.0043 (.94)	-.0013 (.35)	-.0092 (6.20)	-.1169 (.62)	.980/.965	.009	1.37
97	AUTO REPAIR	-.0402 (1.65)	.7950 (1.82)	-.0069 (1.52)	-.0016 (.35)	-.0005 (.15)	-.0058 (4.22)	-.0937 (.66)	.757/.577	.008	1.55
98	AMUSEMENT & RECREATIONAL SERVI	.0180 (.39)	-1.8539 (2.29)	-.0017 (.19)	-.0137 (1.63)	.0020 (.30)	-.0122 (4.61)	.0559 (.56)	.966/.942	.017	1.99
99	MEDICAL & OTHER HEALTH SERVICE	.1635 (3.50)	.0597 (.10)	-.0014 (.20)	-.0254 (4.06)	-.0217 (4.24)	.0092 (4.56)	-.1131 (.30)	.988/.978	.012	2.45
100	EDUCATIONAL SERVICES	-.0090 (.60)	-.5141 (1.74)	-.0062 (1.73)	.0078 (2.80)	.0046 (2.05)	-.0011 (1.01)	-.1913 (1.59)	.955/.922	.006	2.89

trade have positive price terms as constrasted to Insurance and Real estate. This may be due to the higher level of union activity in the former two sectors.

The predominance of negative signs on the price term in the industrial groups should cause no immediate alarm. First, the aggregate wage which defines the denominator of the relative wage indexes is a weighted (by 1967 payrolls) average of the industry earnings indexes. Thus, a few sectors with large positive coefficients (i.e. Coal mining, Steel and Motor vehicles) offset a large number of small sectors with negative coefficients. Second, there are really only several observations, 1973-75, within our sample period for which the price term behaved somewhat independently of unemployment rates. Thus for some sectors, we may assume that the unemployment terms offset the negative price coefficients for periods of demand-induced inflation.

In spite of the collinearity among the three unemployment terms, there are a substantial number of sectors where individal coefficients are statistically significant. A surprise is that the lag pattern in these sectors do not follow the declining pattern as posited by the AJP model. In the industrial group 38 sectors had the same sign on all three unemployment terms with at least one coefficient having a t-statistic greater than one. The largest coefficient (in absolute value) was found on the one-year lagged term in 26 of these sectors. The remaining twelve coefficients were split evenly between the current and two-year lagged terms.

As a whole, the unemployment terms are the most powerful influences in the equations. Without formally analyzing the coefficients (i.e. by regressions on unionization, absolute wage levels, etc.) the results appear to reflect the phenomenon of cyclical narrowing of the wage structure. Sectors 20, Fabric and yarn; 21, Floor coverings; 22, Knitting; 23, Apparel; 28, Furniture; 44, Leather and leather products) are all good examples of strong procyclical behavior in their relative wage prositions. All may be characterized (in terms of the industrial group) as low-wage, basically nonunion sectors. Countercyclical behavior is most evident in sectors 48, Steel; 50, Aluminum; 52, Metal cans; 68, Motor vehicles; and 81, Trucking. Again, since we are using a weighted average aggregate wage to calculate the relative wage indexes, we should not expect to find equal numbers of positive and negative coefficients.

Without specific knowledge of the occupational shifts within particular sectors, it is difficult to interpret the time trends. In 56 out of the 86 industries in group 1, the trend coefficients are statistically significant at the ten percent level. In only 8 sectors did the coefficient exceed one percent per year (in absolute value); however, in 33 sectors the coefficient was greater than one-half percent per year. In this group we may note sectors, 19, Tobacco products; 79, Railroads; and 86, Telephone and telegraph; all of which display positive trends in excess of one percent per year. For these sectors, at least, we may hypothesize that increasing union aggressiveness has contributed to large relative wage gains over the sample period (rather than skill-mix changes). The latter two sectors, of course, have highly non-competitive product markets which may diminish employer resistance at the bargaining table.

The trend coefficients in the trade and finance group are small. In services, however, trends in the relative wage structure are dominated by the large increases in the wages of medical service workers. Since a large proportion of this increase in average medical service wages may have been a once-and-for-all increase in the wages of nursing and other hospital personnel, the trend coefficients should be diminished for forecasting purposes. Our procedure for moderating the trends for this and other sectors are described in Chapter X.

The industry change in employment is not, on the whole, a powerful explanatory variable in the equations. In only seven sectors does the variable enter with a positive sign and is statistically significant at the ten percent level of confidence. Generally, these sectors are in durable manufacturing, and I expect that this term is picking up overtime premiums. This appears to be the case in particular of sectors 47 Cement; 53, Stampings, cutlery, and hardware; 56, Farm machinery; 57, Construction oilfield machinery; and 68 Motor vehicles. Nearly half of the industrial group sectors display negative coefficients, although only five are statistically significant. As we mentioned earlier, this may be a result of intra-industry employment-mix changes which cause "average" earnings to fall as the work force expands. The regression results here suggest that with the exception of a few industries, this phenomenon is not pronounced for the BLS category of production or nonsupervisory workers.

Plots for Selected Sectors

On pages 178 through 187 we have included plots of the relative wage equations for ten selected industries. The plots may give the reader a better feel for the type of variation we are trying to explain, and show

how well our restricted set of variables succeeds in explaining this variance for a representative sample of industries.

The first sector shown is Grain mill products, wage sector number 12. The most remarkable aspect of this sector is the stability of the wage level with respect to the aggregate "industrial" wage. From 1963 forward, the relative wage does not deviate by more than two percent from the relative wage experienced in 1967. The unemployment coefficients indicate weakly procyclical behavior of the relative wage; although none of the individual lag coefficients on UNEM25 is statistically by itself, an F test would probably reject the hypothesis that all three coefficients are zero. The time trend is about .3 percent per year.

As we turn to the next plot, relative wage behavior is far more cyclical for Fabric and yarn (20). A casual inspection of the plot shows that the relative wage for this basically competitive sector increased about six percent from the beginning to the end of the 1960's expansion. Our unemployment variable is quite successful in capturing this movement; each of the (current and) lagged terms is significant at the ten percent level of statistical significance.

The regressions for Furniture (38) and Paper products are shown on pages 180 and 181. Wage behavior in Furniture is slightly procyclical but the major feature in the plot is the substantial negative trend (estimated at about -.8 percent per year). The negative trend may reflect migration of firms in this industry to low wage areas in the South. Paper products on the other hand, illustrate an industry whose relative wage has been extremely stable over the entire sample period.

The regression plot for Rubber products (42),shown on page 182 , shows a sector whose relative wage has fallen with higher rates of inflation. A significant fraction of the workers in this sector are those in the United Rubber Workers union; until 1976 their contracts with the major tire manufacturers did not include automatic cost-of-living adjustments.

The regression plot for Steel (48) shows the need for an explicit contract timing variable. The price coefficient my be biased upward because of the 1974 coincidence of a major settlement and the largest price change in the sample. It seems clear, however, from the 1974 and 1975 observations of the relative wage that the price coefficient would remain large even in a more correctly specified equation. The reader will note that even our current specification is able to explain over two-thirds of the variance of RW for this unionized sector.

Metal cans, as we mentioned earlier, is one of the sectors displaying countercyclical wage behavior. The plot of predicted versus actual for this industry, is shown on page 184 . The industy, as well as steel, shows a very high price coefficient: .710.

Batteries and engine electrical equipment (66) illustrates one of the sectors in which we find a significant partial correlation between the relative wage and the change in sector's employment. As the plot on page 185 indicates, it appears that the sharp year-to-year movements are likely the results of fluctuation in overtime premiums. This sector's activity is closely related to that for the cyclical Motor vehicles sector, whose regression results we show on the succeeding page. Our lack of a contract timing variable for Motor vehicles should not appreciably bias the time trend estimate. Relative wages in this sector have increased about 10 percent over the 1959-75 interval.

The final plot shown is for Railroads (79). I have included this plot to graphically illustrate the tremendous increase in the relative wage for this sector over the sample period. This magnitude of the increase reflects more aggressive union behavior and a desire on the part of railroads to avoid strikes, thus losing (permanently?) business to alternative modes of transportation. For forecasting purposes, as we explain in Chapter XI, the 1.6 percent per year time trend is arbitrarily reduced (incrementally) after 1978.

The plots for these ten industries, I hope, have given the reader some of the flavor of our relative wage equation work. Generally, the set of aggregate variables plus the industry change in employment do a creditable job in explaining the variations in relative wages for most sectors. Inclusion of variables to reflect contract timing in several major industries (steel, aluminum, automobiles) is the next logical improvement in this part of the model, but resources did not permit the completion of such work here.

5.4 Reconciliation of BLS Wage Measures with Labor Income

Since the income model is framed in terms of the U.S. National Accounts, our forecasts for labor income by industry must be consistent with the sources used by BEA. The BLS earnings indexes used in the industry relative wage equations relate to production and non-supervisory workers only. An obvious question is whether the omission of non-production worker earnings creates serious cyclical or secular bias in

REGRESSION RESULTS FOR SECTOR 12 GRAIN MILL PRODUCTS RELATIVE TO GROUP: INDUSTRIAL

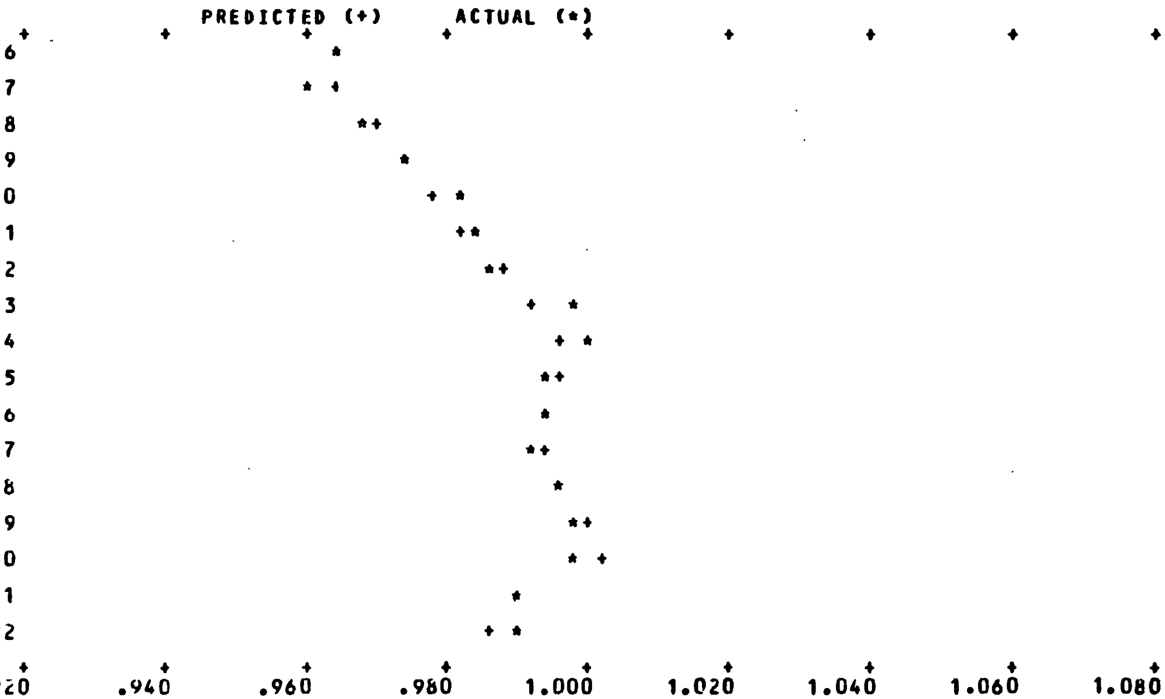
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9312	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.8915	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	1.599	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0042	RHO	.20	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0329		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	-.4572	.1265	3.613
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0010	.0019	.500
4	U-RATE (MALE, 25 & OVER	(T- 1)	-.0021	.0020	1.055
5	U-RATE (MALE, 25 & OVER	(T- 2)	-.0012	.0015	.804
6	TIME	(T- 0)	.0034	.0006	5.746
7	CHANGE IN EMPLOYMENT	(T- 0)	.0652	.0918	.710

DATE	PREDICTED	ACTUAL	
1959	.963	.964	6
1960	.964	.959	7
1961	.970	.967	8
1962	.974	.974	9
1963	.977	.963	10
1964	.983	.984	11
1965	.988	.986	12
1966	.991	.997	13
1967	.995	1.000	14
1968	.996	.993	15
1969	.994	.994	16
1970	.994	.991	17
1971	.996	.996	18
1972	1.001	.998	19
1973	1.001	.997	20
1974	.990	.991	21
1975	.987	.990	22



REGRESSION RESULTS FOR SECTOR 20 FABRIC & YARN RELATIVE TO GROUP: INDUSTRIAL

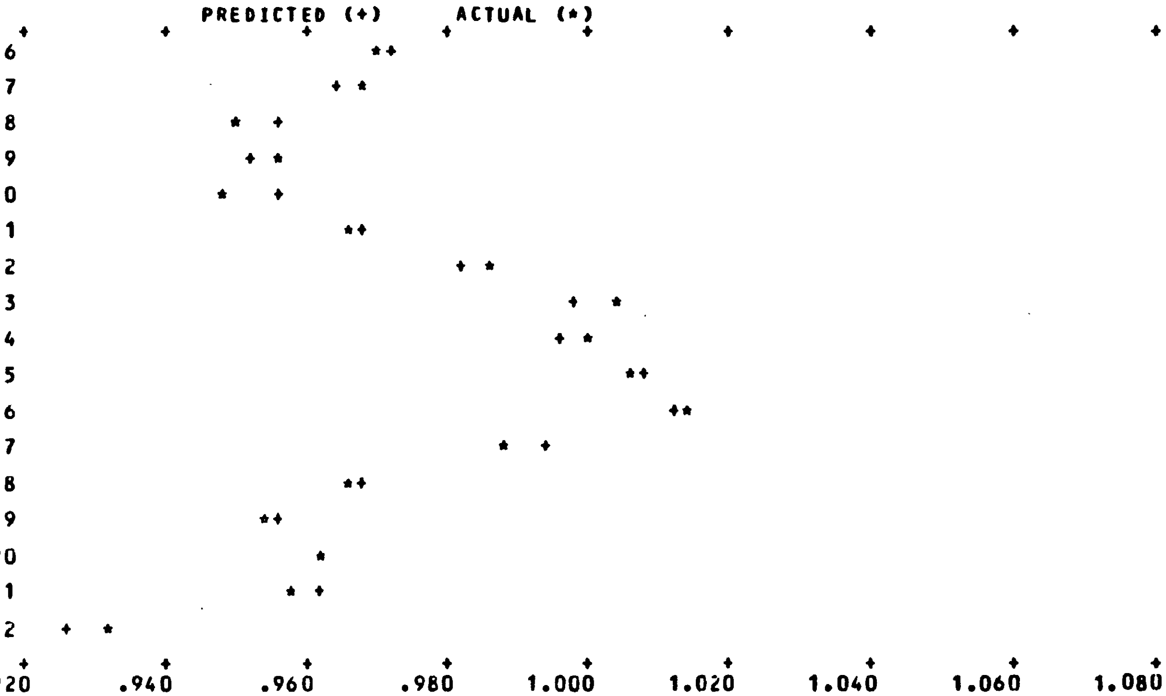
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9611	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.9364	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	2.325	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0059	RHO	-.16	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0252		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	.5058	.2442	2.071
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0103	.0040	2.551
4	U-RATE (MALE, 25 & OVER	(T- 1)	-.0151	.0050	3.010
5	U-RATE (MALE, 25 & OVER	(T- 2)	-.0043	.0025	1.706
6	TIME	(T- 0)	-.0057	.0010	5.643
7	CHANGE IN EMPLOYMENT	(T- 0)	.1290	.0937	1.378

DATE	PREDICTED	ACTUAL	
1959	.972	.971	6
1960	.964	.968	7
1961	.955	.951	8
1962	.952	.957	9
1963	.956	.948	10
1964	.969	.965	11
1965	.982	.986	12
1966	.997	1.004	13
1967	.996	1.000	14
1968	1.008	1.006	15
1969	1.012	1.015	16
1970	.994	.989	17
1971	.967	.966	18
1972	.955	.954	19
1973	.962	.961	20
1974	.963	.957	21
1975	.925	.932	22



REGRESSION RESULTS FOR SECTOR 28 FURNITURE RELATIVE TO GROUP: INDUSTRIAL

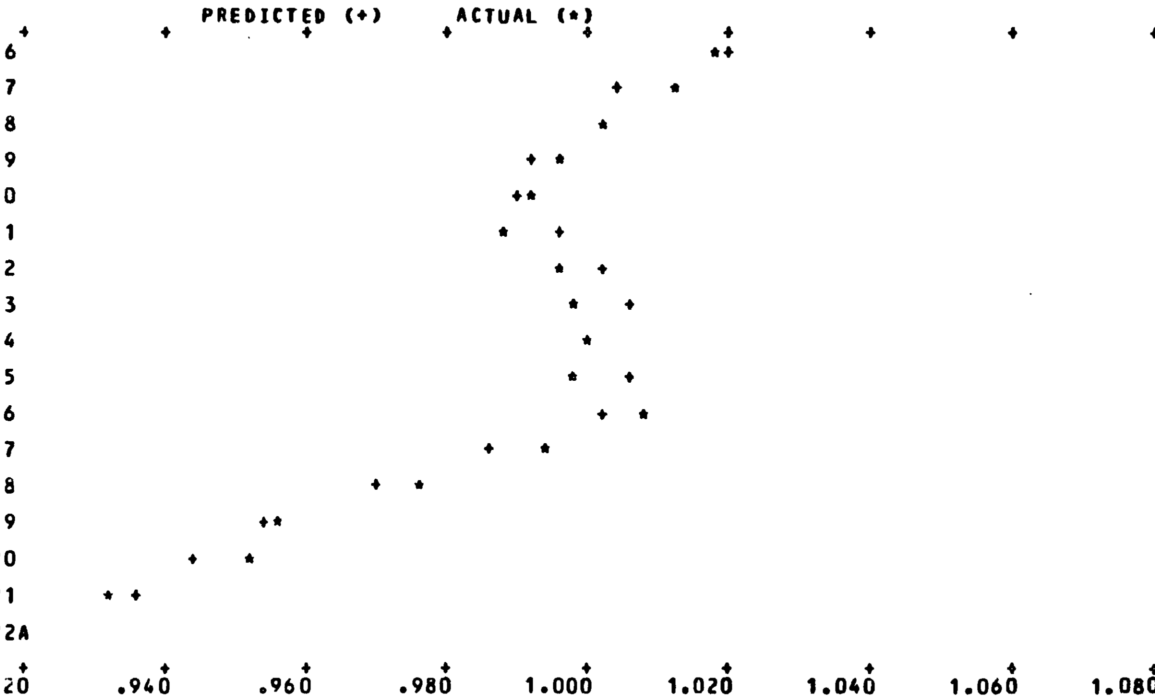
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9596	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.9377	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	1.295	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0077	RHO	.35	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0203		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	-.0419	.2848	.147
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0023	.0063	.367
4	U-RATE (MALE, 25 & OVER	(T- 1)	-.0136	.0077	1.770
5	U-RATE (MALE, 25 & OVER	(T- 2)	-.0068	.0028	2.410
6	TIME	(T- 0)	-.0077	.0013	5.824
7	CHANGE IN EMPLOYMENT	(T- 0)	.0859	.0961	.890

DATE	PREDICTED	ACTUAL	
1959	1.019	1.017	6
1960	1.004	1.011	7
1961	1.001	1.002	8
1962	.993	.997	9
1963	.990	.992	10
1964	.996	.987	11
1965	1.001	.996	12
1966	1.006	.997	13
1967	1.001	1.000	14
1968	1.006	.999	15
1969	1.001	1.008	16
1970	.986	.994	17
1971	.969	.975	18
1972	.954	.956	19
1973	.944	.952	20
1974	.936	.932	21
1975	.913	.905	22A



REGRESSION RESULTS FOR SECTOR 30 PAPER PRODUCTS RELATIVE TO GROUP: INDUSTRIAL

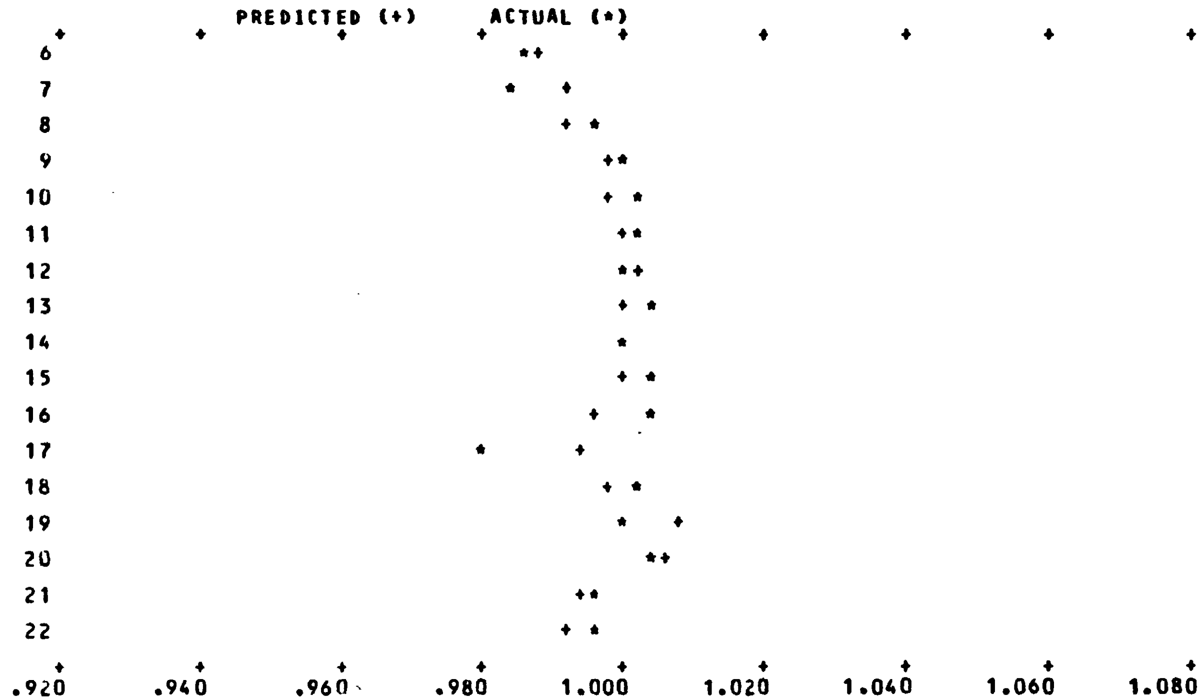
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.4816	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.1705	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	2.372	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0066	RHO	-.19	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0164		
2	XCPI/CPI (.5,.333,.167)	(T- 0)	-.3597	.2045	1.759
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0005	.0045	.120
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0008	.0046	.180
5	U-RATE (MALE, 25 & OVER	(T- 2)	.0011	.0022	.490
6	TIME	(T- 0)	.0023	.0009	2.455
7	CHANGE IN EMPLOYMENT	(T- 0)	.0186	.1109	.168

DATE	PREDICTED	ACTUAL	
1959	.989	.986	6
1960	.991	.985	7
1961	.992	.996	8
1962	.998	1.000	9
1963	.999	1.001	10
1964	1.000	1.003	11
1965	1.002	1.001	12
1966	1.001	1.003	13
1967	1.000	1.000	14
1968	.999	1.004	15
1969	.996	1.003	16
1970	.994	.980	17
1971	.999	1.002	18
1972	1.007	1.001	19
1973	1.006	1.003	20
1974	.994	.996	21
1975	.992	.996	22



REGRESSION RESULTS FOR SECTOR 42 RUBBER PRODUCTS RELATIVE TO GROUP: INDUSTRIAL

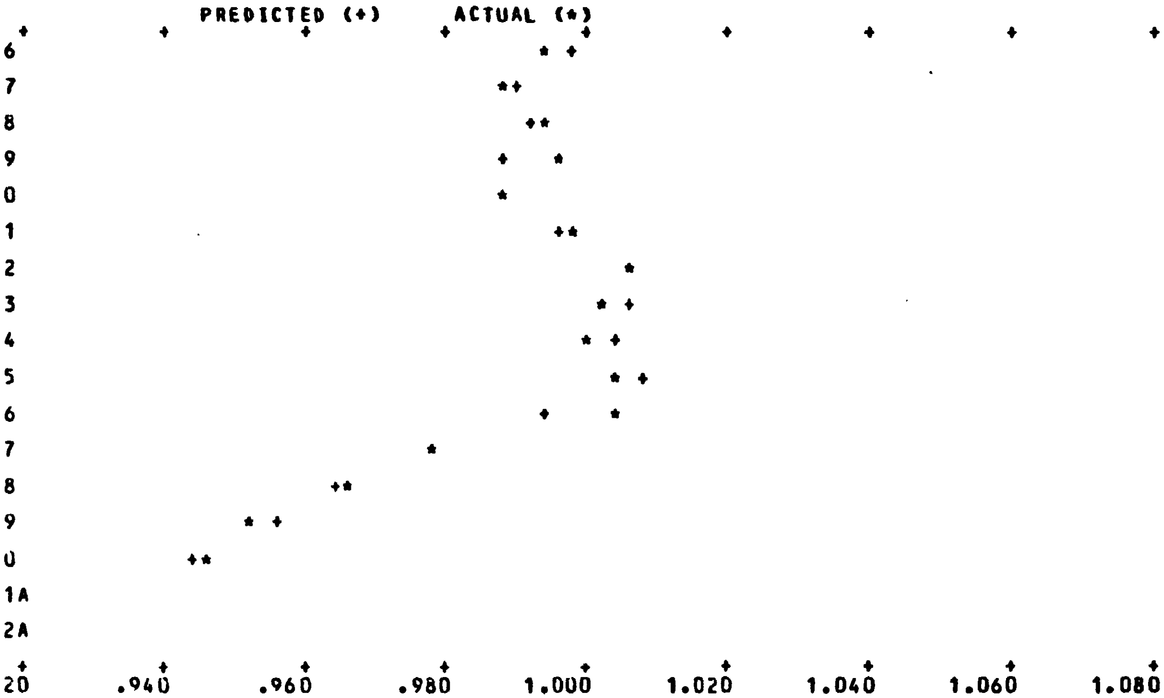
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9860	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.9794	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	1.798	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0051	RHO	.10	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0667		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	-.9310	.1669	5.580
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0021	.0036	.593
4	U-RATE (MALE, 25 & OVER	(T- 1)	-.0160	.0047	3.420
5	U-RATE (MALE, 25 & OVER	(T- 2)	-.0064	.0020	3.228
6	TIME	(T- 0)	-.0045	.0008	5.675
7	CHANGE IN EMPLOYMENT	(T- 0)	.0745	.0542	1.375

DATE	PREDICTED	ACTUAL	
1959	.998	.994	6
1960	.990	.988	7
1961	.993	.993	8
1962	.988	.995	9
1963	.987	.988	10
1964	.996	.999	11
1965	1.006	1.006	12
1966	1.006	1.002	13
1967	1.004	1.000	14
1968	1.009	1.005	15
1969	.994	1.004	16
1970	.978	.979	17
1971	.964	.965	18
1972	.956	.952	19
1973	.944	.945	20
1974	.913	.911	21A
1975	.892	.891	22A



REGRESSION RESULTS FOR SECTOR 48 STEEL RELATIVE TO GROUP: INDUSTRIAL

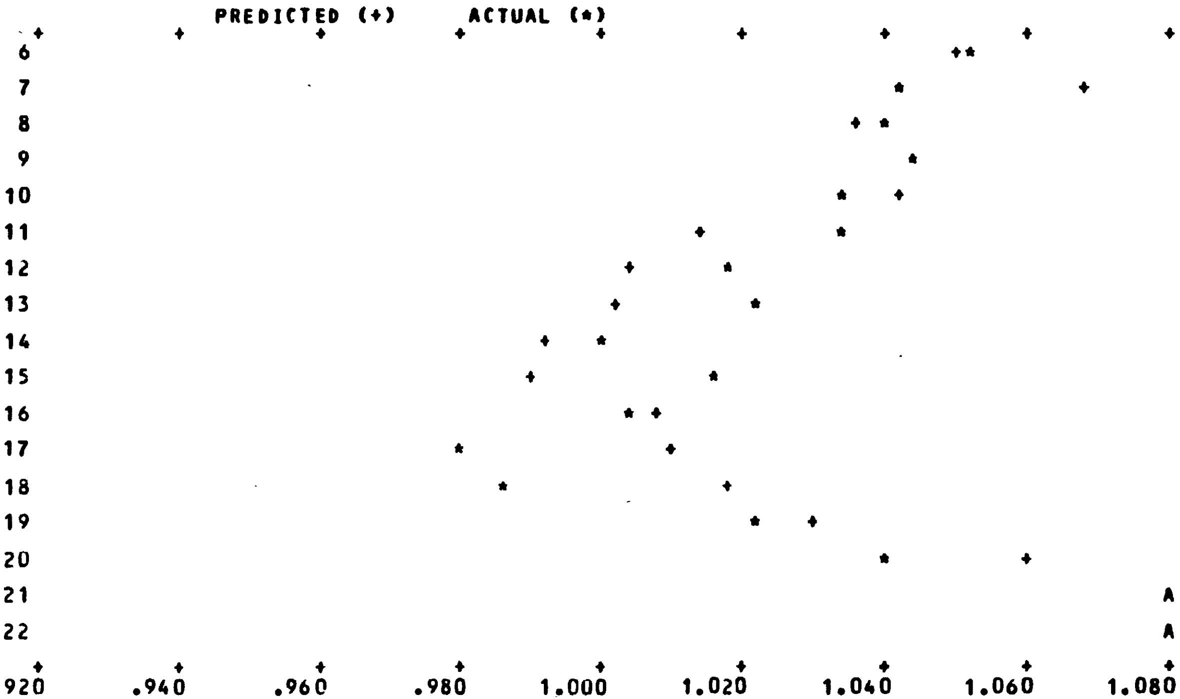
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.7969	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.6577	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.01	D-W	1.130	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0252	RHO	.43	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		-.1713		
2	XCPI/CPI (.5,.333,.167)	(T- 0)	2.3145	.7597	3.046
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0058	.0199	.289
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0207	.0182	1.135
5	U-RATE (MALE, 25 & OVER	(T- 2)	.0194	.0101	1.925
6	TIME	(T- 0)	-.0024	.0034	.700
7	CHANGE IN EMPLOYMENT	(T- 0)	-.0622	.2562	.243

DATE	PREDICTED	ACTUAL	
1959	1.050	1.052	6
1960	1.068	1.042	7
1961	1.036	1.039	8
1962	1.045	1.044	9
1963	1.043	1.034	10
1964	1.014	1.034	11
1965	1.004	1.018	12
1966	1.003	1.021	13
1967	.992	1.000	14
1968	.989	1.016	15
1969	1.007	1.005	16
1970	1.011	.979	17
1971	1.018	.986	18
1972	1.029	1.022	19
1973	1.061	1.040	20
1974	1.117	1.121	21
1975	1.119	1.156	22



REGRESSION RESULTS FOR SECTOR 52 METAL CANS RELATIVE TO GROUP: INDUSTRIAL

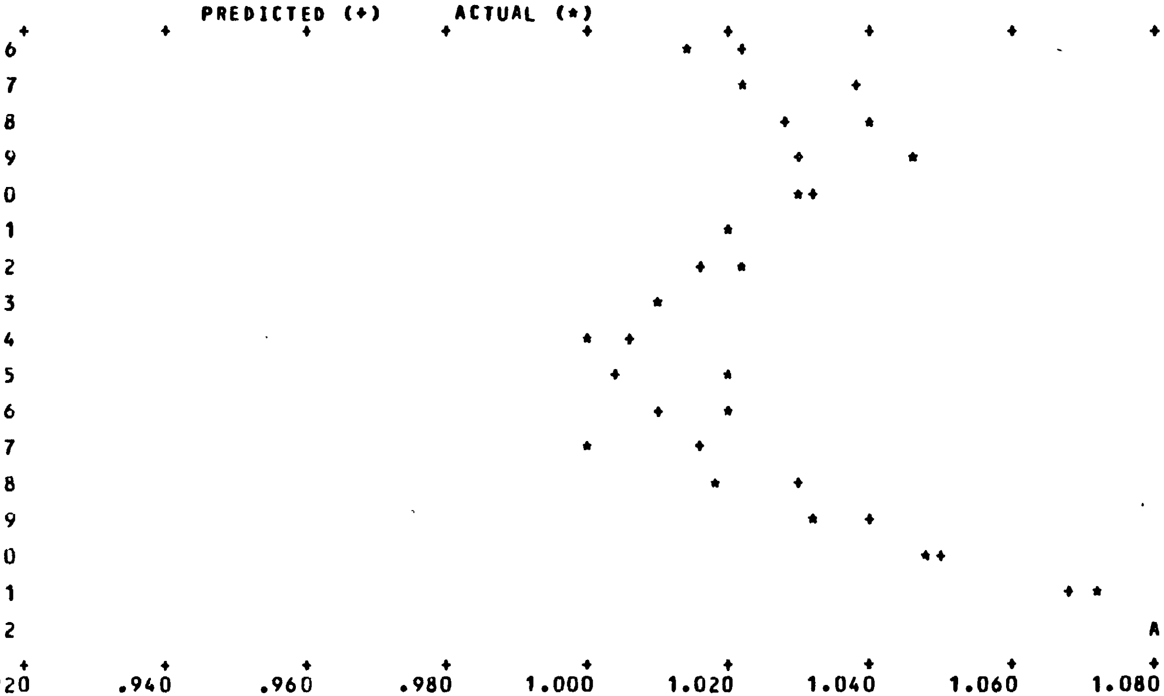
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.8181	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.6989	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	1.533	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0132	RHO	.23	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		-.0532		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	.7103	.3995	1.778
3	U-RATE (MALE, 25 & OVER	(T- 0)	.0023	.0080	.290
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0085	.0059	1.449
5	U-RATE (MALE, 25 & OVER	(T- 2)	.0093	.0042	2.201
6	TIME	(T- 0)	.0018	.0021	.847
7	CHANGE IN EMPLOYMENT	(T- 0)	-.0381	.1373	.278

DATE	PREDICTED	ACTUAL	
1959	1.023	1.014	6
1960	1.037	1.021	7
1961	1.027	1.040	8
1962	1.031	1.047	9
1963	1.033	1.030	10
1964	1.020	1.019	11
1965	1.016	1.021	12
1966	1.009	1.010	13
1967	1.005	1.000	14
1968	1.004	1.020	15
1969	1.011	1.020	16
1970	1.016	1.000	17
1971	1.030	1.019	18
1972	1.040	1.031	19
1973	1.050	1.047	20
1974	1.069	1.073	21
1975	1.085	1.093	22



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REGRESSION RESULTS FOR SECTOR 66 BATTERIES & ENGINE ELECTRICAL RELATIVE TO GROUP: INDUSTRIAL

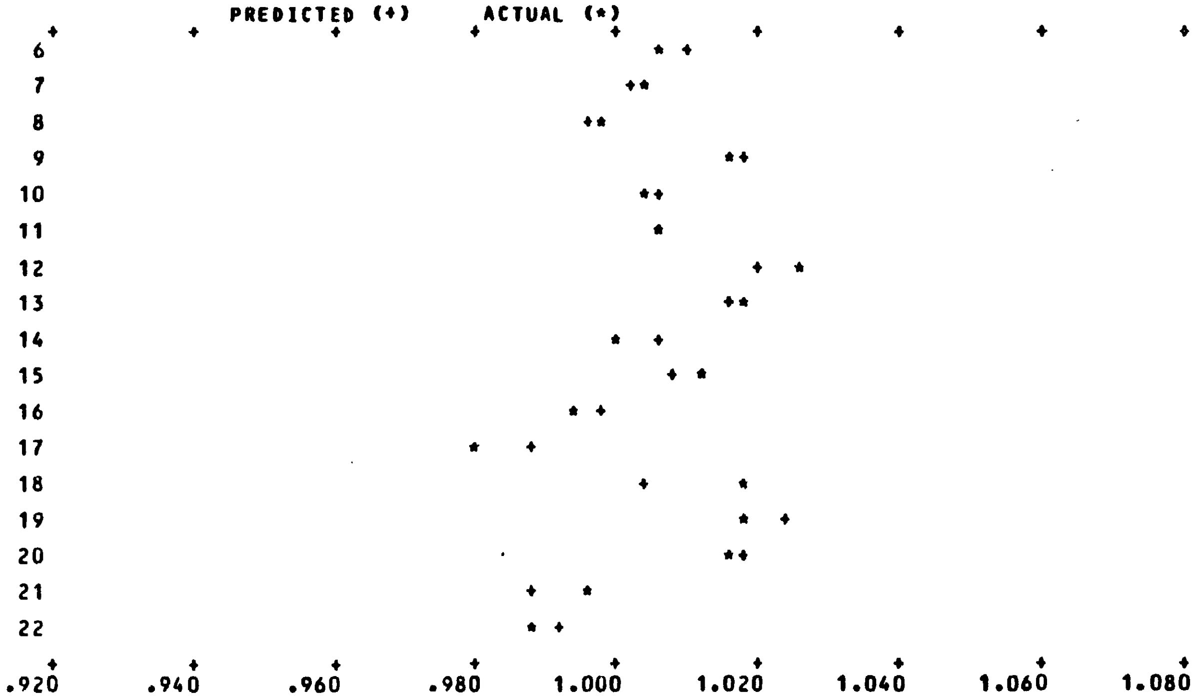
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.7696	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.6324	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	2.977	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0075	RHO	-.49	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0237		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	-.5794	.2204	2.629
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0001	.0037	.028
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0025	.0046	.556
5	U-RATE (MALE, 25 & OVER	(T- 2)	.0019	.0026	.726
6	TIME	(T- 0)	.0028	.0011	2.581
7	CHANGE IN EMPLOYMENT	(T- 0)	.0903	.0403	2.238

DATE	PREDICTED	ACTUAL	
1959	1.009	1.007	6
1960	1.002	1.004	7
1961	.996	.997	8
1962	1.017	1.016	9
1963	1.006	1.004	10
1964	1.006	1.006	11
1965	1.020	1.026	12
1966	1.016	1.018	13
1967	1.006	1.000	14
1968	1.008	1.013	15
1969	.997	.995	16
1970	.989	.979	17
1971	1.003	1.019	18
1972	1.023	1.018	19
1973	1.019	1.015	20
1974	.989	.995	21
1975	.992	.988	22



REGRESSION RESULTS FOR SECTOR 68 MOTOR VEHICLES RELATIVE TO GROUP: INDUSTRIAL

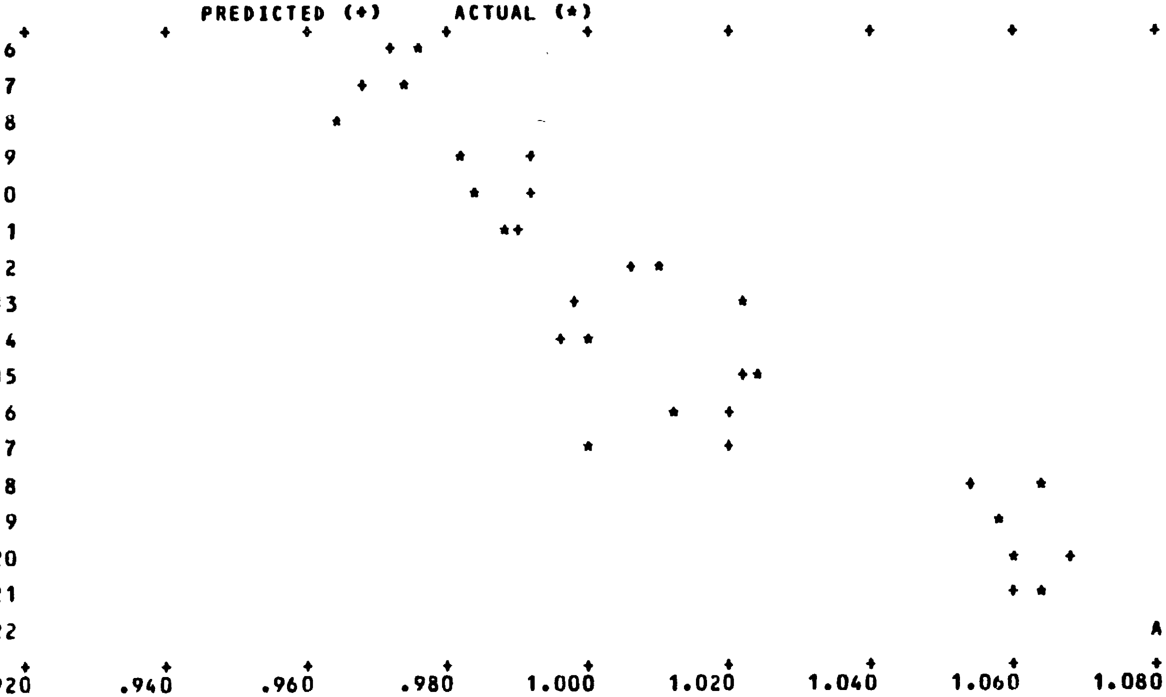
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9339	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.8924	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.00	D-W	1.610	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0124	RHO	.19	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		.0277		
2	%CPI/CPI (.5,.333,.167)	(T- 0)	.0743	.3663	.203
3	U-RATE (MALE, 25 & OVER	(T- 0)	.0060	.0062	.975
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0005	.0077	.064
5	U-RATE (MALE, 25 & OVER	(T- 2)	-.0000	.0040	.000
6	TIME	(T- 0)	.0077	.0018	4.418
7	CHANGE IN EMPLOYMENT	(T- 0)	.0960	.0481	1.997

DATE	PREDICTED	ACTUAL	
1959	.973	.975	6
1960	.969	.973	7
1961	.964	.963	8
1962	.993	.982	9
1963	.992	.984	10
1964	.990	.988	11
1965	1.007	1.010	12
1966	.997	1.022	13
1967	.996	1.000	14
1968	1.022	1.023	15
1969	1.021	1.012	16
1970	1.020	1.000	17
1971	1.054	1.064	18
1972	1.058	1.057	19
1973	1.068	1.060	20
1974	1.060	1.064	21
1975	1.082	1.089	22



REGRESSION RESULTS FOR SECTOR 79 RAILROADS RELATIVE TO GROUP: INDUSTRIAL

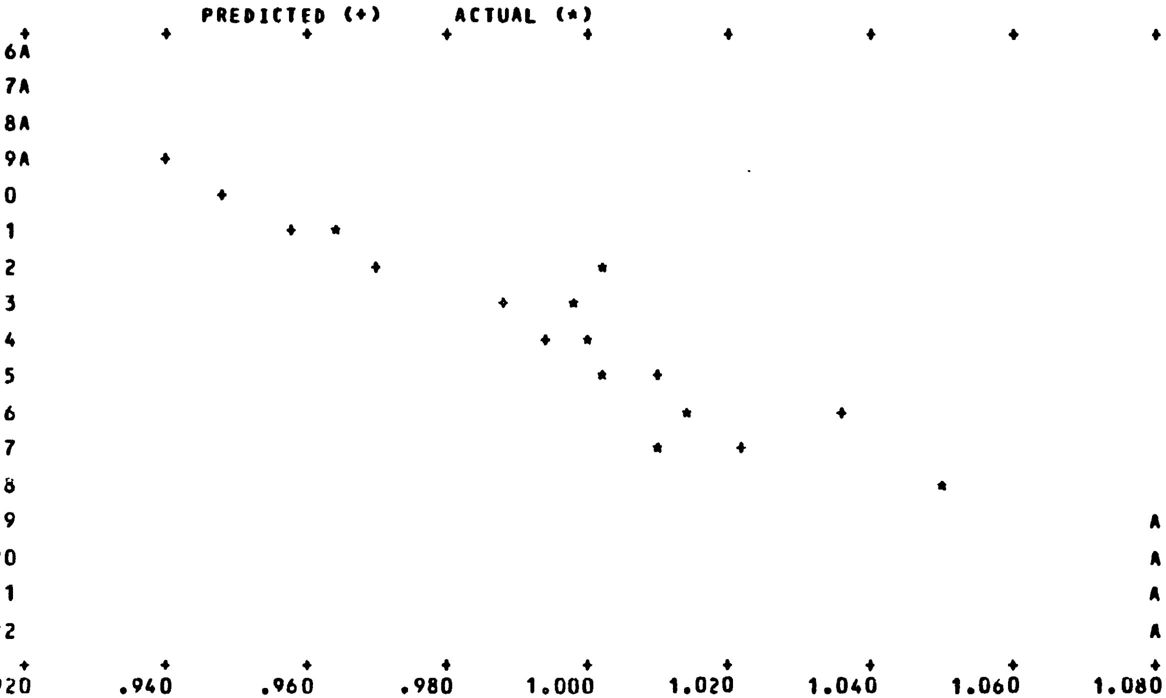
STARTING YEAR FOR REGRESSION 1959 ENDING YEAR FOR REGRESSION 1975

NUMBER OF OBSERVATIONS	17	RSQ	.9485	PERIODS IN SIMULATION	0
DEGREES OF FREEDOM	10	RBARSQ	.9057	ROOT MEAN SQUARED ERROR	.0000
SUM OF SQUARED RESIDUALS	.01	D-W	1.593	PCT ERROR FOR REGRESSION	.00
STD ERROR OF REGRESSION	.0262	RHO	.20	PCT ERROR FOR SIMULATION	.00

RELATIVE WAGE REGRESSED ON

	VARIABLE		COEFFICIENT	STD. ERROR	T-VALUE
1	INTERCEPT		-.0106		
2	XCPI/CPI (.5,.333,.167)	(T- 0)	1.2772	.9999	1.277
3	U-RATE (MALE, 25 & OVER	(T- 0)	-.0271	.0244	1.112
4	U-RATE (MALE, 25 & OVER	(T- 1)	.0269	.0175	1.537
5	U-RATE (MALE, 25 & OVER	(T- 2)	.0148	.0113	1.315
6	TIME	(T- 0)	.0160	.0038	4.228
7	CHANGE IN EMPLOYMENT	(T- 0)	-.1091	.6475	.169

DATE	PREDICTED	ACTUAL	
1959	.898	.916	6A
1960	.908	.912	7A
1961	.886	.910	8A
1962	.941	.894	9A
1963	.949	.917	10
1964	.959	.965	11
1965	.971	1.003	12
1966	.987	.998	13
1967	.995	1.000	14
1968	1.010	1.001	15
1969	1.035	1.014	16
1970	1.022	1.010	17
1971	1.050	1.049	18
1972	1.100	1.097	19
1973	1.147	1.177	20
1974	1.172	1.175	21
1975	1.138	1.135	22



forecasting total wage and salary payments. This section focuses on an attempt to "bridge" between the BLS and BEA wage measures for use in the income model.

Our efforts toward linking the BLS and BEA wage series were motivated initially by the desire that the following identity hold for the forecasting model:

$$\text{(5.32) Labor Income}_{it} = \text{(constant hours) Employment}_{it} * \text{Wage Rate}_{it}$$

That is, the initial aim was to "redefine" the Employment and Earnings (E&E) indexes of earnings at the sub-two-digit level for use as the independent variable in the wage analysis. With this goal in mind, the following steps were undertaken: First, detailed wage and salary data were collected for the period 1958-1972 from the reports of the State Unemployment Insurance (UI) programs. As mentioned in Chapter II, this is the primary source for the wage and salary component of the U.S. National Accounts. This data is compiled from the quarterly contribution (tax) reports submitted to state employment security agencies by employers subject to state unemployment insurance laws. The state agencies compile this data on an industry and size of establishment classification and submit this information to BLS. BLS then constructs national summaries in its Employment and Wages (E&W) publication.

The quarterly publications contain monthly employment data and total wages and salaries paid in the quarter. The industry detail is at the three-digit SIC level except for four-digit classification of manufacturing industries that is required in the first quarter of each year.

The UI data serves as the major source for the National Income Account (NIA) estimates of employment and wages as well as providing the major part of the employment benchmark for the BLS Current Employment Statistics program (whose results appear in Employment and Earnings).

An original aim of this study was to develop a data base that would allow forecasts of GPO by industry below the two-digit level in manufacturing. The UI data were used to allocate the published BEA two-digit wage and salary data to the INFORUM 200-sector level of aggregation. First, the three-digit annual totals were scaled to match the BEA control totals at two-digit basis. Then the first quarter four-digit data were used to prorate within each three-digit group. The resulting four-digit annual data were aggregated to the INFORUM 200-order classification.

Initially, we assumed that the"slippage" between the UI annual employment totals and that reported by E&E was negligible — especially in manufacturing. This assumption was based on our knowledge that (1) the March UI employment data provides the E&E benchmark, (2) that only a small fraction of manufacturing employment is not covered by UI, and (3) on casual inspection of the employment data for several years. An UI wage index was then constructed by dividing the UI payroll data by the E&E employment figures. This wage index was then compared to the index computed for production workers only for each of the 132 INFORUM sectors in manufacturing. Although plots of the two indexes looked generally similar, the year-to-year changes were often quite different, with the UI measure generally being more volatile.

One may legitimately expect this phenomenon due to the changing mix of production and nonproduction workers in the short run. If one assumes

(1) that the E&E weekly earnings represents total wage payments to production workers and (2) the UI and E&E total employment figures are negligibly different, then the average earnings for nonproduction workers can be imputed by knowing the total number of nonproduction workers. The implied nonproduction worker — production worker wage ratios were computed from the data at hand. Inspection of plots of these ratios made it obvious that assumptions in (1) and (2) above did not hold well enough to be able to say anything about nonproductinon wage rates per se. Although some series showed little variance (and some with significant trends) a majority showed large fluctuations with ranges at .10 - .15 on either side of the mean. (Ex. the ratios for Farm Machinery (SIC 352 for 1966-1972): 1.296, 1.400, 1.449, 1.426, 1.507, 1.431, 1.354.) In addition, a number of sectors contained data problems from changes in SIC definition. We treat the employment "mix" problem more directly below.

In view of these results, I went ahead to construct the 1958-1972 UI data base for employment as well. The two wage indexes then compared were:

$$W_{UI} = \frac{\text{Wage Payments}_{UI}}{EMP_{UI} \cdot \frac{H(t)}{H(1972)} \cdot P(t) + N(t) \quad / \ [P(t) + N(t)]} \qquad \text{and}$$

W_{EE} = Average annual earnings for constant-hour week

where

P(t) = number of production workers (from E&E)

N(t) = number of nonproduction workers (from E&E)

H(t) = number of weekly hours of production workers (from E&E)

The results were not substantially altered. The "long-term" trends in W_{UI}/W_{EE} for most industries were small while the year-to-year changes were often quite different. One possible source of this problem may be the use of the first-quarter data only as prorators for industries made up of the four-digit data, but the problem persisted in the "hard" three-digit industries as well.

In view of the sampling variances of the E&E data and the various adjustments both data sets have undergone, one might ask how much of the W_{UI}/W_{EE} variation may be explained by several a priori determinants. To answer this, the following regression was run on all the detailed INFORUM sectors for which the data appeared reasonably consistent.[32]

$$5.33 \quad \log \frac{W_{UI}}{W_{EE}} = a_0 + a_1 \text{ Time} + a_2 \text{ UR} + a_3 \text{ MIX}$$

where

UR is the overall unemployment rate, and

MIX is the percentage of production workers to total industry employment from E&E.

These three variables were sufficient to explain fifty percent or more of the variance (of W_{UI}/W_{EE}) in nearly two-thirds of 119 manufacturing sectors. The fact that nonproduction workers wages are generally higher than production worker wages showed up clearly in the predominance of negative signs on the MIX variable. The MIX variable was the most significant of

[32]This appeared to be the case for 119 sectors.

the three; in 55 industries out of 119 in manufacturing, the coefficient was significant at the ten percent level. The unemployment rate was included on the rationale that irregular bonuses, to production workers as well as nonproduction workers, are related to the business cycle. Note that overtime premiums are included already in <u>both</u> wage measures. The unemployment rate had an expected negative sign in a majority of industries, but was significant in only about a quarter of manufacturing.[33] The third term was included to pick up changing of nonproduction-production worker wage differentials or possible slight sampling differences over time. The trends were very small, only 21 out of the entire sample exceeded a .5 percent per year in absolute value, and nearly half of these occurred in services where we used only nine years for our estimation period.[34]

In view of the small trend adjustments found for most of the detailed sectors and the fact that the present income model is disaggregated only to the two-digit SIC basis, it seemed reasonable to estimate the third-tier reconciliation equations at a two-digit basis for the final version of the model. The computer time saved by reducing the number of sectors in the complete model undoubtedly has a greater return elsewhere.

The specification chosen is similar to that used in the earlier work at the 200-sector level. Since the INFORUM model makes no separate

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[33]Corporate profits in the corresponding two-digit industry were added to the regression as another possible indicator of "bonus" payments that may show up in UI wage data. It was significant with the correct sign in only a handful of sectors.

[34]As we discussed in Appendix V-B, the UI data were used to extrapolate backward from 1964 a number of wage series in the services. Thus, we have only 1964-72 for independent data from both sources in these industries.

forecasts of production and nonproduction workers by sector, for this work we substituted the percentage change in total manhours as a proxy for the MIX variable. Our use here of total manhours (i.e. including self-employed) requires a comment of explanation. The price-wage submodel used in the integrated model uses GPO profit and wage data sources in the development of price markup equations. As such, the price-wage submodel requires a wage rate consistent with the "compensation per man-hour" variable here and, thus, these equations are used within the price model. The current real model forecasts total manhours by industry sector, and it is a direct input to the price model. In order not to have to split the self-employed hours away from the total within the price model proper, the equations here have resorted to using this broader measure of hours as an explanatory variable. For the purpose of generating employee compensation and proprietors' income, equations within the income model are used to generate annual self-employed manhours . These are presented in the following chapter.[35]

Our dependent variable is the unweighted average compensation per manhour by two-digit industry. As a result, it may be affected by the changing mix of employment among high and low wage sectors included in the aggregate. To test the significance of this phenomenon explicitly, the variable HIHLOW was constructed by dividing the total unweighted

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[35]Note that the substitution of MH for MHE is important for sectors where self-employment is large. Moreover, this variable is being used as a short-term influence only. Since self-employed hours are more sluggish than those for employees, this alters the coefficient of this variable, but changes little its explanatory value. This was found to be the case with a set of unreprorted regressions using manhours of employees only.

average of employment in the two-digit sector by a weighted average of employment, the weights being average earnings per employee in 1967. The weighted average employment is constructed at the 200-order level of aggregation.

The unemployment rate (for men age 25 and older) is again included to test for bonus and other irregular payments that may accompany high levels of employment. It also may serve as a proxy for changes in occupational mix in addition to the change in manhours terms.

The final variable included is a time trend. The trend variable serves to reconcile minor differences in growth rates of earnings between sectors,[36] and between production and nonproduction workers, as well as to account for any persistent shifting due to SIC classification differences. The latter item, however, may be negligible at the two-digit SIC basis chosen here.

The adjustment equation may now be expressed in the form in which it was estimated. We estimate:

$$\text{(5.34)} \quad \log\left(\frac{COMP_{2D}/MHE_{2D}}{WINX_{2D}}\right) = \alpha_o + \alpha_1 \, \Delta \log MH_{2D} + \alpha_2 \, Time$$

$$+ \alpha_3 \log\left(\frac{EMP_{2D}}{\sum_{i=1}^{N} w_i^{67} \, EMP_i}\right) + \alpha_4^{UNEM25}$$

$$\text{(HIHLOW)}$$

[36]This is important only when the long-run growth rates of earnings of the micro sectors are correlated with the growth rates of employment. If relative employment remains constant, then the fixed-weight earnings index used as the primary explanatory variable contains all the necessary information about earnings changes for the detailed sectors.

where

$COMP_{2D}$ = total Labor Compensation for a two-digit SIC income model sector

MH_{2D} = total manhours (including self-employed) of workers in an income sector

MHE_{2D} = manhours of employees in an income sector

EMP_{2D} = total number of employees in an income sector, adjusted for length of the work week in the manner of the INFORUM model.

EMP_i = number of employees in I/O sector i, included in the two-digit income model sector

UNEM25 = unemployment rate for men age 25 and older

$WINX_{2D}$ = a fixed-weight index of gross hourly earnings (adjusted for fringes), the weighting made at the wage sector level of disaggregation. The employment weights are those for 1967 and include production and nonproduction workers for each individual sector.

The first item to note about equation (5.34) is that we have constrained the elasticity with respect to fixed-weight compensation index to be unity. That is, if compensation per production worker in each of the wage sectors rises by x percent, we expect the NIA construct, compensation per manhour, to rise by x percent for that two-digit sector. Without this constraint, we would imply a nonzero elasticity of this ratio with respect to the overall price and wage level. The α coefficient is expected to be negative, as short-run increases (decreases) in employment are likely to lower (raise) the overall wage, since production workers generally earn less than nonproduction workers. The latter's employment is less cyclically sensitive.

If the effects of changes in the proportion of workers in high-wage and low-wage I/0 sectors have an important influence on compensation per employee at the two-digit level, then α_2 should be statistically significant and near unity. The variable HIHLOW is included only in the 21 manufacturing equations. For the remaining sectors, the INFORUM model does not forecast employment below the two-digit SIC level.

The regression estimates for the two-digit wage bridge equations (5.34) are shown in Table V-8 (See computer printout). The reader should note first that there is no pair of columns for the employment mix variable, HIHLOW. Preliminary estimations yield generally positive coefficients for HIHLOW, but there was no particular inclination for the values to be near unity. In several cases, high statistical significance was found for employment mix variable with coefficients greater than 3.0 It seemed apparent that the HIHLOW variable in these cases was simply picking up undertermined cyclical influence. Accordingly, the coefficient for HIHLOW was constrained to unity in the 21 manufacturing industries by transforming the dependent variable. The R^2 in Table V-8 applies to the original specification the standard error and D.W. statistic are for the estimated regression. All equations were estimated through 1973.

Looking first at those sectors with, _a priori_, the best data consistency — the 21 manufacturing sectors -- we find the coefficients conform quite closely to our expectations. First, in every case the coefficent of the manhour change variable is negative. Note that although the average contribution of the employment change term (in explaining the variance of

TABLE V-8

WAGE BRIDGE EQUATIONS

#	INDUSTRY	MANHR	T-VAL	TIME	T-VAL	UNEM25	T-VAL	RSQ	S.E.	DW	START
2	AG. SERVICES, FORESTRY, & FISHERIES	-.2978	(.7)	-.0147	(4.3)	.0016	(.1)	.810	.0274	1.86	1964
3	METAL MINING	-.0757	(1.2)	.0063	(4.0)	.0094	(1.6)	.651	.0198	1.00	1958
4	COAL MINING	-.2221	(2.0)	.0132	(6.5)	.0149	(2.6)	.820	.0218	.84	1958
5	CRUDE PETROLEUM & NATURAL GAS	-.1747	(1.0)	.0070	(5.4)	-.0077	(1.6)	.879	.0155	1.02	1958
6	NONMETALLIC MINERAL MINING	-.0217	(.2)	.0023	(2.2)	.0039	(1.1)	.343	.0125	1.06	1958
7	CONTRACT CONSTRUCTION	-.3648	(3.8)	-.0051	(6.5)	-.0153	(5.6)	.840	.0094	1.74	1958
8	FOOD AND KINDRED PRODUCTS	-.3778	(2.0)	.0008	(1.1)	-.0042	(1.7)	.533	.0064	1.63	1958
9	TOBACCO MANUFACTURES	-.1616	(.9)	.0048	(3.3)	.0030	(.7)	.675	.0161	2.27	1958
10	TEXTILE MILL PRODUCTS	-.0409	(1.1)	.0031	(6.7)	.0038	(2.3)	.752	.0056	1.81	1958
11	APPAREL	-.0808	(1.3)	.0031	(4.2)	.0062	(2.5)	.691	.0090	1.31	1958
12	LUMBER AND WOOD PRODUCTS	-.0848	(2.1)	.0041	(7.5)	-.0048	(2.6)	.962	.0067	1.41	1958
13	FURNITURE AND FIXTURES	-.0614	(1.7)	.0010	(1.8)	.0032	(1.6)	.457	.0073	2.04	1958
14	PAPER AND ALLIED PRODUCTS	-.1798	(2.9)	.0017	(3.2)	-.0012	(.7)	.576	.0056	1.71	1958
15	PRINTING AND PUBLISHING	-.4231	(6.1)	-.0014	(3.1)	-.0083	(4.9)	.783	.0050	1.96	1958
16	CHEMICALS AND ALLIED PRODUCTS	-.2277	(4.2)	.0020	(4.8)	-.0049	(3.1)	.942	.0037	2.52	1958
17	PETROLEUM REFINING	-.0274	(.1)	-.0013	(1.1)	-.0118	(2.6)	.440	.0126	1.13	1958
18	RUBBER AND MISC. PLASTICS	-.1137	(3.4)	.0013	(2.2)	-.0004	(.2)	.788	.0076	1.74	1958
19	LEATHER AND LEATHER PRODUCTS	-.1477	(2.5)	-.0012	(1.4)	-.0022	(.8)	.442	.0097	2.26	1958
20	STONE, CLAY, AND GLASS PRODUCTS	-.1098	(2.3)	.0019	(3.3)	-.0015	(.8)	.826	.0071	2.11	1958
21	PRIMARY METALS	-.1333	(5.2)	.0021	(4.1)	-.0015	(.8)	.639	.0063	2.27	1958
22	FABRICATED METAL PRODUCTS	-.1527	(3.1)	.0019	(2.4)	.0004	(.1)	.644	.0096	1.79	1958
23	MACHINERY, EXCEPT ELECTRICAL	-.1543	(3.7)	.0022	(2.3)	.0004	(.1)	.700	.0113	1.62	1958
24	ELECTRICAL MACHINERY	-.1468	(3.7)	.0048	(5.5)	.0017	(.6)	.868	.0103	1.69	1958
25	TRANS. EQUIP. & ORDNANCE	-.0747	(1.2)	.0053	(3.4)	.0018	(.3)	.320	.0174	.75	1958
26	MOTOR VEHICLES	-.1110	(3.2)	.0037	(3.2)	.0035	(.9)	.649	.0141	1.28	1958
27	INSTRUMENTS	-.1814	(3.1)	.0037	(3.9)	-.0017	(.5)	.785	.0112	1.63	1958
28	MISC. MANUFACTURING INDUSTRIES	-.0559	(1.0)	.0043	(7.9)	.0007	(.4)	.903	.0066	2.19	1958
29	RAILROADS	-.0185	(.3)	.0032	(2.8)	.0059	(1.9)	.490	.0071	2.30	1958
30	LOCAL, SUBURBAN, & HIGHWAY PASSENGE	-.1595	(.8)	-.0066	(4.3)	-.0127	(2.3)	.834	.0115	2.63	1964
31	TRUCKING AND WAREHOUSING	-.4432	(2.8)	.0012	(1.0)	-.0074	(1.7)	.572	.0149	1.06	1958
32	WATER TRANSPORTATION	-.5748	(2.3)	.0072	(1.9)	-.0079	(.6)	.735	.0317	2.25	1964
33	AIR TRANSPORTATION	.1026	(.4)	.0207	(7.4)	.0380	(2.3)	.943	.0223	2.08	1964
34	PIPELINE TRANSPORTATION	-.3401	(5.0)	.0037	(4.2)	.0110	(3.1)	.907	.0080	3.06	1964
35	TRANSPORTATION SERVICES	-.2101	(1.1)	.0129	(8.1)	-.0015	(.2)	.933	.0140	1.00	1964
36	TELEPHONE AND TELEGRAPH	-.3383	(2.1)	.0080	(5.6)	.0013	(.2)	.802	.0166	2.16	1958
37	RADIO AND TELEVISION BROADCASTING	-.7452	(1.6)	-.0025	(1.4)	-.0146	(2.2)	.298	.0200	1.38	1958
38	ELECTRIC, GAS, AND SANITARY SERVICE	-.1420	(.8)	-.0005	(1.1)	-.0054	(3.5)	.476	.0054	1.53	1958
39	WHOLESALE TRADE	.0297	(.3)	.0012	(3.1)	-.0040	(2.6)	.865	.0048	2.44	1958
40	RETAIL TRADE	-.0541	(.8)	.0005	(2.3)	.0004	(.4)	.372	.0029	2.41	1958
41	BANKING AND CREDIT AGENCIES	-.0443	(.1)	.0037	(2.8)	-.0013	(.1)	.577	.0117	1.15	1964
42	INSURANCE AGENTS AND BROKERS	-.0005	(.0)	.0104	(3.2)	-.0021	(.5)	.938	.0101	1.54	1964
43	REAL ESTATE AND COMBINATION OFFICES	-.3062	(.8)	.0099	(2.5)	-.0117	(1.2)	.636	.0220	.63	1964
44	HOTELS AND OTHER LODGING PLACES	.3756	(1.5)	-.0036	(2.3)	.0002	(.0)	.652	.0166	1.29	1958
45	PERSONAL SERVICES	-.5658	(4.5)	-.0064	(6.6)	-.0023	(.7)	.978	.0068	1.96	1964
46	MISC. BUSINESS SERVICES	-.3161	(2.1)	-.0008	(.8)	-.0139	(3.1)	.697	.0086	2.55	1964
47	AUTOMOBILE REPAIR AND GARAGES	-.5691	(2.1)	.0059	(4.3)	.0144	(2.0)	.770	.0122	2.02	1964
48	AMUSEMENT AND RECREATION SERVICES	-1.5191	(2.1)	.0132	(2.1)	-.0214	(1.2)	.545	.0377	1.57	1964
49	MEDICAL AND OTHER HEALTH SERVICES	.9915	(2.5)	.0146	(8.0)	.0248	(4.3)	.969	.0138	2.24	1964
50	EDUCATIONAL SERVICES	-.3918	(1.3)	.0018	(.9)	-.0076	(1.0)	.459	.0160	1.14	1964

the two wage levels) is probably higher in the more cyclical durable goods industries, the three largest (in absolute value) coefficients are in nondurables. The coefficients reflect both the elasticity of the intra-industry employment mix with respect to a change in total manhours and the level of the production worker-nonproduction wage differential. One may speculate that the more heavily unionized durable goods industries have smaller wage differentials and thus layoffs contribute less to increasing the average wage.

The trend coefficients are possible with the exception of three sectors and they are generally small. The largest trend occurs in Transportation equipment and ordnance where it is .5 percent annually; in nearly half of the 21 sectors the absolute values are less than .2 percent per year. The predominance of positive trends is consistent with mix effects brought about as more highly paid nonproduction workers increase in proportion to the total employment. Of course, the wage differentials of these two broadly defined groups may be increasing slightly as well. I have made no attempt to sort out the relative importance of these two factors on this more aggregated data.

The unemployment rate is statistically significant at the ten percent level in only six manufacturing sectors. From inspection of the plots for Textile Mill products and Apparel it is quite obvious that UNEM25 is serving as proxy for cyclical fluctuatins in occupational mix. The average wage rises approximately one half percent for every one percentage point rise in our primary unemployment rate in both these sectors. An explanation for a negative sign on this variable — as found in Book, Printing and Publishing, and Chemicals, for example — is not so obvious. One possible rationale is that bonus payments and some executive salaries (which are, of course, excluded from the E&E measure) are negatively correlated with the unemployment rate.

Unfortunately, the quality of the bridge equations deteriorates as we move outside of manufacturing. Most likely this problem is due to the use of shorter samples and data deficiencies in both wage measures.

In general, the signs on the change in manhours variable are still negative, although there is substantially more variation than in manufacturing. The time trends also show more variation than in manufacturing and the high absolute values in some cases suggest sampling problems with E&E data or different classification of firms by UI and BLS. Ten sectors had unemployment rate coefficients statistically significant at the ten percent level and all but two were negative.

For a few of the nonmanufacturing sectors, the regression results appeared unreasonable enough to generate problems in the full model. As a first step, equations were dropped for sectors (48) Amusement and Recreational Services, and (49) Medical and other Health Services. Hopefully, future work can pin point the causes for the large inconsistencies for these data series. Secondly, it seemed unreasonable to allow the high trend coefficients to operate for long-run simulations. Most of these coefficients are estimated from the short 1964-73 sample period. Accordingly, for forecasting purposes, the trends are allowed to be in full effect for three years past the sample period (i.e. 1974-76) and then arbitrarily reduced by .001 per year (in absolute value) until no trend is more than half a percent per year in absolute value. Thus, the trends are at least brought into some upper limit as suggested by the more reliable results for manufacturing. This restriction will have its greatest effect on Coal Mining, Air Transportation, Transportation Services, and Insurance Agents and Brokers.

In spite of the problems with some of the nonmanufacturing sectors, the approach of estimating bridge equations appears to be a workable one. For nearly all sectors we find compensation per manhour negatively related to changes in employment, given hourly earnings of production workers. The greatest advantage of this approach, of course, is that it allows us to estimate elsewhere functions for an empirical measure of wage rates more compatible with the requirements of economic theory.

APPENDIX V-A

Construction of Hourly Earnings Indexes With Pre-1964 Data

Since BLS only began collecting employment and earnings data for many sectors in the services and some industries in transportation in 1964, the published fixed-weight hourly earnings index for the private nonfarm economy is available only from January, 1964. At the industry division level, BLS publishes only fixed-weight indexes for the pre-1964 period for total manufacturing (1947 forward), and durable and nondurable manufacturing (1959 forward). This appendix first describes briefly the sources and procedures used to construct eight component hourly earnings indexes; and then the steps undertaken to obtain the more aggregate indexes used in the regressions.[1]

The eight component indexes for 1954-1963 were generally constructed from seasonally unadjusted hourly earnings from Employment and Earnings at the two-digit SIC level, using fixed 1967 employment weights provided by BLS. The aggregated monthly series were then seasonally adjusted by the Census X-11 computer program. The resulting series were then used to extrapolate the published 1964:1 value back to 1954:1. The Industries chosen and exceptions to this procedure are listed below:

Mining

A fixed-weight index from 1954:1 through 1958:1 was constructed with two-digit hourly earning series: (SIC's) 10, 12, and 14. This was

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[1]The eight component indexes were also extended back to 1958 by David Wyss and Larry Shiffman at the Federal Reserve Board.

linked to a fixed-weight series using SIC's 10, 12, 13, and 14 for the period 1958:1 to 1964:1. After seasonal adjustment, the series was used to extrapolate the published index from 1964:1 backward.

Construction

Same procedure as for Mining from 1954:1 through 1964 and using SIC's 15, 16, and 17.

Manufacturing

The published BLS index for total manufacturing was utalized in the construction of the more aggreate indexes. However, in some preliminary analysis, sectoral regressions were run for the durable and nondurable components. The sources for the pre-1959 data are listed below.

Durable Manufacturing

From 1956 through 1958 a fixed-weight hourly earnings index was constructed by aggregating BLS published data for straight-time earnings at the two-digit SIC level (with published BLS 1967 manhour weights). For 1954 and 1955 average straight-time hourly earnings (not adjusted for interindustry shifts) for durables were employed. The 24 quarterly values (1954:1 through 1959:4) were then seasonally adjusted by use of the 1959 seasonal factors as published in BLS Bulletin 1897, "The Hourly Earnings Index, 1964, August 1975," and linked to the 1959:1 value.

Nondurable Manufacturing

Same procedure as followed for durables but, of course, substituting the ten two-digit series for nondurables to make up the 1956-1958 portion of the index. The 1954 and 1955 observations again were taken from an aggregate series for nondurables, unadjusted for interindustry employment shifts.

Transportation, Commmunications, and Utilities

Since BLS made a substantial extension of industry coverage in 1958, the construction of the pre-1964 index proceeded in two steps. In Step 1 a fixed-weight series was constructed for the period 1954:1-1964:4 and then seasonally adjusted. The following series were used:

SIC 401 Railroads

SIC 481 Telephone communication

SIC 482 Telegraph communication

SIC 491 Electric companaies and systems

SIC 492 Gas companies and systems

SIC 493 Combination companies and systems.

In Step 2, a seasonally adjusted series for 1958:1 to 1964:4 was constructed by adding to the above series the following:

SIC 411 Local and suburban transportation

SIC 413 Intercity highway transportation

SIC 421 Trucking

SIC 46 Pipe line transportation

SIC 483 Radio and TV broadcasting

SIC 494 Water, steam, and sanitary systems.

The resuting two series are linked to each other in 1958:1 and then linked to the published series in 1964:1.

Wholesale and Retail Trade

The first step in this procedure was to construct a series for retail trade. For 1954-1957 the published (unadjusted for industry mix) series from E&E was taken as is. For 1958-1964, a fixed-weight index was constructed from separate data for SIC's 52, 53, 54, 56, and 57. This linked series for retail trade was aggregated with wholesale trade and used to extrapolate backward to the published 1964:1 point.

Finance, Insurance, and Real Estate

Only monthly data for banking existed prior to 1964. As a result, an annual series was made up by creating a fixed-weight index of average earning per full-time equivalent employee from the following industries: (1) Banking, (2) Credit Agencies, (3) Insurance carriers, (4) Insurance agents, brokers, and service, and (5) real estate. These data were taken from Table 6.5 (1958 benchmark) of the National Accounts in the *Survey of Current Business*. Quarterly data were then made up by polynomial interpolation, using the hourly earnings series for banking as a mover.

Services

The same procedure as for Finance, Insurance, and Real Estate was followed. All of the 13 individual sectors, except private households, listed under Services in Table 6.5 (SCB) were used to build the annual fixed-(1967) weight series from 1954-1963. Quarterly interpolation was made with the hourly earnings index for wholesale and retail trade

Private Nonfarm Index (Adjusted for fringe-benefits and payroll taxes)

Quarterly data on labor compensation, and wages and salaries are available from BEA for each of the eight industry divisions listed above. This data is constructed as part of their estimation of national income originating for each of these sectors. Each of the hourly earnings series were adjusted for fringes and employer payroll taxes by multiplying the series by the quarterly ratio of compensation the wages and salaries. The resulting series were then normalized to a 1967 = 1.0 base.

The private nonfarm index was aggregated with 1967 payroll weights. These weights were computed by multiplying the manhour weights published by BLS (Appendix A - The Hourly Earnings Index, 1964 - August 1975, BLS Bulletin 1897) by 1967 average hourly earning for the corresponding sector. The weights are:

Mining	.0141
Contract Construction	.0926
Manufacturing	.3479
Transporation, Communications, and Utilities	.1077
Wholesale & Retail Trade	.2186
Finance, Insurance & Real Estate	.0542
Services	.1648

Sectoral Indexes Used in Regressions

The four sectoral indexes used in the wage-change equations are simply aggregations of the above indexes using the same fixed weights. For sector 1 (Manufacturing, Mining, Transportation, Communications and Utiltities) the aggregate manufacturing index was substituted for the separate durable and nondurable indexes. This was done to utilize the BLS fixed-weight manufacturing index for 1954-1958.

APPENDIX V-B

Industry Earnings and Employment Series

This appendix describes briefly the sources of data for the industry wage equations (in Section 5.3 and Appendix V-C). We also discuss some of the rationale for the industry aggregation used to define the 100 wage sectors.

In our construction of industry wage indexes we, like most others, have turned to the only readily available and consistent source — the BLS series for average hours and earnings for production workers. This data was first compiled for use in the Gilmartin dissertation on industry pricing. As such, the data were constructed in such a way to be used in both price (in the construction unit labor costs) and wage studies.

Since the Gilmartin price equations were estimated at the detailed 200-sector level, the BLS employment and earnings data were first aggregated to this level. Actually, three separate files were constructed for each industry. The first file is simply an aggregation of total employment in I/O sector j. A handful of SIC industries on the BLS computer tape were included in more than one INFORUM sector. In these cases, four-digit SIC splits were made on the basis of 1967 employment data from the _Census of Manufacturers_.

Into the second file we aggregated what we may term hourly-adjusted employment. This convention was consistent with definition of employment used in the standard INFORUM model. After picking a base year, INFORUM employment is the number of nonproduction workers plus production workers adjusted for changes in the work week. That is, in quarter t for industry i, employment for the study here is

$$(1)\ E_{it} = \frac{H_i(t)}{H_i(1972)} \cdot P(t) + N_i(t)$$

where

H = average weekly hours of production workers

P = average number of production workers

N = average number of nonproduction workers.

The third file is a payroll file. Gilmartin, in constructing labor cost indexes, assumed that wage rates for production workers and nonproduction workers were positively correlated across industries. Therefore, as a crude attempt to incorporate this assumption, the wage rate of production workers was imputed to nonproduction workers for each detailed SIC industry that was aggregated into a particular I/O sector. Specifically, the constructed payroll value for month i in I/O sector j was

$$(2)\ \text{Payroll}_{jt} = \left[N_i(t)\ \frac{H_i(1972)}{H_i(t)} + P(t) \right] * WE_{it}$$

where

WE_{it} = average weekly earnings of production workers in SIC industry i in month t.

An index of wage rates was obtained by dividing the payroll entry in file 3 by the corresponding hourly-adjusted employment figures in file 2. When there is only one SIC industry aggregated into an I/0 industry, the wage index thus computed is precisely average gross hourly earnings of production workers. This is accomplished by the adjustment of hours for nonproduction workers in equation (2). When two or more SIC industries are aggregated, the wage index is seen to be a Paasche index of hourly earnings, the weights being total employment, rather than production workers only. Since the ratio of production workers to total employment varies little across industries at this level of aggregation, the indexes here are very close to simple average hourly earnings computed with production worker data only. This was confirmed by a check for a half dozen or so industries. Thus, we refer in Chapter V to average hourly earnings of production workers, although strictly speaking, our index is slightly different.[1]

For some sectors, BLS collected no data prior to 1964. Since we wished a uniform sample period of 1958:1 through 1974:2, the gaps in the earlier period of BLS data were filled in by annual data from the unemployment insurance reports published in Employment and Wages. This procedure is described briefly in Section 5.4. Monthly data were obtained by polynomial interpolation using data of closely related industries as movers.

For the work relating to industry wage-change equations described in Appendix V-C, the monthly wage indexes were seasonally adjusted by

[1]Since the present model does not use the Gilmartin equations and provides an explicit bridge between the BLS and national income data, future updates will probably aggregate this data in a more conventional fashion.

the Census X-11 program: The resulting monthly values were aggregated to quarters by taking simple three-month averages.[2] The four-quarter employment change terms in those equations were taken from file 2 described above, after quarterly aggregation.

Wage Sector Aggregation

The data series constructed from the above procedures were available for about 170 sectors of the standard INFORUM model. This clearly appeared to be too many to handle satisfactorily in either the estimation or model-building phases of the study. As we mentioned in Section 5.1, our industry data does not necessarily correspond to particular bargaining units or labor markets. What I was concerned about, however, was that sufficient disaggregation be present for possible simulation studies in the future. This meant immediately that the two-digit SIC aggregation used in most wage studies was too broad. That is, one could not easily simulate the effects of an increase, in say, the aluminum worker's wage if aluminum were aggregated with other primary metals.

Some *a priori* aggregation on the basis of union affiliation is precluded by the high degree multi-industrial dispersion in manufacturing. For instance, the *1971 Directory of National Unions and Employee Associations* reports that for 1970:

> In fabricated metal products, for example, one union of 33, representing only 9,000 out of 918,000 workers, reported 80 to 100 percent of its members were in the industry. The remaining members in the industry (909,000) were distributed among 32 unions, and of these, 23 each had less than 20 percent of their members in that industry. In chemicals, 23 out of 26 unions had less than 20 percent of their members in that industry.

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[2]The indexes are also subsequently aggregated to 100 sectors. See below.

As a result, our classification scheme derives partly from direct examination of the data. First, trend equations were estimated on the quarterly relative wage, $\frac{W_{it}}{\bar{W}}$, for the period 1958:II - 1974:II.[3] Second, correlation and principal components computations were made for quarter-to-quarter wage changes for all the INFORUM sectors within a two-digit SIC group. The procedure for aggregatinon remained subjective but the following criteria were used: (1) industries with abnormal long-term relative trends were kept separate, (2) industries which showed small correlation with others in quarter-to-quarter wage changes in the two-digit group were not aggregated, and (3) industries whose absolute wage differential were dissimilar or for which demand effects may be independent were not aggregated.

If we erred in this procedure, it is probably to have kept too many separate sectors. We reduced the number of sectors to 70 in manufacturing, and to 30 in nonmanufacturing. The sector titles along with the included 200-sector industries and SIC's were shown in Table V-6.

The wage indexes were aggregated on a fixed-weight basis; the weights were 1967 payrolls. In the construction of the relative wage variable $W_i/\bar{W}$, (for use in the quarterly relative wage specification only) the same procedure was followed for making up $\bar{W}$. Thus, $\bar{W}$ is similar to the BLS published fixed-weight hourly earnings index. In June 1974, the last month of our data, our aggregate index was 1.573, compared to 1.585 for the BLS hourly earning index excluding overtime.

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[3]The aggregate index used to construct the independent variable here is described below.

The seasonally adjusted indsutry wage indexes, after the aggregation just discussed, were those used in the wage-change equations described in Section 5.3. In the final model, the annual relative wage equations were estimated with this same data after adjustment for fringes and taxes. This adjustment was made by using an index of the ratio of two-digit SIC (GPO) labor compensation to wages and salaries. Each wage sector within a two-digit industry was adjusted by the same index.

We conclude this appendix by some brief comments relating to the particular wage sector aggregations within two-digit SIC industries.

Food and Kindred Products

The essentially three-digit INFORUM sectoring was left nearly intact. The correlations were generally less than .35 and we wanted to leave a structure amenable to possible future work on the contribution of processing costs to prices of various food products.

Textile Mill Products

Correlations showed knitting (SIC 225) to behave somewhat differently from the other four sectors. We rather arbitrarily grouped Floor coverings(SIC 227) and Miscellaneous Textiles (SIC 229).

Apparel

Apparel and Household textiles were kept separate due to the low (.302) quarter-to-quarter correlation between them.

Lumber and Wood Products

Logging Camps (SIC 241) and Saw and Planing Mills (SIC 242) were each put in separate sectors on account of their divergent trends.

Paper and Paper Products

E&E data doesn't permit disaggregation for INFORUM sectors Pulp mills and Paper and paperboard mills (SIC 261, 262, 263). To these we add Wall and building paper (SIC 266) for which no completely separate E&E data exists either. Paperboard containers (SIC 264) and Paper products (SIC 265) are aggregated together; they displayed very similar time and unemployment rate coefficients.

Chemicals

In Chemicals we wished to keep separate Industrial chemicals (SIC 281). We added to it only Plastic materials and resins (SIC 282); the correlation between the two was .770. To Miscellaneous chemical products (SIC's 2861, 2890) we added Fertilizers and pesticides (both comprising SIC 287). The remainder of SIC 282 was put into one sector; Synthetic rubber, Cellulosic fibers, and Non-cellulosic fibers. The remaining three sectors (72-74) broke quite nicely into two sectors, Paints (SIC 285) in one sector; and Drugs (SIC 283) and Cleaning toilet products (SIC 284) into another.

Rubber and Plastic Products

Tires and inner tubes (SIC 301) and Rubber products (SIC 302, 303, 306) have been aggregated since they show similar cyclical behavior (as well as a reasonably high quarter-to-quarter correlation of .443). Miscellaneous plastic products (SIC 307) showed rather different behavior as might be expected from a less unionized structure.

Primary Metals

Steel, Copper, and Aluminum were not aggregated to maintain flexibility in future simulation work. The remaining non-ferrous metals smelting, rolling, drawing, and forging activities were combined into a single sector.

Machinery, except Electrical

The high intercorrelation in the 16 INFORUM sectors in Non-electrical machinery makes aggregation difficult. Compters and other office machinery (SIC 357) showed up clearly in the principal components table and thus comprises one industry. Engines and Turbines (SIC 351) had the only positive coefficient on the unemployment rate in the relative wage equations and is left intact. Farm machinery (SIC 352) is given its own sector since it may show different fluctuations in output as compared to other industries in the group. SIC 353 is treated as a whole, combining INFORUM sectors Construction, mine, and oilfield machinery, and Materials handling machinery. The machine tools sectors (115-117 in SIC 354) are put into one sector.

The remaining INFORUM sectors (SIC's 355, 356, 358) are put into Other machinery. The similar regression coefficients obtained for these sectors in relative wage equations indicated that there is no serious problem in following this aggregation.

Electrical Machinery

No neat aggregation scheme emerges from the correlation and regression studies for this machinery group either. SIC's 361 and 362, Electrical transmission equipment and Electrical industrial apparatus, were put together with the exception of INFORUM sector Industrial controls (3622) whose correlation showed it much more similar to Electrical components. SIC 3699, X-ray, electrical equipment, nec. was also put in with the SIC 361-362 group. The correlation matrix showed Household appliances (SIC 363) to stand apart from Electrical lighting and wiring equipment (SIC 364) and Radio and TV receiving (SIC 365). There is no separate four-digit data for Phonograph records (SIC 3652). Communication equipment (SIC 366) is a large sector and we left it intact. Electronic components (SIC 367) is also considered alone except for the addition of Industrial controls. The remaining industries in SIC 369, Batteries and Engine electrical equipment are put together.

Transportation Equipment (except Auto)

We have left five sectors in this group since employment fluctuations may arise quite independently. Complete guided missiles is taken out of ordnance and put into a more logical group, Aircraft. Cycles, transportation equipment, nec. SIC (375, 3799) and Trailer coaches are aggregated since there is no separate E&E data.

Instruments

Engineering and scientific instruments (SIC 381) and Mechanical measuring devices (SIC 382) are combined; their quarter-to-quarter correlation is .474 and they have similar trend coefficients. Watches and clocks (SIC 387) is a small sector but there is no logical home for it; the highest correlation with any other sector was only .255.

Optical and opthalmic goods (SIC 383), Medical and Surgical instruments (SIC 384) and Photograph instruments (SIC 386) are difficult to group. The first two have similar trend coefficients but the last two are more correlated in the short-run. We pulled out Photographic equipment since its absolute wage is significantly higher than the other two.

In the other two-digit groups we have not mentioned — Furniture, Petroleum, Leather, and Miscellaneous Manufacturing — the INFORUM sectors have been aggregated to the two-digit level. In nonmanufacturing this has been done was well, except in Metal mining. The behavior of Iron ores vs. Copper and Other nonferrous ores mining was quite divergent and so Iron ores was left on its own.

One more familiar with the structure of labor markets and bargaining patterns in manufacturing may wish to quarrel with the aggregation chosen here. I felt, however, that this scheme should provide substantial flexibility in a highly disaggregated input-output model and may provide some insights that two-digit data may not afford.

APPENDIX V-C

Industry Wage Change Equations Tested

As we discussed in Section 5.1, the initial goal of our work on wage determination was to develop a set of detailed industry equations to explain absolute rates of change of hourly earnings indexes. We also presented in Section 5.2 some general reasons as to why this effort was not successful. In spite of the fact that this work does not show up in the current model, it still seems worthwhile to describe briefly some of the industry specifications tested and their empirical results. This report may be an aid to future research which may attempt to disaggregate below what is presently in the price-wage model.

Wage Definition

The wage variable used here (w_j) was nearly identical to that later used for the relative wage equations in Section 5.3. However, no adjustments were made for fringe benefits or social security taxes; BLS gross hourly earnings data were aggregated to the I/O industry level and seasonally adjusted with the Census X-11 program. After quarterizing, the resulting series were then aggregated once more to the 100-sector level used in the relative wage equations. All data began in 1958:1 and ended in 1974:2.

Initial Specification

Although a variety of alternative specifications were run, I have selected only several to report upon in any detail. Some specifications were not run for the entire 99 sectors;[1] and for these, we comment only on the general findings.

Industry specification one (Is1) was the following:[2]

$$(\text{Is1})\ \underline{\Delta}\, w_j = a_o + a_1 \frac{1}{\Sigma\lambda} \sum_{i=o}^{11} \lambda^i \underline{\Delta}\, P_{t-i-1}$$

$$+ a_2\ 1/\text{UNEM20} + a_3\ (\text{UNEM20} - \text{UNEM20}_{t-1})$$

$$+ a_4\ \text{GUIDE} + a_5\ \text{FREEZE} + a_6\ (w_j/w^*)_{-1}$$

$$+ a_7\ \text{PRODEV}_j + a_8\ \frac{\text{EMP}_{j\ t-1} - \text{EMP}_{j\ t-5}}{\text{EMP}_{j\ t-5}}\ .\ 1/\text{UNEM20}$$

where

$\underline{\Delta}$ = denote "quarterly percentage change in"

P = Implicit Personal Consumption Deflator

UNEM20 = Unemployment rate for men aged 20 and older

GUIDE = Kennedy-Johnson Guidelines dummy

FREEZE = dummy for 1971:4 - 1972:2 wage freeze and release

$(w_j/w^*)_{-1}$ = four-quarter average of the industry wage divided by a fixed-weight index of wages for the 99-sectors: lagged one quarter,

PRODEV_j = output per constant-hours employee in industry j divided by a twelve-quarter moving average of output per manhour,

EMP_j = constant-hours employment in industry j.

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[1]For Sector 1, Agriculture, there is the BLS hourly earnings data; thus regressions were run for only 99 out of the 100 sectors.

[2]The specifications also included strike dummies for in which strikes could be documented from BLS tabulations of work stoppages.

From our previous discussion, all variables except the last two require no further explanation here. There are two possible reasons to expect the productivity deviation to play a role in the equation. First, it may serve as a proxy for profits which long have been advanced as a determinant of wages, especially in industries with collective bargaining. Second, it may serve as an additional indicator (i.e. with the unemployment rate) of excess demand for labor within firms as argued by Vanderkamp.[3]

The employment change was entered to be consistent with the straightforward proposition that the supply curve of labor to particular industries may be upward sloping. It is entered in multiplicative form with the reciprocal unemployment rate to capture the idea that a given percentage change in employment will lead to relative higher wage increases when the overall labor market is tight.

Equation (Is1) was estimated from 1959:1 through 1972:2 by ordinary least squares. The value of λ for defining the geometric lag on the price variable was found by searching for the maximum fit. The search used intervals of .1 for λ, starting with a.9 and decrementing.

Empirical Results

The lagged relative wage was the only variable whose coefficients matched our preconceived notions. In all but two sectors, its sign was negative; and it was statistically significant (at the ten percent level) in all but ten regressions. However, as we noted at the beginning of

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[3]John Vanderkamp, "Wage Adjustment, Productivity, and Price Change Expectations," Review of Economic Studies, Vol. XXXIX, No. 117 (January 1972), pp. 62.

this chapter, one cannot be sure that this result is picking a true behavioral "catch-up" phenonenon or simply the fact that there are discontinuities in the sequence of wage adjustments.

The price variable was the next post powerful variable in the equation but in only about two-thirds of the industries did its coefficient fall into the 0.0 to 1.0 range. In twenty industries its coefficient was negative. The performance of the unemployment level and is first differences were about the same. In only about a fourth of the industries did we find the level a variable with a statistically significant positive value. The signs on the guidelines dummy were predoninantly negative but few were significant at the five percent level.

The two industry-specific variables produced disappointing results. The productivity deviation variable was singificantly positive in only about a doezen industries. There were equally as many sectors with significantly negative coefficients. Perhaps some of this problem is a result of the particular construction of this variable. We used the standard INFORUM annual gross output series to calculate productivity and then interpolated to obtain quarterly series. A series using, say, the FRB production indexes (where they did not themselves use manhours as extrapolators) might have provided better results.

Finally, the employment change variable showed no inclination to behave in accordance with the simple noeoclassical theory. In a large number of sectors it entered with a statistically signifícent negative' sign. For these sectors we can surmise that were substantial employment. The new workers hired at lower wages decrease the overall earnings level; this fact can explain the negative coefficients observed in the regressions.

Revised Specifications

Subsequent computations with (Is1) revealed that in a large number of industries there was an extremely high correlation between the relative wage and the price variable. The basic problem is that manufacturing as a whole fell behind in the overall wage structure as labor markets tightened in the late sixties. Thus, for most of the seventy manufacturing sectors, the deterioration in this wage relative to an economy-wide wage index is closely related to the long distributed lag one changes in the personal consumption deflator. As a result, for a revised specification (Is2) I replaced w* by w^{man}, where w^{man} is a fixed weight index of manufacturing wages only. In addition, the non-productive productivity variable was dropped and the employment change term simplified. Thus, the revised equation became:

$$\text{(Is2)} \quad \underline{\Delta} w_j = a_o + a_1 \frac{1}{\Sigma\lambda} \sum_{i=o}^{11} \lambda^i \underline{\Delta} P_{t-i-1}$$

$$+ a_2\, 1/\text{UNEM20} + a_3\, \Delta\ \text{UNEM20}$$

$$+ a_4\, \text{GUIDE} + a_5\, \text{FREEZE}$$

$$+ a_6\, w_j/w^{man} + a_7\, (\Delta\ \text{EMP}/\text{EMP})_{-1}$$

Where the variables definations are the same as that for (Is1) and

w^{man} = fixed-weight index of manufacturing wages

EMP = four-quarter change in constant-hours employment

Instead of presenting the results in full detail, some qualitative feel for them may be gained by referring to Table V-9. One can see from

TABLE V-9

Coefficient Distribution for Industry Wage Equation (Is2)

Variable		(Is2)	(Is2)*
		Number of Industries	
PCD	$0 < a_1 < 1.0$	36	42
	$a_1 > 1.0$	48	46
	$a_1 < 0$	15	11
1/UNEM20	$a_2 > 0$	70	75
	(Number significant at 10% level)	(37)	(38)
	$a_2 \leq 0$	29	24
ΔUNEM20	$a_3 < 0$	76	79
	(Number significant at 10% level	(36)	(38)
	$a_3 \geq 0$	23	20
w_j/w^{man}	$a_6 \leq 0$	91	92
	$a_6 \geq 0$	8	7
EMP_j/Emp_j	$a_7 \geq 00$	21	25
	(Number significant at 10% level)	(7)	(6)
	$a_7 < 0$	78	74
λ	$\geq .80$	64	62
	$< .80$	35	37

*Estimated through 1974:2

the first panel that the price coefficients are consistent with those obtained in the aggregate equations. In the single aggregate equation the largest price coefficient was obtained for the PCE deflator with sample period 1958:1 - 1971:2. The sample period here was similar, 1959:1 - 1972:2, and we found that more sectors had price coefficients exceeding 1.0 than those with coefficients in the 0.0 to 1.0 range.

Although both labor market variables generally showed up with the correct sign, fully one-quarter of the sectors had either one of the other unemployment coefficients with an incorrect sign. Again the relative wage term was very powerful, with only eight sectors in the 1959:1 - 1972:2 sample period regressions displaying positive coefficients. The employment change variable continued to pick up what are probably employment mix effects on the "average" industry earnings index.

The second column in Table V-9 shows the coefficient distribution after the sample period had been extended to 1974:2. On the face of it, it appears that the results are reasonably stable, but there were a significant number of individual industries wehere sizable changes in coefficients took place. For example, the price coefficient for sector 31, Newspapers and periodicals, dropped from 1.418 to .762 (offset by change in a_o by .02 and change from -.993 to -.489 on the relative wage variable). Some other industries where price coefficeints were particularly unstable are: 50, Aluminum, (.272 to .863); 54, Stampings, cutlery, and hardware, (1.194 to .806); 60, Computers and other office machinery (.906 to .350); 74, Engineering instruments, (.322 to .793); and 83, Air transportation (1.841 to 1.010). This is by no means an exhaustive list, but it should give the reader an indication of the difficulty in finding stable wage functions for industries at this fine level of disaggregation.

In spite of the substantial variance in the coefficients (across industries) for a particular variable, I am reasonally sure that this set of coefficients for (Is2) in predicting the aggregate wage level, would have perfomred as well (or as poorly) as aggregate equations estimated from the same data. The weighted average of the coefficients (weights were 1967 payrolls, the same used to construct the aggregate earnings index) across industries compared quite favorably to the coefficients from a single aggregate equation (estimated 1959:1 to 1972:2).[4] For instance, the average price coefficient was .998 as compared to the aggregate equations's price coefficient of 1.053. However, as we stressed at the outset of the chapter, the coefficient matrix from (Is2) would have undoubtedly led to unreliable predictions of the wage structure.

Other Specifications Tested

Several other specifications were tested on the full data set. One of these tried a survey measure of price expectations constructed by George deMenil from the Michigan Survey of Consumer Finances.[5]

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[4]The aggregate equation referred to here should not be confused with any shown in Section 4.2. The dependent variable of this aggregate was computed with our industry gross hourly earnings indexes, and not adjusted for fringe benefit. Moreover, the specification and sample period differ from those in Section 4.2.

[5]George deMenil and Surjit Bhalla, "Direct Measurement of Popular Price Expectations," American Economic Review, (March, 1974), pp. 169-180.

To be consistent with previous researchers' specifications, this variable was entered in conjunction with a "catch-up" variable — the actual price change minus that expected four quarters earlier. The geometric lag on the actual changes in the PCD was, of course, dropped. Unfortunately, in the majority of sectors either one or the other (or both) price coefficients had a priori unreasonable values. Furthermore, in only a handful of industries were the regression fits better than for (Is2); and in many instances the fits were much worse.

In some other experiments, attempts were made to refine the relative wage variable. On the presumption that there may be a nonlinear relation between the deviation from the (sample period) "normal" relative wage and the forces tending to return to normal, the term $(w_j/w^{man})^2$ was tested in (Is2). The regression fits were about the same as for the linear version, suggesting no important nonlinearities. Negative results were also obtained when only values of (w_j/w^{man}) exceeding unity were tested.[6]

After obtaining significant effects for employment change in some preliminary relative wage equations, it seemed worthwhile to test the efficacy of the acceleration of employment in the industry wage change equations. Coefficients in the current four quarter percentage change and its lagged value were estimated freely for a sample of industries.

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[6]That is, we tried to crudely answer whether the forces retarding wage increases when these relative wage were "high," were as strong as the "catch-up" forces prevailing when the industry had an equally "low" relative wage. Of course, a positive finding here would make stronger the case for a wage-wage spiral acting independently of changes in prices.

In many industries for which I tested both the current and the lagged employment change were highly significant, with the ususal pattern being a positive coefficient on the unlagged term and a slighter higher (in absolute value) negative coefficient on the lagged term. A probable explanation of this phenonomenon is that the employment acceleration is picking up overtime premiums, while the "equilibrium" result of any change in employment is smaller wage increase since there are shifts in the intra-industry employment mix (i.e. new lower paid workers decreasing average earnings). Some additional experiments with this specification in which employment was replaced by output (interpolated to obtain quarterly values) or productivity produced negative results. In nearly all cases the employment change variables gave higher coefficients of determination. Unfortunately, although the employment acceleration produced in some cases much better fits than for the original (Is2) specification, there still remained substantial problems with price and unemployment coefficients.

CHAPTER VI

PROPRIETORS' INCOME

Our final income component we consider on an industry basis is proprietors' income. In the aggregate this item is not insignificant; in the 1972-75 period nonfarm proprietors' income averaged 64 percent of total corporate profits. In this chapter we shall develop equations with as much industry detail as feasible for both proprietors' income and the total hours worked by self-employed.

6.1 Treatment of Proprietors' Income in Previous Models

Proprietors' income includes payments both for the proprietor's labor and for his capital. This dual nature has made specification of equations for noncorporate income difficult, and several methods have emerged in econometric models. The most common assumption is that proprietors' income is some simple function of current dollar gross product originating. In the Wharton macro model, as described by Evans, the nonfarm proprietors' income equation was[1]

$$(6.1)\quad PB = 1.24 + \underset{(.0067)}{0.0607}\,(\Delta\, pX + .75\ \Delta pX_{-1} + .50\ \Delta pX_{-2} + .25\ \Delta pX_{-3})$$

$$+ .9529\ 1/4 \sum_{i=1}^{4} PB_{-i} \qquad \bar{R}^2 = .998$$

where

PB = income of unincorporated business enterprises, billions of current dollars

[1] Michael K. Evans, Macroeconomic Activity (New York: Harper and Row, 1969), p. 285.

pX = gross national product, billions of current dollars.

For the purposes of short-term quarterly forecasting, this equation may be satisfactory, but it pays no attention to the proportion of self-employed in the labor force for the longer term. In addition, the framework of a macro model limits the possibility for the distribution of output to affect total proprietors' income.

The BEA quarterly model, however, does attempt to capture the fact that most proprietors are in agriculture or services by using consumption expenditures for nondurable goods and nonhousing services to explain proprietors' income. Their equation is[2]

$$(6.2)\quad \log (PRI/PRI_{-1:4}) = \underset{(1.1)}{-.006638} + \underset{(4.6)}{1.339} (PN \cdot CN + PSNH \cdot CSNH)/$$

$$(PN \cdot CN + PSNH \cdot CSNH)_{-1} - \underset{(2.0)}{.477} \log (WR/WR_{-1:4})$$

$$\bar{R}^2 = .244,\ SEE = .00874,\ SE.N\ (PRI) = .97,\ DW = .75$$

where

PRI = Proprietors' income, billions of dollars

PN = Price index for nondurable goods consumption

CN = PCE, nondurable goods, 1958 dollars

PSNH = Price index for nonhousing services

CSNH = PCE, nonhousing services, 1958 dollars

W = Wages and salaries plus other labor income per employee in private industry.

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[2] "The BEA Quarterly Econometric Model," Bureau of Economic Analysis, Department of Commerce, Staff Paper No. 22, July 1973, pp. 77-79.

This equation reflects crudely the capital income component of self-employed income by its inclusion of the wage rate with a negative sign. In capturing some of the primary industrial origins of proprietors' income, however, the equation ignores other industries of origin of noncorporate income such as intermediate sales (e.g., miscellaneous business services), exports of farm commodities, as well as a substantial segment in wholesale and retail trade.

More relevant to our work here are models with industry aggregation. Although there is an opportunity for detailed treatment of proprietors' income, the Wharton Annual and Industry Forecasting Model considers nonfarm proprietors' income within a single equation.[3] In fact, the equation also explains personal rental income and net interest:

$$(6.3)\quad OINC = 6.6621 + .5372\,(CD/100.0) * (INOG + ON40 + ON41 + IN44 + IN55) - CWC - CCAC$$

$$\bar{R}^2 = .9980, \quad S.E. = .9520, \quad DW = .5855$$

where

OINC = Net interest, rent, and nonfarm proprietor income

CD = Sector deflator—commercial

INOG = Output—contract construction

IN40 = Output—wholesale and retail

IN41 = Output—finance and insurance

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[3]Ross S. Preston, The Wharton Annual and Industry Forecasting Model (Philadelphia: Economics Research Unit, University of Pennsylvania, 1972), pp. 98.

IN44 = Output--total services

IN55 = Output--rest of the world

CWC = Compensation of employees--commercial

CCAC = Capital consumption allowances--commercial

At the obvious cost of industrial disaggregation, this equation can pinpoint those sectors where the self-employed make up a significant portion of total employment. Note that this equation implicitly treats proprietors' income as "residual" income, as some share of value added after subtracting wages and other nonfactor payments.

The CANDIDE model completely eliminates proprietor income by splitting it on an a priori basis into nonwage and wage components.[4] I could not discover how this split was made; presumably wage income was imputed to proprietors at the wage rate of employees in the industry. Such a procedure makes it imperative to statistically estimate corporate profits from a residual category containing (among other items in CANDIDE) nonwage income of unincorporated business. Although such a treatment facilitates analysis of factor shares, it also has the disadvantage of blurring the appropriate tax bases for corporate and personal income taxes.

An opposite approach to that of the share equation in the Wharton

[4]A. E. L. Waslander, CANDIDE Model 1.0: Sector Incomes and Government Revenues, CANDIDE Project Paper No. 16, Economic Council of Canada, for the Interdepartmental Committee (Ottawa: Information Canada, 1974), pp. 17.

model was taken by O'Connor in his input-output income model.[5] He simply ran logarithmic time trends of the ratio of average income (per self-employed worker) to the corresponding wage rate for major industry groups. A second set of equations projected the number of self-employed by simple trend extrapolation. Thus, total proprietors' income was determined by time and the wage rates of employees.

6.2 Proprietors' Income in the Integrated INFORUM Model

The approaches discussed above have looked at proprietors' income as either profit-type income or wage income or have made some arbitrary split between the two. We have chosen here to allow both a stable wage component and a cyclical profit component to pay a role in our equation.

We begin by postulating a general specification for noncorporate business income in sector i, $PROPIN_i$, as

$$(6.4)\quad PROPIN_i = a(MHP_i \cdot WR_i) - s[RESID_i - aMHP_i \cdot WR_i)]$$

where

$PROPIN_i$ = Unincorporated business income (including the inventory valuation adjustment)

MHP_i = Hours worked by self-employed in industry i

WR_i = Compensation per manhour of employees in industry i

$RESID_i$ = Value added – wage bill – CCA_i – indirect business taxes + subsidies for industry i.

[5]Brian O'Connor, "An Income Side to An Input/Output Model of the United States," (Unpublished doctoral dissertation, University of Maryland, 1973), pp. 22-27.

The term (a · WR · MHP) represents that portion of proprietors' income that is explained solely with respect to a stable linear function of the wage rate. This quantity is subtracted from residual income in the industry to approximate more closely the actual capital income in the sector.

The letter "s" stands for the share of proprietors in capital income; it is not a fixed parameter, but a variable which must be, itself, modeled. Ideally, it would be related to the fraction of capital owned by proprietors. Since no data are available on this fraction, two alternative assumptions were tested. One made s proportional to the ratio of self-employed to total employment and the second added to this form a logarithmic time trend. The specifications tested were thus:

$$(6.5) \quad PROPIN_i = a(MHP_i - WR_i) - b\left(\frac{MHP_i}{MHP_i + MHE_i}\right) \cdot [RESID_i - a(MHP_i \cdot WR_i)]$$

and

$$(6.6) \quad PROPIN_i = a(MHP_i \cdot WR_i) - b\left(\frac{MHP_i}{MHP_i + MHE_i}\right) e^{ct} \cdot [RESID_i - a(MHP_i \cdot WR_i)]$$

where

MHE_i = Manhours of employees in industry i and the other variables have been defined in (6.4.)

Because these equations involve both a, b, and a · b, they are not amenable to ordinary least squares estimation. A nonlinear least squares program was used with limits imposed on each of the coefficients.[6]

Ideally we would have desired equations for each of the basic 50 sectors in the income model. However, there are a number of two-digit industries, especially in manufacturing, where the number of self-employed is very small (or nonexistent). For these sectors the series on noncorporate income were generally very erratic, for the incorporation or bankruptcy of a few partnerships or sole proprietorships may cause sharp breaks in the data. Accordingly, the number of sectors was reduced to 23, with the most detail being retained in the service and trade sectors.

The data for the income components is taken from the GPO file supplied by BEA. The manhours data are derived from NIA Tables 6.10 and 6.11 in the July issue (beginning with the 1976 issue) of the Survey of Current Business and unpublished data provided by BEA.

Table 6.10 contains estimates of total hours worked by employees at two-digit SIC industry detail. The number of manhours worked by both employees and self-employed are given in Table 6.12 for 14 broad industry divisions. Hours worked by the self-employed are obtained by BEA using special survey data collected by the Bureau of Labor Statistics. To obtain an estimate of manhours worked by self-employed at lower levels of aggregation, we have used unpublished data on the number of self-employed by two-digit industry made available by BEA. These data were used to prorate to the two-digit level the hours

[6]The Mardquardt nonlinear least squares algorithm was employed.

worked by self-employed for each of the 14 broad industry groups (that is, subtracting the hours in Table 6.10 from those in Table 6.11). This is equivalent to assuming that the same length of workweek for self-employed for each of the detailed industries within a broad industry group. After the manhour estimates were made for each of the 50 sectors in the basic income model, we aggregated this data to 23 sectors for the proprietors' income analysis.

Table VI-1 shows that explaining proprietors' income as a function of the wage rate alone is clearly inferior to the share approach or some combination of share and wage rate. In every sector in which a reasonable regression could be obtained, the share coefficient, b, is statistically significant.

The pattern of coefficients among different industries does not lend itself to easy interpretation. One problem in explaining the results is probably due to the heterogenous mixture of activities within the available disaggregated data. For instance, Local and Suburban and Highway Passenger Transportation includes taxicab drivers showing up in noncorporate business along with corporate intercity bus lines. Amusements and Recreation Services includes a myriad of activities by small businesses, but also the corporate profits of the movie industry. What is surprising about this latter sector is that a constrained solution on the share explained 45 percent of the variance of the very erratic noncorporate component. For several sectors in which we might suppose corporate and noncorporate business to be engaged in similar activity--Construction (4) and Trucking (9)-- both wage and

TABLE VI-1

Proprietors' Income Equations

	Sector	1972 Income	Wage (a)	Share (b)	Time (c)	R^2	S.E.
1	Farms	20013.0	.330 (.8)	1.455 (63.1)	-.0042 (3.6)	.989	475.1
2	Agricultural Services, Forestry & Fisheries	754.0		1.924 (51.4)		.977	22.2
3	Mining	137.0	exogenous	(share)			
4	Construction	6999.0	.618 (12.8)	2.587 (9.5)		.980	189.6
5	Lumber and Wood Products	619.0	.844 (7.5)	1.111 (1.6)		.696	58.0
6	Nonelectrical Machinery	494.0	.390 (3.7)	1.436 (3.7)	.008 (1.4)	.552	44.6
7	Other Manufacturing	809.0	exogenous	(share)			
8	Local, Suburgan, & Highway Passenger	181.0	.203 (.8)	4.423 (5.2)	-.030 (3.8)	.455	22.2
9	Trucking	1233.0	.533 (2.2)	3.059 (5.5)	-.0268 (1.0)	.910	73.7
10	Other Transportation	100.0	.227 (3.1)	3.329 (4.9)		.524	18.4
11	Electric, Gas, and Sanitary Service	348.0	.664 (1.4)	.905 (1.6)	.030 (1.8)	.847	42.5
12	Wholesale Trade	3802.0		4.574 (6.0)		.556	415.6
13	Retail Trade	10230.4	.483 (14.4)	2.053 (21.9)		.857	363.4

TABLE VI-1 (Continued)

	Sector	1972 Income	Wage (a)	Share (b)	Time (c)	R^2	S.E.
14	Banking and Credit Agencies	777.0	2.246	2.474		.605	179.6
			(8.9)	(1.9)			
15	Insurance Agents & Brokers	2084.0	1.853	1.100		.956	113.7
			(26.8)	(1.7)			
16	Real Estate	2470.0	.594	2.632	-.010	.939	122.1
			(2.7)	(22.1)	(3.8)		
17	Hotels & Lodging Places	86.0	exogenous (share)				
18	Personal Services	2852.0	.353	2.728	-.0139	.994	42.1
			(3.9)	(51.8)	(4.2)		
19	Miscellaneous Business Services	10612.0	1.669	2.358		.996	182.7
			(17.6)	(5.0)			
20	Auto Repair	983.0	.148	2.521	-.007	.995	15.8
			(1.30)	(44.18)	(2.0)		
21	Amusements and Recreational Services	258.0		5.000	-.0133	.456	45.7
				(14.58)	(1.5)		
22	Medical and Health Services	10392.0	3.025	4.830		.997	169.1
			(50.3)	(37.7)			
23	Education Services	220.0	(no corporate income)				

share elements show up, with wage rate coefficients both in the range .5 - .7.

The pattern of results unfortunately show that the coefficients cannot be taken literally to sort out the wage and nonwage elements of proprietors' income in a given industry. Obviously, there is an opportunity wage element in the proprietors of wholesale trade establishments in spite of the zero coefficient on the wage rate in that sector. We prefer to interpret the coefficients in terms of the relative cyclical stability of the profit income of the noncorporate versus corporate enterprises. For wholesale trade it appears that these move similarly enough for a simple share term to adequately explain the observed noncorporate income.

6.3 Self-Employed Manhours by Industry

The approach described in the previous section requires estimates for the total manhours of self-employed persons and employees for each industry. As in the O'Connor model, it seems eminently reasonable to link proprietors' income to the number of proprietors. The current INFORUM model projects an estimate of total employment for each (investment) sector which includes both categories of workers. Our job here is to explain the distribution between self-employed and employees for forecasting application.

Inspection of the time series for the 23 groups shows that explaining the number of proprietors as a ratio to total employment or output will not work well. Because of the capital requirements involved, one would not expect the number of proprietors to change rapidly with respect to output. During a downturn, a proprietorship or partnership, as posited by standard theory, would continue to exist as long as it covered average variable costs, and these costs may include some wage element to the business owners.

It seems reasonable to assume that as the ratio of average proprietor income to the wage rate rises, more proprietors will appear on the scene. Unfortunately, this relationship may reverse itself also, for as average proprietor income rises businesses may tend to incorporate for income tax advantages. Just how to identify this effect seems beyond the ability of our crude aggregate data to distinguish.

In view of these two considerations, the following model was tested for each of the 23 industry groups.

$$MHP^* = f\ (\text{Time, Output, "Relative Wage}_{-1}\text{"})^a$$

$$MHP - MHP_{-1} - \lambda\ (MHP^* - MHP_{-1}) \qquad (6.7)$$

[a]Relative wage = (Proprietor Income + IVA)/MHP ÷ Compensation per manhour for employees

The "partial adjustment" model was estimated in logarithmic form for the period 1949-1973. The lagged value of the relative wage replaced the current value to avoid a simultaneous solution problem in the forecasting model. It seems unlikely that simultaneity would be that much of a problem in view of the rigidity involved. The trend variable is retained where output seems to have negligible impact on the number of self-employed, as determined from regressions run with and without the time variable. The trend terms are probably picking up the increasing economies of scale and market power that corporate enterprises enjoy relative to proprietorships and partnerships.

The regression results for Equation (6.7) are shown in Table VI-2. The most important finding is that the long-run output elasticities are generally below one and in some cases did not show up at all. In only Other Transportation (10), and Educational Services (23), and the three manufacturing sectors, were the output elasticities near 1.0. The relative wage variable is generally weak, but we retained it at the lowest margin of significance. It appeared most strongly in the Banking and Credit Agencies, an industry which includes stock brokers. In this industry a fall in proprietor income from $1,133 million to $732 million from 1968 to 1969, and subsequently to $543 million in 1970, was associated with a drop of 32 million hours worked by self-employed between 1969 and 1970, from 78.00 to 47.15 million hours (roughly a drop of about 17,000 persons).

The lagged relative wage variable is strong also in sector 22, Medical Services. There has been a sharp drop in the hours worked by self-employed since the late 1960's. (i.e. from 834 to 699 million hours from 1968 to 1973.) Perhaps the regression is picking the phenomenon of doctors and dentists going to work in private (or public) clinics at fixed annual salaries.

In a number of sectors reasonable results could not be obtained even after experimentation with dropping selected variables. For such sectors, time trends were retained as an expedient method of exogenous specification. Two of the most important sectors that are trend projected are Contract Construction and Retail Trade. In Contract Construction negative output elasticities were obtained in all specifications tested. The number of self-employed (not manhours) fell from

TABLE VI-2

Equations for Manhours Worked by Self-Employed

Sector	1972 Manhours	Constant	Time	Output	Relative Wage	MHP_{-1}	$\bar{R}^2$	S.E.	D.W.
1. Farms	4575	8.370	-.014	.473	.084	.930	.992	211.4	2.034
			(55.5)	(1.3)	(1.3)	(5.4)			
2. Agricultural Services, Forestry, Fisheries[1]	343.0	5.802	.016				.919	14.0	2.31
			(11.2)						
3. Mining	28.0	3.496	-.038				.926	6.2	1.38
		(9.8)	(17.0)						
4. Contract Construction[1]	1440.0	7.254	.010				.763	60.3	1.73
		(17.5)	(5.7)						
5. Lumber & Wood Products	122.9	-2.724	-.019	.439		.657	.936	10.7	2.21
		(1.6)	(2.1)	(2.2)		(3.6)			
6. Nonelectrical Machinery	127.2	-3.139	-.033	.484		.499	.956	8.4	1.51
		(1.9)	(3.4)	(3.1)		(3.0)			
7. Other Manufacturing	242.9	-3.273	-.027	.461		.478	.905	16.9	2.06
		(1.0)	(2.5)	(1.9)		(2.6)			
8. Local, Suburban & Highway Passenger	70.2	.292	.004		.226	.951	.764	1.9	2.72
		(.6)	(2.3)		(3.0)	(7.6)			
9. Trucking	313.7	.067		.026		.943	.777	11.5	1.65
		(.1)		(1.2)		(9.1)			

TABLE VI-2 (Continued)

Sector	1972 Manhours	Constant	Time	Output	Relative Wage	MHP_{-1}	$\bar{R}^2$	S.E.	D.W.
10. Other Transportation	43.8	-3.540		.526		.427	.797	3.2	1.82
		(1.40)		(2.0)		(2.3)			
11. Electric, Gas, & Sanitary Services	24.1	-.367	-.002				.462	2.8	1.52
		(.5)	(1.0)						
12. Wholesale Trade	492.0	1.103		.046	.125	.735	.581	14.4	2.13
		(1.3)		(1.5)	(1.9)	(5.4)			
13. Retail Trade[2]	3760.0	8.26	-.010				.537	168.3	2.78
		(82.3)	(2.6)						
14. Banking	42.7	1.106	-.014		.360	.613	.733	5.6	2.07
		(2.3)	(4.1)		(3.9)	(5.0)			
15. Insurance	160.7	1.195			.206	.668	.735	11.6	1.40
		(1.6)			(1.3)	(4.1)			
16. Real Estate	335.6	1.287		.047	-.067	.692	.670	17.7	1.26
		(1.2)		(1.2)	(1.2)	(3.9)			
17. Hotels, and Other Lodging Places	534.5	2.306	.013		.102	.671	.886	24.3	1.05
		(2.3)	(2.8)		(2.3)	(4.3)			
18. Personal Services	1317.2	.959		.382		.348	.930	32.9	1.81
		(2.4)		(5.0)		(2.8)			
19. Misc. Business Services	1056.9	.615		.339		.364	.988	21.7	2.50
		(2.8)		(5.0)		(2.7)			

TABLE VI-2 (Continued)

Sector	1972 Manhours	Constant	Time	Output	Relative Wage	MHP -1	$\bar{R}^2$	S.E.	D.W.
20. Auto Repair	352.3	1.764 (3.1)		.152 (3.9)		.433 (2.8)	.885	12.6	2.15
21. Amusement and Recreational Services[1]	198.2	4.981 (67.1)	.014 (1.9)		-.281 (3.1)		.854	16.2	2.75
22. Medical Services	704.6	.935 (1.3)	-.001 (.6)		.196 (3.7)	.818 (7.6)	.884	18.9	1.46
23. Educational Services	266.1	-1.776 (3.0)		.365 (3.0)		.645 (5.0)	.976	11.1	2.65

[1]Estimation begins in 1960

[2]Estimation begins in 1966

a high of 1,004,000 in 1950—near the peak of post-war construction boom—to 686,000 in 1960. It then rose gradually in 1973. The current equation uses a sample period beginning in 1960 with time as the sole independent variable.

The same problem of a negative output elasticity was obtained for Retail Trade. There was a rather substantial drop in the number of self-employed in the early part of the 1960's (from 2.015 to 1.563 million from 1960 to 1966), but that trend slowed substantially thereafter. Our trend equation for manhours uses a sample period beginning in 1966 in recognition of this structural change.

Summary

Our approach to forecasting proprietors' income in sections 6.2 and 6.3 should be an improvement over previous work. We find that in about half of the sectors chosen, the hours worked by proprietors responds in the long run to changes in output. The results for the remaining sectors indicate little response within the relevant range of alternative growth paths. The result here would call for a re-examination of combining both salaried and self-employed workers in the INFORUM employment equations. Given the number of self-employed, the results in 6.2 indicate that for most sectors proprietors' income can be explained by some share of total profit-type income, the share being a simple function of the ratio of self-employed manhours to total manhours. The degree of industry detail should be advantageous for forecasting economy-wide proprietors' income under different distributions of final demand.

Chapter VII

TAXES, TRANSFERS AND OTHER AGGREGATE FUNCTIONS

The previous chapters have been concerned with developing income distributions by industry in terms of U.S. National Accounts conventions. We now turn to the derivation of disposable personal income--via the government tax and transfer functions--which will close the model with respect to personal consumption.

The present chapter is divided into five parts which approximately follow the flow from national income to personal income and finally to disposable personal income. Section 7.1 fills in the miscellaneous income items of interest and rental income which were not considered at an industry basis. In section 7.2 corporate inventory valuation adjustment, tax, and dividend functions are estimated. Section 7.3 deals with both the employer and employee taxes for the various social insurance programs in the U.S. Personal taxes are treated next in section 7.4. And finally, sector 7.5 outlines our methodology for projecting social security and other transfer payments to individuals. Chart VII-1 will aid the reader in seeing how these aggregate functions complement the previous work with industry detail. The chapter and section (if appropriate) for which each income flow item is discussed is listed to the left of each box in the chart.

These aggregate equations were estimated with annual data from 1955 through 1973 unless otherwise noted. Where alternative specifications were equally plausible, the final form was chosen on the basis of in-sample fit and a post-regression simulation from 1971-1973.

Chart VII-1

Relationship of Major Income Flows and Guide to Text Discussion*

Chapter	Sign	Item	Label
		Gov. GNP	exog.
Ch. 2 & 3	+	Private GPO	endog.
		(Gov. GNP + Private GPO) = GNP - Statistical discrepancy	
Ch. 4	+	CCA, IRS based	endog., ind.
	+	CCA adjustment	exog., agg.
	=	Net National Product - statistical descrepancy	
Ch. 7	-	Indirect business taxes	endog., ind.
Ch. 9	-	Business transfers	endog., agg.
	+	Subsidies less current surplus of government enterprises	exog., ind.
	=	National Income	
Ch. 7.1	-	Net Interest	endog.**, agg.
Ch. 7.1	-	Rental income	endog.**, agg
Ch. 7.5	-	Labor compensation	endog., ind.
Ch. 6	-	Proprietor income + IVA	endog., ind.
	=	Corporate profits + IVA	endog., agg.
Ch. 7.2	-	Corporate IVA	endog., agg.
Ch. 7.2	-	Corporate profits tax	endog., agg.
Ch. 7.2	↓	Dividends	endog., agg.

Chapter	Sign	Item	Label
	=	National Income	
	-	Corporate profits + IVA	
Ch. 7.3	-	Contributions for social insurance	endog., agg.
Ch. 7.5	+	Government transfer payments	exog., agg.
Ch. 7.1	+	Net interest paid by government	endog.
Ch. 7.1	+	Monetary interest paid by consumers	endog.
	=	Personal income	
Ch. 7.4	-	Personal taxes and non-taxes	endog.
	=	Disposable Personal Income	

*The abbreviated labels appending the boxes of the table are exog. (exogenous), endog. (endogenous), ind. (contains industry detail), and agg. (aggregate only).

**Although an equation has been estimated for this item, its value is currently exogenous in the model.

7.1 Interest Income, Rental Income and Business Transfers

Net Interest

The net interest component of national income is intended to measure total interest payments by business to persons for the use of capital. Net interest comprises both monetary and imputed flows; the largest flow is imputed interest paid by commercial banks.

Because net interest is constructed from a variety of data sources and includes a number of imputations, it is difficult to specify a simple behavioral function to explain it. No standard treatment for net interest has evolved in the various econometric models. For example; in the BEA quarterly model it is specified exogenously; in the Wharton industry model it is estimated along with rental income of persons and proprietors' income; and in an early version of the FRB-MIT-PENN model it was not explicitly considered since corporate profits were not determined residually by the product-income identity. O'Connor focused particularly on mortgage interest payments of the housing sector as a large part of net interest and regressed the ratio of net interest/GNP to the stock of housing.[1]

The beginning of a thorough treatment of net interest would be to explain separately the monetary and imputed portions of the total. Without wishing to devote undue resources to specifying carefully this rather smoothly behaving income component, that approach has not been

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[1]Brian O'Connor, "An Income Side to an Input-Output Model of the United States," (unpublished Ph.D. dissertation, University of Maryland, 1973), pp. 72-73.

started here and a more empirical aggregate approach is used instead.

Our approach begins by developing an historical series of business debt (including the mortgage debt of the owner-occupied housing industry) from national accounts sources.[2] From Table 8.1 of the national accounts we cumulate from 1929 forward the quantity, gross investment-gross savings, for the business sector.[3] We call this magnitude BD. The increases in the debt are financed by mortgages and issues of bonds and stock. Mortgages and bond issue are predominant and, for the present, I have ignored the new issues of common stock. The national accounts entity, net interest (NI), is assumed for our purposes to have an elasticity of unity with respect to BD. Thus our specification to be estimated is of the following general form:

$$\text{(7.1a)} \qquad \log (NI/BD) = f(r, r_{t-1}, r_{t-2}, \ldots r_{t-n})$$

where r is the "effective" interest rate.

The major difficulty in estimating (7.1a) is specifying the appropriate lag structure on the interest rates. If increments to the debt were never refinanced, then we should simply weight year t's interest rate with that year's increment to BD (i.e., $NI_t = \sum_{i=0}^{\infty} r_{t-i} BD_{t-i}$). Since the debt is refinanced, however, we expect recent interest rates to be weighted more heavily than ones, say, ten years earlier. At the same time we expect NI/BD to rise in periods

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[2]This series will differ conceptually from other published data on business (or corporate debt, since the banking sector is included in our series.

[3]For 1929 we assumed the existing debt to be 100 billion dollars. This figure is approximately equal to net interest in 1929 dividend by .04.

where recent large additions to the debt were incurred with high interest rates. As a means of crudely capturing both these effects a variable-weight distributed lag model has been estimated. We assume that the weight on the interest rate r_{t-i} is a linear function of the (proportional) increment to BD that was incurred while r_{t-i} prevailed Thus our final estimating equation is:

$$(7.1) \qquad \log NI/BD_{-i} = \sum_{i=0}^{5} a_i r_{t-i} + \sum_{i=1}^{5} b_i (S_{t-i} r_{t-i}), \ \Sigma b_i = 0.0$$

where $S_{t-i} = (BD_{t-i} - BD_{t-i-1})/BD_{t-i}$

and r_{t-i} = corporate AAA bond rate

The AAA bond rate is assumed to represent the variety of (generally long term) interest rates that underly both monetary and imputed portions of the net interest magnitude. The five-year lag was decided on the fit of trial regressions which used ordinary fixed weight distributed lags. In the final specification, first degree polynomial lags were used on both lags. The sum of weights on the second distributed lag has been constrained to zero. Thus, the long-run response of a one percentage point change in the bond rate is given by Σa_i.

The one period lag on BD in the denominator of the dependent variable is used to circumvent a simultaneous equation problem in the full model. That is, BD, can be computed as the difference between current dollar gross investment and the sum of CCA plus undistributed corporate profits. However, to obtain undistributed corporate profits, we of course need total corporate profits, which has net interest as a determinant. Thus, to maintain a recursive scheme we require that the debt related to net interest payments in the current year be the debt existing at the beginning of the year. In (7.1) we have allowed the current year's interest rate to effect current net interest, on the grounds that a certain portion of the debt is continuously refinanced. The numerical estimates for (7.1) are given in Table VII-1. The sum of weights on r (a_i) is very close to one. This result gives us some confidence that our constructed BD variable is a reasonable debt base for explaining net interest. The ratio of NI/BD_{-1} rises from .023 in 1955 to .088 in 1975, which is consistent with the rise in long term bond rates over this period.

The t-values indicate that both distributed lags are important in the regression. A regression employing only a standard fixed weight lag on r has an R^2 of .9169 as compared to the .9654 fit of (7.1). (The sum of the weights was again near one, however.) The fixed and variable lag specification may also be compared on the basis of post-sample predictions for 1974 and 1975. Equation (7.1) has a root mean squared error (RMSE) of .035 while the fixed weight version's RMSE is .089. The fixed weight version misses completely the <u>combination</u> of extraordinarily high interest rates (in 1974 and 1975) and business sector deficits (in 1973 and 1974) which increased the NI/BD_{-1} ratio from .075 in 1973 to .087 and .088 in 1974 and 1975, respectively.

<u>Government Interest</u>

Net interest paid by federal and state governments (GOVINT) is not part of national income but is an element in personal income. The equation estimated uses the three-month treasury bill rate (BILRAT) as

Table VII-1
Equations for Interest Income, Rental Income
and Business Transfers

Net Interest

(7.1) $\log (NI/BD_{-1}) = \sum_{i=0}^{5} a_i \; r_{t-i} + \sum_{i=1}^{5} b_i \; S_i \; r_{t-i}$

lqg distributions:

i	a	b
0	.128 (1.5)	
1	.144 (2.9)	2.83 (4.3)
2	.159 (11.8)	1.42 (4.3)
3	.174 (7.8)	0.0
4	.190 (3.3)	-1.42 (4.3)
5	.250 (2.2)	-2.83 (4.3)
	1.000	0.0

1955-1973

R^2 = .962, S.E. = .0037, D.W. = .57

Government Interest

(7.2) log (GOVINT/PUBDEB) = .0183 + .237 RTB + .203 RTB_{-1}
(15.3) (4.1) (3.5)

1955-1973

$\bar{R}^2$ = .940, S.E. = .0019, D.W. = .70

Interest Paid by Consumers

(7.3) log CONINT = 6.485 + .863 log PCEDUR + .224 log RTB_{-1}
(9.2) (8.4) (3.3)

1955-1973

$\bar{R}^2$ = .973, S.E.(CONINT) = 78.3., D.E. = .370

Rental Income of Persons

(714) log (RENTAL/PCEH) = -.564 - .0242 Time -.0142 MORGRT
(22.1)

1960-1973

$\bar{R}^2$ = .987, S.E. (RENTAL/PCEH) = .00416, D.W. = .89

Table VII-1 (Continued)

Business Transfers

$$(7.5) \quad BUSTRN = \underset{(18.9)}{-8662} + \underset{(36.4)}{1.257} \log (PRIGPO) + \underset{(2.6)}{.0242} \; UNEM25$$

1955-1973

$\bar{R}^2 = .987$, S.E. = (1.45), D.W. = .870

Definition of Symbols

BD	business debt constructed from national income data on gross business flows (see text).
BUSTRN	business transfer payments
CONINT	interest paid by consumers
GOVINT	government interest, billions of dollars
MORGRT	mortgage interest rate
NI	net (business) interest
PCEDUR	consumption of durable goods, current dollars
PCEH	personal consumption expenditures for housing services
PURDEB	federal government debt held by the public
r	Moody's AAA bond rate
RENTAL	rental income of persons
RTB	90-day treasury bill rate
S	proportion of outstanding business debt (BD) incurred in current year (see text).
UNEM25	unemployment rate for men 25 and older
PRIGPO	GPO originating in the private sector

a proxy for the cost of debt financing, and the amount of federal debt held by the public (PUBDEB).

As for the net interest equation, the equation has been estimated to require unitary elasticity of interest payments with respect to the debt. Thus, the estimation form is

$$(7.2) \qquad \log\ (\text{GOVINT/PUBDEB}) = a + \sum_{i=0}^{1} b_i\ \text{BILRAT}_{t-i}$$

The estimation results of (7.2) are shown in Table VII-1. The constant term was highly significant under a variety of alternative specifications, as well as in (7.2), and so it has been retained in our final specification. This result is probably attributable to an underlying (unspecified) term structure relationship between the government bond yield and the short term bill rate. Without wishing to account specifically for the composition of government debt (i.e. bills, notes, and bonds) and the relationships among the relevant interest rates, the equation here should prove satisfactory for our purposes.

Interest Paid by Consumers

Interest paid by consumers exactly offsets another item in the U.S. Accounts, "Interest Received by Consumers." Since this item in its latter form is an element of personal income, we construct an equation for it to maintain comparibility of our personal income definition with the NIA and with other models. The INFORUM model cannot generate the appropriate debt base underlying these interest payments and so we have used current dollar consumption of durables as a proxy. As a proxy for the cost of credit, the current and lagged treasury bill rates were entered in a logarithmic specification. The current year's interest rate was insignificant and was dropped from the final equation. The low Durbin-Watson in Table VII-1 indicates that the final equation is probably misspecified, but the development of more appropriate debt and interest rate proxies will have to await future work.

Rental Income of Persons

The equation for rental income of persons uses total personal consumption expenditures for housing as its primary explanatory variable. This treatment is similar to that in the BEA quarterly model, except that the equation here is estimated in level form rather than first differences. In addition, the mortgage interest rate is included to reflect the varying proportion of gross space rent that is made up by interest payments. As shown in Table VII-1, the equation (7.4) is estimated by constraining the elasticity of net rent to space rent expenditures to be unity.

About half of rental income of persons in the NIA is the result of imputations arising from owner-occupied dwellings. If the published data (Table 8.3 SCB) with regard to these imputations can be taken as a guide for total rental income behavior, the falling proportion of net rent comes at the expense of rising proportions of all three of the other major items comprising space rent: namely, CCA, indirect business taxes, and interest.

A more satisfactory treatment of this item would entail a set of equations explaining each of the components of gross space rent and an equation for the price of gross rents. Net rents would then be the difference between total revenues and these various cost items. The procedure here should be adequate, however, for forecasting this rather smoothly behaved income component.

Business Transfers

Although BEA constructs estimates for business transfers by industry, we choose to treat them as a simple aggregate. The largest proportion of this item is allowances for bad debts by wholesale and retail trade. Since we may expect the bad debt allowances to be cyclical, the unemployment rate for men aged 25 and older has been entered into our equation. We find an elasticity with respect to private gross product originating to be slightly greater than unity as shown in equation (7.5) in Table VII-1.

7.2 Corporate IVA, Profits, Taxes and Dividends

Inventory Valuation Adjustment

A significant portion of raw materials and finished goods inventories withdrawn in a given period may be valued at prices prevailing in a preceding period. This method of charging inventories at original cost is due to widespread use of the FIFO (first-in, first-out) accounting convention by business. As an expenditure component of Gross National Product, the relevant investment in inventories is the physical change in inventories valued at the average price of the period. This concept comes close to replacement cost of the inventory change. Charging withdrawals at original cost also gives rise to an inventory "gain" or "loss" in the reported profits of the firm. Thus, on the income side of the national accounts the inventory valuation adjustment (IVA) is constructed to remove this element from firms' reported profits.

In the model constructed here, profit incomes for each two-digit industry are taken to be total sales minus the value of intermediate and primary inputs (including depreciation). Since all these items are valued at average prices for the year, the residual profit element conforms to the NIA concept of profit income, or more exactly to corporate profits plus IVA. However, for income tax purposes, inventory profits (IVA) is taxes as ordinary income so that we need to make an estimate for the IVA in order to arrive at a more appropriate tax base.

The exact procedure followed by BEA in making up the IVA is a complex one which this author is not qualified to outline in any detail. Required are appropriate weights for pricing raw materials, work-in-progress, and finished goods inventories, the price indexes for these items, and information regarding the percentage of inventories valued by each of the various accounting conventions accepted by the IRS. In approximating the IVA by a simple equation, we follow Lawrence Officer in his treatment of IVA for an industry model of the Canadian economy.[4] Consider an approximation for the change in current dollar inventories:

$$\Delta (P_t \cdot S_t) \simeq S_{t-1} (P_t - P_{t-1}) + P_{t-1} \cdot (S_t - S_{t-1})$$

where S = the stock of inventories in constant dollars at the end of the period;

and P = the inventories deflator.

The term $P_{t-1} \cdot (S_t - S_{t-1})$ is an approximation to the current dollar investment in inventories while $S_{t-1} \cdot (P_t - P_{t-1})$ shows the increase in the book value of inventories resulting from price increases alone. If the firm (1) based its pricing policy on the current replacement cost of inventories, (2) followed FIFO accounting, (3) and sold in the current period all of the inventories produced in the previous period, then $S_{t-1} \cdot (P_t - P_{t-1})$ would be precisely the amount of inventory profits which would be removed by the IVA.[5]

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[4] Lawrence H. Officer, Supply Relationships in the Canadian Economy, (East Lansing, Michigan: Michigan State University, 1972), pp. 40-42.

[5] If the firm prices on the basis of "historical" cost, then some or all of the inventory "profit" will accrue to the firm's buyers rather than the firm itself. Thus IVA, measured by industry refers to the source of the IVA, not necessarily its ultimate recipient.

We therefore construct a series for what Officer calls the "synthetic IVA," $[S_{t-1} \cdot (P_t - P_{t-1})]$, to be used in equations "explaining" IVA:

$$(7.6) \quad IVA_t = a + b\,[S_{t-1} \cdot (P_t - P_{t-1})]$$

Although the IVA component is available by two-digit industry, we choose at this stage to estimate only a single equation for total IVA. As mentioned earlier, the price deflator for inventories by holder is a weighted average of raw materials, work-in-progress, and finished goods. In essence, a substantial part of the BEA computations would have to be reproduced to obtain historical values of appropriate prices and inventory stocks for estimation purposes. Furthermore, the current INFORUM model treats inventories by product, not by holder. A complete behavioral model of how changes in inventories of a given product are distributed among manufacturers, wholesalers, and retailers would need to be constructed. Such a task is beyond the scope of this study, and--considering the limitations of inventory data--one not likely to be pursued in the immediate future.

In estimating (7.6), end-of-year inventory stock in constant 1972 prices is taken from Table 5.10 of the SCB (non-farm only). Several alternative price deflators were tested in this equation: (a) fixed-weight average of the consumer durables deflator, consumer nondurables deflator, and producer durable equipment (using 1972 expenditures as weights), and (b) the industrial component of the WPI. The results for (a) and (b) are shown in Table VII-2. The WPI price is substantially

Table VII-2
Corporate IVA, Taxes, and Dividends

Corporate Inventory Valuation Adjustment

eq. (7.6a) CORIVA = −.673 −.0034 IVASI
(1.7) (3.7)

Fit: 1948–1970 $\bar{R}^2$ = .361, S.E. = 1.39, D.W. = 1.619

Sim: 1971–1973 RMSE = 6.75

eq. (7.6c) CORIVA = −.622 −.0039 IVAS2
(1.9) (4.8)

Fit: 1948–1970 $\bar{R}^2$ = .496, S.E. = 1.24, D.W. = 1,856

Sim: 1971–1973 RMSE - 5.89

eq. (7.6c) (full sample) CORIVA = −.023 −.0069 IVAS2
(.05) (9.5)

Fit: 1948–1973 $\bar{R}^2$ = .780, S.E. = 1.78, D.W. = 1.999

Federal Corporate Taxes

eq. (7.7) log(CPTXFD + TAXCRD) = −4.6447 _ 1.000* log CTXR + .9901 log BTCP
(19.1) (44.5)

$\bar{R}^2$ = .991, S.E.N(CPTXFD + TAXCRD) = .878, D.W. - .964

State and Local Corporate Taxes

eq. (7.8) log (CPTXSL/BTCP) = .483 + .104 Time −.541 log $(BTCP/BTCP)_{-1}$
(.132) (6.3) (1.6)

Fit: 1964–1973 $\bar{R}^2$ = .845, S.E. = .0041, D.W. - 1.21

Dividends

eq. (7.9a) DIV = −.331 + .1045 ATCP + .864 DIV
(4.5) (20.0)

Fit: 1947–1970 $\bar{R}^2$ = .991, S.E. - .438, D.W. = 1.926

PCTREG - 2.61

Sim: 1971–1973 RMSE = .699, PCTSIM = 2.98

Table VII-2 (Continued)

eq. (7.9b) $DIV = \underset{(2.3)}{.594} + \underset{(7.5)}{.128}\ CASHFL + \underset{(5.9)}{.459}\ DIV_{-1}$

Fit: 1947-1970 $\bar{R}^2 = .996$, S.E. = .328, D.W. = 1.85,

PCTREG = 1.65

Sim: 1971-1973 RMSE = 2.41, PCTSIM = 9.51

eq. (7.9c) $DIV = \underset{(4.8)}{1.162} + \underset{(6.1)}{1.460}\ CASHFL + \underset{(3.4)}{.0850}\ CASHFL$

Fit: 1947-1970 $\bar{R}^2 = .992$, S.E. = .432, D.W. = 1.202,

PCTREG = 2.48

Sim: 1971-1973 RMSE = 3.47, PCTSIM = 12.69

eq. (7.9a) $DIV = \underset{(.7)}{-.205} + \underset{(4.6)}{.0935}\ ATCP + \underset{(20.0)}{.856}\ DIV_{-1}$

Fit: 1947-1973 $\bar{R}^2 = .992$, S.E. = .539, D.W. = 2.44

Definition of Symbols

ATCP	Corporate profits after taxes, billions of dollars
BTCP	Corporate profits before taxes, billions of dollars
CASHFL	Corporate cash flow (corporate profits after taxes plus corporate CCAO, billions of dollars
CORIVA	Inventory valuation adjustment, corporate, billions of dollars
CPTXFD	Federal corporate profits tax liability, billions of dollars
CPTXSL	State and local corporate profits tax liabilities, billions of dollars
CTXR	Corporate profits tax rate, decimal
DIV	Corporate dividend payments (including Rest of the World), billions of dollars
IVASI	Synethetic Inventory Valuation Adjustment using weighted average of GNP deflators for producer durables and consumer durables. (See text)

Table VII-2 (Continued)

IVAS2	Same as IVAS1, but using industrial component of WPI. (See text)
PCTREG	Average absolute percentage error for regression period.
PCTSIM	Average absolute percentage error for simulation period.
TAXCRD	Investment tax credit, billions of dollars

better than the weighted GNP deflator price both in terms of fit and RMSE of the three-year simulation. Neither equation can track the IVA recorded in 1972 and 1973 of -6.6 and -18.4 billion. These values are completely outside of ths historical period of fit where the largest (negative) IVA is -5.0. The simulation values for the WPI equation for these two years is -4.3 and -8.5. Naturally, the parameter values in (7.6c) change substantially when the 1971-73 data are introduced.

Federal Corporate Income Tax

Corporate income taxes are estimated on a liability basis in the national income and product accounts. The revenue elasticity with respect to base may not equal precisely 1.0, becuase of the slightly progressive nature of the corporate income tax and that fact that we are using NIA definitions of profits and tax liability, which differ slightly from those of the IRS.[6] Equation (7.7) uses corporate profits plus the investment tax credit as the dependent variable in a standard logarithmic form. The rate elasticity is constrained to unity, a priori, since infrequent changes in the tax law may make this estimate statistically unreliable (although an unconstrained version found the deviation from one to be no more than .03).

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[6]Table 8.5 in the July issue of the Survey of Current Business tabulates the major item making up the discrepancy between NIA and IRS corporate profits and tax liabilities.

State and Local Corporate Taxes

State and local corporate income tax liabilities were about fifteen percent of federal corporate income taxes in 1973. The aggregate liabilities depend on both rate changes in states having such existing tax laws and on additional states passing corporate tax laws. This fact makes taxes more difficult to forecast than federal taxes. Looking at the aggregate figures, total state and local tax collections of corporation income taxes more than tripled between 1964 and 1973, while aggregate profits did not quite double. Rate increases in several states in 1970 lead to a nearly "normal" increase in liabilities for that year in spite of the absolute fall in total corporate profits.

An elaborate treatment of state and local corporate profits taxes would possibly attempt a geographic distribution of the state and local tax liabilities incurred by each two-digit industry. This treatment would allow differential growth rates of profit among industries to affect the aggregate effective rate. Our procedure here is substantially more modest. Equation (7.8) allows the effective rate to be a linear function of time; a truncated sample period beginning in 1964 is used. There appeared to be a sharp rise in the effective tax rate in the mid-1960's and so we have chosen arbitrarily to begin the regression in 1964. To allow for progressivity in the tax structure, the change in profits is also included; it appears with the expected negative sign.

Dividends

The dividend equation used here takes the standard Lintner form in relating dividends to current profits and the lagged value of dividends. The general Lintner hypothesis is that firms maintain a desired "target" payout ratio, r, and adjust only slowly to any change in profits.[7] Thus,

$$(7.9) \quad D_t^* = \gamma P_t$$

$$\Delta D_t = \lambda(D_t^* - D_{t-1})$$

Rearranging these two equations gives the standard estimation form with a lagged dependent variable.

Darling,[8] subsequently to Lintner's original work, proposed that gross profits (i.e., including depreciation allowances) be used instead of net profits and that a change in sales variable be added to reflect the firm's demand for internal financing of new investment. The O'Connor income model incorporated the first part of the Darling proposal by estimating equations for 38 industries using gross profits and lagged dividends as explanatory variable.[9]

The present model retreats somewhat from the O'Connor approach in estimating a single equation for aggregate dividend payments. The present treatment may be justified for several reasons. First, the

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[7] J. Lintner, "Distribution of Income of Corporations Among Dividends, Retained Earnings, and Taxes," Proceeding of the American Economic Association, Vol. 46, No. 2) May 1956, pp. 97-113.

[8] P. Darling, "The Influence of Expectations and Liquidity on Dividend Policy," Journal of Political Economy, (Vol. 65, No. 3), June 1957, pp. 201-224.

[9] O'Connor, op.cit., pp. 73-76.

O'Connor model used the NIA series for industry profits and dividend payments. These series are consistent with each other as the profits data are classified on an enterprise basis. However, the present model attempts to forecast profits on the establishment classification of the GPO series. To incorporate dividend functions at the two-digit level, a reallocation of establishment profits would be required, perhaps using the BEA enterprise-establishment bridge matrix.

Secondly, specification of dividend behavior by industry would be vital only if retained earnings were to be used further in the model. At present, the INFORUM investment equations are based on a neoclassical framework and ignore financing constraints. Dividends here are considered only for their contribution to personal income. As dividends make up less than three percent of personal income (1972), forecasting them with a single equation--as opposed to separate equations at an industry level--should introduce little additional error into the personal income estimates.

Three alternative aggregate equations were tested. (7.9a) uses the basic Lintner approach of using after-tax net profits. (7.9b) replaces the net profit variable with gross cash flow. Equation (7.9c) drops the lagged dependent variable and uses the current and lagged value of the cash flow. On the basis of $\bar{R}^2$ alone, the three equations are indistinguishable. However, when the equations are used in a post-sample simulation from 1971-73, the mean absolute percentage errors (PCTSIM) for (7.9b) and (7.9c) deteriorate relative to the standard Lintner equations and, thus, (7.9b) and (7.9c) are rejected. Therefore, on the basis of the simulation fit, the results show an advantage to the net rather than gross profit variable. Equation (7.9a) has a further advantage of not requiring a split between corporate and noncorporate depreciation allowances.

7.3 Personal Taxes

Federal Individual Income Taxes

The complexity of the federal individual tax laws make any neat econometric treatment practically impossible. Although the basic rate structure has remained unchanged since 1964, taxable income base has undergone almost continual revision as nominal amounts for the personal exemptions and the standard deduction have been increased.

One of the simplest and most successful regression approaches to predicting federal personal income taxes was incorporated by the BEA quarterly model. The first step in the BEA approach is to estimate the IRS taxable income base upon which tax liabilities are assessed. This equation is a modification of the Waldorf specification, the general form of which was originally proposed by Brown and Kruizenka.[10] It is reproduced from the BEA report below:[11]

$$(7.10)\quad \log\,[1.0 - (PIT/PI + SIP - TRP)] - .35 \log\,(TPFE/N)$$

$$= \underset{(3.0)}{.0153} - \underset{(29.1)}{.4936} \log\,(PI + SIP - TRP)/N)$$

$$- \underset{(1.5)}{.0342} \log\,(SM/SM_{-1}) + \underset{(2.2)}{.00648}\, DPIT$$

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[10] William W. Waldorf, "The Responsiveness of Federal Personal Income Taxes to Income Changes," Survey of Current Business, Vol. 47, No. 12 (December 1967), pp. 32-45. The original Brown and Kruizenka article may be found in E. Cary Brown and Richard J. Kruizenka, "Income Sensitivity of a Personal Tax," Review of Economics and Statistics, (August 1959), pp. 26-269.

[11] "The BEA Quarterly Econometric Model," Bureau of Economic Analysis, Department of Commerce, Staff Paper No. 22, July 1973, pp. 84-93.

Annual 1953-1968 $\bar{R}^2 = .990$, S.E. = .0039, D.W. = 1.56

and where:

PIT = Federal personal taxable income, billions of dollars,

PI = Personal Income

SIP = Employee contributions for social insurance

TRP = Transfer payments to persons

N = Total population

DPIT = Dummy for taxable income, 1953-57 = 0.0, otherwise = 1.0.

The item to be explained in this nonstandard specification is taxable income, PIT. The dependent variable for estimation, 1 minus the proportion of taxable income to adjusted gross income (AGI) proxy, (PI + SIP - TRP) is used to fix an upper limit of unity on the ratio of taxable income to AGI proxy. The value of average exemptions per capita, rather than statutory exemption rate, is used since the proportion of persons age 65 and over has been rising.

The fundamental relationship in the equation is that the elasticity of taxable income to the AGI proxy is less than 1.0 and tends to decline as per capita (nominal) incomes increase. This is because the marginal rate of taxable income with respect to AGI is relatively constant while the ratio of taxable income to AGI declines due to fixed exemptions.

After the figure for taxable income has been obtained, personal tax liability is estimated in a rather cursory fashion as shown in (7.11) below.

(7.11) $\log TPFL - \log RTPF - \log RSCH$

$$= .0058 + \underset{(28.3)}{1.06} \log PIT$$

1965–1969 $\bar{R}^2 = .955$, S.E. = .0058, D.W. = 2.58

where

TPFL = total personal federal tax liabilities

RTPF = first bracket tax rate for Federal individual tax rates

RSCH = tax surcharge rate

PIT = federal personal taxable income

The first bracket tax rate is shown as an explanatory variable but contributes little to the equation. This is because (7.11) was actually estimated for two periods (1953-1963, 1965-1959); in each period the tax rates were unchanged. Since the tax cut enacted in early 1964 was not fully effective for the entire year, the tax function is undefined for that year.

Regression versus Tax File Simulation Approach

Joseph Pechman has compared the tax elasticities estimated with an equation similar to (7.10) with elasticities based on an analysis of the Internal Revenue Tax file.[12] This file contains the income and tax information for a random stratified sample of federal individual income tax returns. As Pechman writes "The calculations based on the tax file have

[12] Joseph Pechman, "Responsiveness of the Federal Individual Income Tax to Changes in Income," Brookings Papers on Economic Activity, 1973:2, pp. 385-428.

two advantages: first, they automatically reflect the effect of changes in the distribution of incomes when incomes change; and, second, they can take into account the effects of changes in the tax law with a relatively high degree of accuracy."[13]

Pechman takes the 1970 tax file and projects tax liabilities to 1995 under various inflation rates using both Waldorf-type equations and tax file simulations. Although the two approaches yielded quite similar results for historical data (1954-1970), the Waldorf-type equations do not capture the full effect of the progressivity of the income tax for the higher rates of nominal income growth assumed for the projection period. A table from the Pechman study comparing the two approaches is reproduced below as Table VII-3.

The higher elasticities using the tax file result in a difference of 11 percent in the tax liabilities in 1985 when 5 percent growth in adjusted personal income per capita is assumed. Both methods, of course, yield declining tax elasticities as the ratio of taxable income to adjusted personal income approaches one.

Approaches in this Model

For this study an attempt was made to explicitly model changes in the distribution of adjusted gross income in order that more general types of tax law revisions could be handled. Specifically, such a scheme could handle potential revisions in tax rates that affected income brackets *differentially*. Unfortunately, this effort did not go

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[13] *Ibid.*, p. 386.

TABLE VII-3

Individual Income Tax Elasticities from Pechman's Brookings Study

Table 3. Federal Individual Income Tax Liabilities, Built-in Flexibility, and Elasticities, Assuming 5 and 8 Percent Annual Rates of Growth of Per Capita Adjusted Personal Income, Based on the Revised Waldorf Equations and the 1970 Tax File Simulations, Selected Years, 1975–95

	5 percent annual growth rate		*8 percent annual growth rate*	
Year	*Revised Waldorf equations*	*Tax file simulations*[a]	*Revised Waldorf equations*	*Tax file simulations*[a]
	Tax liabilities (billions of dollars)			
1975	121	125	131	136
1980	181	193	237	263
1985	268	298	421	500
1990	393	458	737	937
1995	574	699	1,273	1,697
	Built-in flexibility[b]			
1975	0.167	0.176	0.170	0.183
1980	0.181	0.200	0.192	0.223
1985	0.196	0.227	0.214	0.270
1990	0.210	0.258	0.237	0.317
1995	0.225	0.289	0.261	0.350
	Elasticities[c]			
1975	1.41	1.54	1.40	1.58
1980	1.37	1.51	1.35	1.53
1985	1.34	1.49	1.31	1.50
1990	1.32	1.48	1.28	1.45
1995	1.29	1.45	1.25	1.35

Sources: Projections for the revised Waldorf equations are based on equations (3) and (6) of the appendix.
a. The tax file estimates assume no change in the relative distribution of income as income grows.
b. Built-in flexibility is the ratio of the absolute increase (decrease) in tax liabilities to the absolute increase (decrease) in adjusted personal income.
c. Elasticity is the ratio of the percentage change in tax liabilities to the percentage change in adjusted personal income.

Source: Table 3 in "Responsiveness of the Federal Individual Income Tax to Changes in Income," Joseph Pechman, Brookings Papers on Economic Activity, 1973:2

far enough; in that, although the historical fits of the IRS (cumulative) income distributions were very good, we could not assure that the method would yield declining tax elasticities for future years.

As a result, the present model makes use of the tax elasticities estimated by Pechman in the study described above. We simply extrapolate the effective tax rate (r) by the change in the adjusted gross income proxy (AGIP). Thus, if the tax elasticity for year t is r(t), then

$$(7.12) \quad r(t) \;=\; r(t-1) * [AGIP(t)/AGIP(t-1)]^{(r(t)\ -1.0)}$$

To start this process for the first year of the model (here 1973), r(t-1) is equal to the IRS personal income tax liabilities divided by adjusted gross income for 1972. The starting value for r is 1.52; this is roughly the mean of the Waldorf regression and tax file simulation elasticities that were calculated by Pechman. Elasticities for subsequent years are obtained by linearly interpolating a line whose value is 1.40 in 1985. This corresponds to the 8 percent growth case shown in Table VII-3. This table, as well as others displayed by Pechman, shows that the decline in the elasticities is not highly sensitive to alternative (reasonable) rates of growth of nominal incomes.

The elasticities estimated by Pechman incorporate the major changes in the income tax law which were made in 1971, but become fully effective in 1972. The impact on the elasticity (and effective rate) in the tax change in 1975, of course, can not be measured explicitly without redoing the Brookings analysis with the tax file. Accordingly, this change has been made by reducing liabilities by a given absolute dollar amount. We shall discuss this adjustment procedure more thoroughly in chapter X.

AGI and Tax Receipts

Several other equations are required to complete the system for the federal personal income tax. The first links the IRS definition of adjusted gross income to AGIP: personal income + employee contributions for social insurance - transfer payments. The change in the Standard & Poor's index of 500 stocks was tried as a crude proxy for capital gains and was marginally significant. The AGI elasticity with respect to its proxy measure is slightly greater than unity as shown in equation (7.13) in Table VII-4.

The NIA personal income tax item measures taxes as they are paid rather than tax liabilities. The NIA series used in deriving personal income is on a cash basis, which includes withheld and nonwithheld tax payments on current year liabilities plus net year-end settlements. The year-end settlements are, of course, the difference between overpayments and refunds on the previous year's liabilities.

The equation to link tax payments to tax liabilities is taken from the 1967 study by Waldorf.[14] The hypothesis in that study was that for nonwithheld income, taxpayers estimated their quarterly declaration for a given year on the basis of liability in the preceding year. This assumption is incorporated empirically in the following manner.

$$(7.23)\quad R_t = a_o L_t^{a_1} (L_{t-1}/L_{t-2})^{a_2}$$

where

R = NIA Federal income tax payments (less refunds)

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[14]Waldorf, op.cit., pp. 41-42.

Table VII-4
Equations for Personal Tax Payments

Adjusted Gross Income

(7.13) $\log AGI = -.408 + 1.0162 \log AGIP$
$(6.4) \quad (233.4)$

Fit: 1954-1972 $\bar{R}^2 = .9997$, S.E. = 3.08, D.W. = 1.93

Personal Income Tax Receipts

(7.14) Rev. $\log FDINTX = -7.018 + 1.0191\ PTXLIB$
$(.7) \quad (42.5)$

$+ .2163\ (PTXLIB_{t-1}/PTXLIB_{t-2}) - .0626\ DUM64$
(1.5)

Fit: 1955-1972 $\bar{R}^2 = .986$, S.E. = 2.696, D.W. = 2.336

Other Federal Personal Taxes

(7.15) $ESTATE = -.731 + .0067\ ADJPRX - .543\ DUM73$
$(3.7) \quad (19.5) \quad (1.9)$

Fit: 1956-1973 $\bar{R}^2 = .965$, S.E. = .240, D.W. = 1.01

State and Local Personal Taxes

(7.16) $SLPTAX = -21.20 + .0599\ ADJPRX$
$(8.3) \quad (18.0)$

Fit: 1967-1973 $\bar{R}^2 = .985$, S.E. = 1.070, D.W. = 1.51

Definition of variables:

AGI = IRS Adjusted Gross Income, all returns, billions of dollars

AGIP = Proxy for AGI: personal income plus employee contributions for social insurance less transfer payments, billions of dollars

FDINTX = Federal personal income tax payments, billions of dollars

PTXLIB = Federal personal income tax liabilities, billions of dollars

Table VII-4 (Continued)

DUM64	=	Dummy for change in withholding taxes: 1.0 for 1964 and later, before 1964 - 0.0.
ESTATE	=	Federal estate and gift taxes and nontaxes, billions of dollars
DUM73	=	Dummy for change in state tax law in 1973. (Payment period reduced from 15 to 9 months.)
SLPTAX	=	State and local personal taxes and nontaxes, billions of dollars
STKPRI	=	Price index for Standard and Poor's 500 stocks.

L = Statistics of Income individual income tax liabilities

a_2 is expected to be positive as a result of some inertia on the part of taxpayers making quarterly declarations. The higher the growth in this year's liabilities over last year's, the greater is the year-end settlement (i.e., resulting from underpayment) made in the subsequent year.

This equation was estimated in the logarithmic form from 1956 to 1972 and is shown in Table VII-4. The elasticity with respect to current year liabilities is within one standard deviation of unity. The significance of the lagged change in liabilities is not as great as in the earlier Waldorf study, but we retain this variable. A dummy variable is included to reflect a statutory decrease in the withholding rates in 1964 which altered the existing relation of payments to liabilities.

Summary for Federal Individual Income Tax

The entire procedure for obtaining federal personal income tax payments may now be summarized in abstract form:

(7.12) $r(t) - r\ (t-1) * AGIP(t)/AGIP(t-1)^{[r(t)-1.0]}$

(7.13 $\log AGI(t) = + \alpha_1 + \alpha_2\ AGIP^{(t)} + \alpha_3\ STKPRI$

$PTXLIB(t) = r(t) * AGI(t) \pm ADJLIB$

(7.14) $\log\ (FDINTX^*) = B_0 + B_1 \log\ (PTXLIB(t) + B_2$

$\log\ (PTXLIB(t-1(/PTXLIB(t-2)$

$FDINTX = FDINTX^* \pm ADJPAY$

where

ADJLIB = constant adjustment to income tax liabilities, billions of dollars

ADJPAY = constant adjustment to income tax payments, billions of dollars, and the other variables have been defined previously.

Other Personal Taxes

Two additional equations complete the treatment of personal tax and nontax payments. Equation (7.15) explains federal estate and gift taxes and nontaxes as a simple linear function of the adjusted gross income proxy. A dummy variable for 1971 and 1972 is included for the shortening of the payment period from fifteen to nine months for the inheritance tax and requiring of quarterly declarations for the gift tax; both changes became effective in 1971. The equation for state and local personal taxes used a truncated sample period as the marginal tax rate under state income tax laws increases substantially after 1965. It uses again the AGI proxy as the sole independent variable in a simple linear function. The results are shown in Table VII-4 as equation (7.16).

7.4 Social Insurance Taxes

The equations for social insurance taxes are straightforward. These data are taken directly from Table 3.8, "Contributions for Social Insurance," as shown in the July issues of the Survey of Current Business. For each program we have lumped together the employee and employer contributions, since the total tax is probably the more relevant economic magnitude. In forecasting application the split between the employee and employer share is made exogenously, by reference to the most recent observed ratios.

OASDHI and Railroad Retirement

The contributions under the railroad retirement system are aggregated with those of the OASDHI program in order to use simply the private wage bill as the taxable base. Railroad retirement taxes amounted to less than three percent of the total in 1972.

The specification used is nearly identical to that used in the BEA Quarterly model and is shown as equation (7.17) in Table VII-5.[15] Both the social security rate and maximum taxable earnings per employer are entered in the logarithmic form with the rate elasticity constrained to unity. A dummy variable is inserted to reflect a substantial addition in coverage effective in 1955. As expected, the elasticity with respect to the taxable base is less than 1.0 due the earnings limit.

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[15] The BEA Quarterly Econometric Model, op.cit., pp. 88-92.

Table VII-5
Social Insurance Tax Equations

OASDHI and railroad retirement

$$\text{(7.17)}\quad \log \text{OASDHI} = \underset{(28.9)}{4.067} + 1.00^{*} \log \text{SSRATE} + \underset{(10.3)}{.473} \log \text{SSMAX} + \underset{(17.6)}{.678} \log \text{PRIWBL} + \underset{(1.1)}{.017}\,\text{SSCOV}$$

Fit: 1954–1973 $\bar{R}^2 = .999$, S.E. =.479, D.W. = .77

Self-Employment tax

$$\text{(7.18)}\quad \log \text{OASELF} = -3.011 + \underset{(2.2)}{1.000} \log \text{SELFRT} + 1.021 \log \text{SSMAX}$$

$\bar{R}^2 = .948$, S.E. = .176, D.W. = 1.24

Federal employee retirement

$$\text{(7.19)}\quad \log \text{FEDRET} = \underset{(4.0)}{-6.33} + 1.000^{*} \log \text{FDRRAT} + \underset{(10.9)}{1.607} \log \text{FEDWAG}$$

Fit: 1965–1973 $\bar{R}^2 = .935$, S.E. = .300, D.W. = .67

State and Local employee retirement

$$\text{(7.20)}\quad \log \text{SLRETR} = \underset{(25.1)}{-2.578} + \underset{(106.6)}{1.043} \log \text{SALWAG}$$

$\bar{R}^2 = .999$, S.E. = .147, D.W. = 1.046

Note: * denotes constrained coefficient

Table VII-5 (Continued)

Definition of Symbols:

OASDHI = Employee and employer contributions under OASDHI and railroad retirement systems, billions of dollars

SSRATE = Combined employer-employee contribution rate for OASDHI, decimal

SSMAX = Maximum earnings subject to social security deductions, dollars

SSCOV = Dummy for additional coverage under social security: 1942-1954 = 0.0, otherwise 1.0

PRIWBL = Wage bill in private economy

OASELF = Social security contributions by self-employed, billions of dollars

SELFRT = Contribution rate for self-employed under OASDHI, decimal

PRPINC = Total proprietors' income

FEDRET = Employer and employee contributions for federal social insurance programs, billions of dollars

FEDRAT = Contribution rate under the federal civil service retirement program

FEDWAG = Wage bill for federal employees (including enterprises), billions of dollars

SLRETR = Employer and employee contributions for state and local insurance programs, billions of dollars

SALWAG = Wage bill for state and local employees (including enterprises).

Self-Employment Tax

The equation for OASDHI for self-employed is similar to that for employees and is shown in Table VII-5. Total proprietor income is used in the taxable base (PRPINC) but is not significant. Since the maximum taxable earnings level is the same as that for employees, the higher proportion of self-employed whose income exceeded the limit caused only the limit itself to be significant in the estimation.

Federal Retirement Insurance

Combined employer-employee contributions under Federal retirement systems were about eight percent of that for OASDHI in 1972. The major problem encountered in estimating collections for this category is defining the appropriate tax base. We have used total wages and salaries for Federal employees (including enterprises) but the results in Table VII-5 indicate this measure as only a rough approximation. The low Durbin-Watson indicates misspecification. The problem is apparently that the proportion of Federal employees covered by the principal staff retirement system—the civil service retirement system—has changed irregularly over time. The contribution rate is taken to be that under the civil service system, which was seven percent in 1972 with no ceiling. Since the rate was changed only twice during the estimation period, the elasticity of collections with respect to the rate was constrained *a priori* to unity.

State and Local Retirement Insurance

General or special retirement systems by states and localities were in effect for about eight million employees in 1973, or about three-fourths of the employees of these governments. The diversity of these plans precludes the use of any particular contribution rates. The social security tax was tried as a proxy, but was not significant. The final equation (7.20) uses simply the wage bill for state and local governments (including enterprises) as the income base in a logarithmic form. The fit is extremely good with the base elasticity slightly greater than one.

Unemployment Insurance

The method of financing the combined Federal-State unemployment system in the U.S. is a complex one, and defies brief, detailed explanation here. Under the Federal Unemployment Tax Act, the "standard" tax rate in 1973 was 3.2 percent on the first $4,200 of a covered employee's wages. All but eight states under their individual programs conform to this 3.2 percent "standard" rate, but may assign lower rates to employers with favorable unemployment experience. In 1972, the estimated average contribution rate of employers under state laws was 1.8 percent of their taxable payroll and .8 percent of total covered wages. The total tax collections rose from 3.69 billion in 1971 to 5.50 billion in 1972 as coverage was extended to employers with fewer than four employees.

The institutional nature of this program prevents any econometric treatment. For forecasting purposes, the effective rate on total wages and salaries is specified exogenously.

Miscellaneous Social Insurance Taxes

The remaining items categorized in the national income accounts as social insurance contributions are minor and are treated exogenously. Payments for veteran's life insurance amounted to 652 million dollars in 1973, of which 643 millions were personal contributions. Payments under voluntary programs of supplementary medical insurance for the aged enacted in 1965 are also defined as social insurance taxes. Current premium rates (1975 and 1976) are $6.70 per month and are subject to change each fiscal year. The total amount of premiums paid in 1974 was 3.9 billion.

7.5 Government Transfer Payments

Government transfer payments to persons have increased dramatically as a result of legislation passed in the mid-1960's. In 1975 government transfers (excluding unemployment benefits) accounted for 12.1 percent of personal income as compared to 6.6 percent a decade earlier.

Some initial attempts to make each of the major transfer payment items endogenous to the model met with limited success due to their institutional nature. As a result, for the present version of the model most transfers are treated exogenously. We have drawn heavily on projections made by the Congressional Budget Office and the Social Security Administration.[16] Our basic approach is to use these outside projected growth rates of real transfers by type to extrapolate the most closely matched national accounts transfer payment item.

The data source for government transfer payments to persons on a national accounts basis is Table 3.12 in the Survey of Current Business. Some twenty separate items are listed in that table; for ease of presentation in the model we collapse that number of seven. Table VII-6 lists the categories chosen and historical data for year 1972-75.

In several instances, the projections of the categories listed in the table are made by aggregating more detailed items. This is done to facilitate future work on the model which may separate federal from state and local government expenditures. We turn now to describing briefly the sources for each of the seven categories.

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[16] U.S. Congress, Congressional Budget Office, Five-Year Budget Projections Fiscal Years 1977-81, (Washington: Government Printing Office, 1976).

Table VII-6
Government Transfer Payments to Persons, 1972-75*
(Millions of Dollars)

		1972	1973	1974	1975
(1)	Unemployment Insurance	5,615	4,282	6,639	16,631
(2)	OASDI and Railroad Retirement	43,192	53,231	60,394	69,127
(3)	Hospital and Supplementary Medical Insurance	8,607	9,712	12,510	15,531
(4)	Government Employment Pensions	12,455	15,621	18,623	22,078
(5)	Veteran's Benefits	8,868	9,484	10,708	13,408
(6)	Public Assistance	10,982	11,313	13,994	16,244
(7)	Other Government Transfers	6,322	7,988	9,540	15,914

* Source: Table 3.12, July 1976 Survey of Current Business

Unemployment Benefits

Payments for unemployment insurance (UI) are closely related to general economic conditions and thus cause no special problem in developing a specific equation to forecast their magnitude. Our equation is linear in the logarithms of the wage rate in the private sector and the number of unemployed under UI coverage. It is shown as equation (7.30) in Table VII-7. Although the fit over the post-war period is quite good, the coefficients are (statistically) significantly different from unity. This may be caused by an omission of the average duration of unemployment, a factor which is not available to us in forecasting applications.

OASDI and Railroad Retirement Benefits

Social security benefits to retirees and the disabled are projected to rise on account of (1) cost-of-living revisions, (2) the long-run upward trend in the number of beneficiaries, and (3) the level of average monthly earnings comprising the benefit base for new retirees. With regard to cost-of-living increases, the 1972 legislation providing automatic adjustment of benefit schedules with respect to the CPI has made this item more amenable to endogenous treatment in economic forecasting models.

However, even the knowledge of past general increases in the benefit schedules does not make the job of estimating the parameters for factors (2) and (3) above very easy. This is a result of periodic extensions in coverage and liberalization of eligibility requirements, as well as shifts in the mix of various types of beneficiaries.

Table VII-7
Miscellaneous Equations for Government Transfer Payments

Unemployment insurance benefits

(7.21) log (UIBEN/UICOV) = -6.813 + .3609 log PRWRAT

+ 1.462 log UNEMP
(15.6)

Fit: 1947-1973 $\bar{R}^2$ = .954, S.E. = .383, D.W. = .991

Beneficiaries under state and local retirement programs

(7.22) log SLBENF = -29.4 + 3.67 log POP65
(43.5) (53.4)

Fit: 1960-1971 $\bar{R}^2$ = .995, S.E. = 14.2, D.W. = 1.67

Definition of symbols:

POP65 = Population over age 65

PRWRAT = Average annual earnings per full-time employee, all private industries (source: Table 6.5, July SCB, 1958 benchmark)

SLBENF = Number of beneficiaries under state and local retirement programs

Time = 1.0 in 1947

UIBEN = Unemployment insurance benefits, billions of dollars

UICOV = Percentage of private employees covered by unemployment insurance

UNEMP = Number of unemployed, millions

As a result, our exogenous projections for OASDI payments draw heavily from the official projection prepared annually by the Board of Trustees of the OASDI trust funds.[17] This report incorporates actuarial and economic assumptions into its estimates for both a five-year forecast and one extending to the year 2050.

The official forecasts for benefit payments are, of course, contingent on an assumed path for the CPI. Because the benefits are now indexed by the CPI, we may reasonably assume here that the forecasts fully reflect the assumed price level. Thus, we deflate the nominal payments assumed by the Board of Trustees by the CPI to obtain estimates for our purposes here. Table VII-8 shows our computations using these government estimates.

Payments under the railroad retirement system are also included in this category. In 1975 these payments were only five percent of those under OASDI. Real payments grew at a five percent annual rate from 1972-75; for the remainder of the forecast period, these payments are assumed to grow four percent annually in real terms.

Hospital and Medical Insurance Benefits

Benefits under the Federal Hospital Insurance and Supplementary Medical Insurance programs amounted to $8.6 billion in 1972 or about one-fifth of the payments under OASDI. The 1976 reports of the Board of Trustees for both these programs presented detailed cost projections

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[17] 1975 Annual Report of the Board of Trustees of the Federal Old Age and Survivors Insurance and Disability Insurance Trust Funds, Report, 94th Congress, 1st Session, House Document No. 94-135 (Washington: Government Printing Office, 1975).

Table VII-8
Exogenous Assumptions for OASDI Payments

	(1) OASDI Benefits[a]	(2) %Δ CPI[b]	(3) PCE Deflator[c]	(4) Benefits 1972$
1972[d]	40948		1.000	40948
1973[d]	50665		1.055	48023
1974[d]	57607		1.169	49279
1975[d]	65852		1.263	52139
1976	75722	6.3	1.343	56425
1977	84183	6.0	1.423	59159
1978	93584	6.0	1.509	62017
1979	103794	5.5	1.591	65238
1980	114560	5.0	1.671	68558
1981	125710	4.5	1.746	71999

Note:

[a]Source: 1976 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, p. 35.

[b]Ibid., p. 25.

[c]PCE deflator is assumed to move as the projections for the CPI after 1976.

[d]Actual figures, millions of dollars.

through calendar year 1981.[18] These estimates have been aggregated and converted to a constant dollar basis as were those for OASDI. Estimates for years beyond 1981 were made by simple extrapolation using the latest annual percentage increment. The official projections used a number of other assumptions in addition to the CPI in constructing future estimates of hospital costs on the basis of factor prices. At this stage we use only the CPI to deflate their current dollar estimates.

Government Employee Pensions

Exogenous estimates for future real pension benefits to government employees were made in two parts. In the first part, the estimates for federal civilian and military retirees were taken from Five-Year Budget Projections: Fiscal Years 1978-1982, a document prepared by the Congressional Budget Office (CBO). A similar procedure to that used for the OASDI projections was used. First, a sequence of constant 1976-dollar benefit payments was computed by using the CBO's baseline assumptions for the CPI. Since there is a slight definitional difference between the CBO category for government employees and the NIA, and since these projections are on a fiscal year basis (October 1-September 30), these 1976-dollar figures were used to extrapolate the last known (1975) 1972-dollar value from the national accounts.

To forecast pension payments for state and local government employees, we began by estimating an equation to explain the beneficiary

[18] 1976 Annual Report of the Board of Trustees of the Federal Hospital Insurance Trust Fund, Report, 94th Congress, 1st Session, House Document No. 94-136 (Washington: Government Printing Office, 1976).

population.[19] In equation (7.22) in Table VII-7, we related the number of beneficiaries receiving state and local pension benefits to the population aged 65 and older. The movements of this series was assumed to approximate the beneficiary population underlying the state and local government pension item in Table 3.12 of the SCB. Average beneficiary payments are assumed to rise in proportion to the CPI as under the OASDI projections. The Congressional Budget Office estimates that about ten percent of the rise in social security payments over the 1975-80 period is due to a rising wage base which leads to higher benefit entitlements for new retirees. The effect of the wage base rising two percent per year is also incorporated into the forecasts for the state and local employee pensions.

Veterans Benefits

Estimates for veterans benefits were taken from the Congressional Budget Office in their 1978-82 budget projections. As with the CBO government employee pension projections, a 1976-dollar series was constructed which then was used to extrapolate the 1976 NIA (actual, in 1972 dollars) magnitude.

Public Assistance

Public assistance payments in this category are made by state and

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[19] Data for the number of retirees under state and local retirement programs were taken from Table No. 456, "Social Insurance and Related Programs—Cash Beneficiaries and Benefits, by Program: 1960 to 1970," in Statistical Abstract of the United States, 1972. Time series were constructed by reference to various issues of this source.

local governments but financed largely from federal grants-in-aid. Included here is aid for families with dependent children (AFDC) and supplemental security income (SSI) for the handicapped and aged.

Since the federal share of this type of assistance is predominant, we have used the CBO projections for the federal portion of AFDC and SSI. Again, these estimates were converted to real terms and then used to extrapolate the national accounts categories for both federal and state and local public assistance. Implicitly, the federal share of these payments is assumed to remain constant over the forecast period.

Other Government Transfers

The projections for the federal portion of other government transfers are made by using the CBO estimates for "Food stamps, housing assistance, and other benefit payments programs." This total was modified by subtracting our best guess as to what the CBO assumed for housing assistance payments. Such payments are not considered transfer payments to persons in the national accounts (they are subsidies to the owner-occupied housing industry). The resulting total, after conversion to constant dollars, was then used to extrapolate the sum of following items in Table 3.12 of the SCB: Veterans Life insurance, workman's compensation, food stamp benefits, black lung benefits, and "other."

The items in the state and local portion of the "other" category made up only about twenty percent of the total in 1974. These benefits are assumed to grow four percent annually in real terms for the forecast period.

Chapter VIII

THE BEHAVIOR OF VALUE-ADDED PRICES BY INDUSTRY

As we discussed in Chapter I, the income model developed here was designed to complement the existing INFORUM real model and a monthly price submodel. Although the monthly price submodel had been operating for several years and had produced reasonable short-term forecasts of the aggregate WPI, initial attempts to integrate it with the income model here produced unsatisfactory results. As a result, a much simpler specification of gross output prices is offered as a temporary solution.

Neglecting lags, our gross output prices are obtained through the standard input-output relation:

$$p = [I-A']^{-1} V$$

where

p = vector of gross output (selling) prices

A = matrix of I/O coefficients and

V = vector of value added per unit of output.

Thus, material costs are viewed to be passed through on a dollar-for dollar basis in the long run. The present chapter is concerned mainly with the determination with the vector V, the value-added prices by sector. In Chapter IX we elaborate on the derivation of gross output prices, in which we introduce lags and indirect business taxes.

8.1 Survey of Current Literature

Before turning to a critique of the existing INFORUM treatment of prices and our temporary solution, a survey of some recent econometric literature on industry price determination will put our work in perspective. We may distinguish three categories of studies that have relevance for our work here: (1) industry price studies with emphasis on hypothesis testing, (2) deterministic input-output models of price determination, and (3) industry price studies for use in complete models. We begin with category (1), which is best exemplified by the recent work of Paul H. Earl.

Industry Price Studies - Hypothesis Testing

Paul Earl, in a 1974 book entitled Inflation and Structure of Industrial Prices, presents the results of re-estimating 18 separate industry price models that have appeared in the postwar literature.[1] Regressions were performed with quarterly data extending from 1958:1 to 1969:2 on 22 two-digit and three-digit U.S. manufacturing industries. The dependent variable in all cases was the quarterly percent change of a fixed-weight price index constructed from the WPI.

The 18 studies were arranged into specific categories of cost and demand variables. Without going into detail on how each of the variables were constructed, we present a list of the Earl taxonomy in Table VIII-1.

The most prevalent specification in the previous studies included variables from the short-run cost (SRC) and direct excess demand (DED).

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[1] Paul H. Earl, Inflation and the Structure of Industrial Prices, (Lexington, Mass., D.C. Heath, 1974).

TABLE VIII-1

Taxonomy for Paul Earl's Price Equations

SRC (Short Run Cost)

1) average hourly earnings
2) unit labor cost
3) material price index (industry specific)

LRC (Long Run Cost)

1) normalized unit labor cost constructed by moving average
2) cost of capital: long-term interest rate
3) target rate of return: ratio of profit after tax to stockholder's equity

DED (Direct Excess Demand)

1) percentage change in shipments
2) percentage change in output (Federal Reserve Index)
3) capacity utilization rate (FRB)
4) change in GNP
5) change in disposable income
6) change in inventories
7) change in desired inventories

IFD (Indirect Excess Demand)

1) unemployment rate

LR-DED (Long-Run, Direct Excess Demand)

1) moving average of output
2) moving average of capacity utilization
3) deviation of normalized inventory-sales ratio from actual ratio.

This general specification holds for most of the equations developed in the 1970 study by Eckstein and Wyss, the first attempt to construct industry specific material-cost regressors for industry price analysis (at the two and three-digit SIC level).[2]

After choosing the best equation for each industry from previous studies, Earl undertakes to improve each equation by the testing of several additional hypotheses (mainly with the LR-DED variables in Table VIII-1), and by more careful treatment of lags. In five out of the 22 industry equations, an increase of over .15 in R^2 was achieved, with less dramatic improvement in most other industries.

What are the major conclusions of the Earl study that have relevance for us? First, the Earl results, for the sectors chosen, reject the "normal prices" hypothesis that excess demand has little influence on short-run price movements. Earl finds on the bases of beta coefficients that the DED regressors have a greater effect on price change than do the cost regressors in the price equations for two-thirds of his industries. Unfortunately, there is no uniformity in the type of demand variable represented. Second, a tentative finding in the Earl study is that lag structure on the cost regressors is more pronounced than excess demand regressors. The largest lag used on an SR-DED variable was two quarters, whereas, the SRC variables entered with a one to four quarter lag. Of major importance is the fact that the lag structures

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[2]Otto Eckstein and David Wyss, "Industry Price Equations," In Otto Eckstein (ed.), The Econometrics of Price Determination, (Washington, D.C.: Board of Governors of the Federal Reserve System, 1970.) pp. 133-165

were found not to be dependent on any particular industry characteristics. Earl's treatment of lags, however, is marred by the fact that simple correlation analysis was used to locate the optimum lag length, as opposed to implementing distributed lags.

There are two important problems in attempting to integrate the results of an econometric study such as Earl's into a complete model. As a practical matter, no existing model can generate internally the type of excess demand variables used by Earl and many of his predecessors. The most difficult variable to forecast is probably changes in inventories, and this happens to be the most prevalent excess demand measure in Earl's final equations.

The second problem inherent in these studies is their implications for relative shares in the long run. In the Earl, as in the earlier Eckstein-Wyss study, the coefficients of the labor cost and material cost regressors in many cases differ substantially from census-data ratios for payroll over shipments and cost of materials over shipments. In the Earl study, for only about half of the industries were the coefficients reasonably close to the census ratios. For a number of equations in that study, either the material cost or labor cost variable was omitted entirely from the final specification.

Eckstein-Wyss suggest that a possible reason for peculiar cost elasticities is that an industry may tie price increases to major increases in negotiated wages.[3] This might be expected in oligopolistic industries where uniform wage increases serve as an unambiguous signal

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[3]*Ibid.*, p. 145.

that each firm's marginal cost curve has shifted, but two of the industries cited by Eckstein and Wyss as showing this behavior -- Textiles and Stone, clay, and glass -- are relatively competitive.

Schultze suggests that material costs may be passed forward only when they are considered permanent.[4] To construct a "normalized" unit material cost variable might indeed require more smoothing than simply a distributed lag over the previous year. Thus, the use of a volatile actual material cost variable may bias its coefficient toward zero.

It is clear, however, from the discussion above that the short-term gross output price equations would pose serious difficulties in the context of a complete model. The profit margins implied by such equations are not likely to be reasonably forecast beyond a few quarters.

We turn next to a consideration of several input-output studies of price determination for which the pitfalls of regression analysis were bypassed.

Deterministic Input-Output Models of Price Determination

In recent years there have been several studies which have used input-output analysis to study changes in prices over time. Leontief showed the dependence of current output prices on past "prices" of value added through his dynamic inverse.[5] The dynamic element in the

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[4]Charles L. Schultze and Joseph L. Tryon, "Prices and Wages in the Brookings Econometric Model," in Edwin Kuh (ed.) The Brookings Quarterly Econometric Model of the United States, (Chicago: Rand McNally, 1967), pp. 271-295.

[5]Wassily Leontief, "The Dynamic Inverse," in (ed. A. P. Carter and A. Brody), Contributions to Input-Output Analysis, (Amsterdam: North Holland, 1970), pp. 17-46.

Leontief model is the capital gain or loss incurred by changes in the replacement cost of assets as prices rise or fall; selling prices are determined on the basis of current input prices plus or minus the capital gain or loss.

The dynamics in other studies have been in terms of the delays in passing on costs of production. Godley and Nordhaus used information on the turnover of inventory stocks to estimate the lags between primary costs and wholesale selling prices for a number of manufacturing industries in Britain.[6] B .P. Haig and M. P. Wood used a similar technique to that of Godley and Nordhaus in simulating monthly retail prices from 1969 to 1973 for the Australian economy.[7] They included a simple model of aggregate wage determination to close their model; import prices and raw material prices were taken exogenously.

Since the Haig and Wood model is a closed system with full industry detail, it warrants further comment. As Haig and Wood state, prices in their model "are determined by a cost-plus system of pricing, and the inflationary process is the result of attempts by wage earners and businesses to maintain their relative shares of income following an initial exogenous shock affecting directly either wages, profits, or prices."[8]

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[6]W.A.H. Godley and W.D. Nordhaus, "Pricing in the Trade Cycle," Economic Journal 82, No. 327 (September 1972), pp. 853-882

[7]B.D. Haig and M.P. Wood, "A Dynamic Model for Analyzing Price Changes," in Advances in Input-Output Analysis, Karen R. Polenske and Jiri V. Skolke, (eds.) (Cambridge, Mass: Ballanger, 1976, pp. 73-92.)

[8]Ibid., p. 75.

The key relation in the model is the determination of the manufacturing price, P^m. In simplest terms,

$$(8.1)\ P^m_{jt} = MU_j \times (\Sigma a_{ij}\ p_i)_{t-k1} + (W_j \times EOQ_j)_{t-k2}$$

where

P^m_{jt} = selling price of output of i^{th} industry

MU_j = profit mark-up on costs per unit of output

a_{ij} = input-output coefficient for product i into product j

W_j = average earnings in industry i

EOQ_j = labor requirements per unit of output in industry i.

The number of months for the lag of material costs (k1) is assumed to be the period of stock turnover. Turnover periods were calculated separately for raw materials, work-in-progress, and finished goods. The length of lags in passing on material costs was obtained by summing the lengths of turnover for each of these classes of stocks. The longest lag obtained in this fashion was eight months, the average for the twelve industries in their study was about four months. Labor cost was assumed to be spread evenly over the period of work in progress, the lag length for wage costs was taken as the period of turnover of work-in-progress stock. However, this resulted in a very short lag for most industries, usually just one month.

Haig and Wood also developed equations, by industry product, for retail prices. Historical trade margins (in value terms) are presumed to remain constant and, again, inventory data is utilized to compute the lags between wholesale and retail prices. Prices of imports and retail taxes are also included in the computation of the total retail price index.

The model is closed (in the sense of wage-price interaction) by two equations explaining aggregate earnings behavior. Taken together, they explain earnings on the basis of a two-quarter lag in the retail price index and a two-quarter lag in the male unemployment rate.

A dynamic simulation is made that starts in July 1969 and extends through March 1973. Haig and Wood state that the purpose of the model was to examine the determinants of the change of the total price index, not the components of the price index. (One wonders how much one can separate the two in the disaggregated analysis they undertake.) In terms of their forecast of the total retail index their results would have to be judged successful; their simulated value was less than half a percent from the actual at the end of their four year test. The results for individual items are less impressive but Haig and Wood do not undertake a comprehensive error analysis.

A major strength of the Haig and Wood approach, as of the earlier study by Godley and Nordhaus, is an explicit rationalization for different lags by different industries in passing through material costs. It would be of interest to check if the "best" lags found by Earl for his U.S. sample matched to any degree the inventory turnover periods calculated from census data.

Secondly, the Haig and Wood approach provides an explicit relation, albeit a very simple one, for determining profit income by industry. Thirdly, Haig and Wood modeled the lags between the wholesale and retail sector, thus adding an important element of reality into their simulation of a wage-price spiral.

The obvious omission in the Haig and Wood type of study is any explicit introduction of demand factors into the pricing behavior. This is not to fault in particular Haig and Wood, for an additional purpose of theirs was to test whether a normal pricing hypothesis embedded within a dynamic input-output framework can reasonably explain the aggregate price indexes. However, it is clear from the econometric evidence for the U.S. that a viable forecasting procedure for industry prices requires demand as well as cost variables.

A Static I/O Analysis of Recent U.S. Inflation

William Nordhaus and John Shoven used input-output assumptions in a static framework to decompose the U.S. inflation from 1970 through July 1974.[9] Beginning with the 1967 input-output matrix A, they partitioned it into four quadrants:

$$(8.2) \qquad A = \left[\begin{array}{c|c} A_{11} & A_{12} \\ \hline A_{21} & A_{22} \end{array}\right]$$

where

A_{11} = 15 x 15 matrix of exogenous inputs into exogenous outputs

A_{12} = 15 x 75 matrix of exogenous inputs into endogenous outputs

A_{21} = 75 x 15 matrix of endogenous inputs into exogenous outputs

A_{22} = 75 x 75 matrix of endogenous inputs into endogenous outputs.

The exogenous or price sensitive sectors comprised agriculture, mining, and inputs. The remaining 75 sectors were assumed to set prices on the basis of normal, or cyclically adjusted, average cost of production. With regard to demand effects, Nordhaus and Shoven state that

[9] W.D. Nordhaus and John B. Shoven, "A Technique for Analyzing and Decomposing Inflation," Paper presented at the NBER Conference on Price Behavior, Bethesda, Maryland, November, 1974.

"there appears to be very little price reaction in the normal pricing sectors to changes in demand, at least within the range of variation observed over the post-war period.[10] This is obviously in striking contrast to the results obtained by Earl for many U.S. manufacturing industries.

By the standard input-output accounting definitions, output prices in the base period satisfy

$$(8.3)\ P = A' p + WL + T + \pi$$

where

W = the aggregate wage rate

L = a vector of unit labor requirements

T = a vector of indirect business taxes per unit of output

π = a vector of gross unit profits.

Combining (8.2) and (8.3) one may solve for the <u>changes</u> in the endogenous prices (ΔP_{en}) in terms of given changes in the exogenous prices (ΔP_{ex}), and the change in the price of labor, ΔW:

$$(8.4)\ \Delta P_{en} = A'_{22}\,\Delta P_{en} + A'_{12}\,\Delta P_{ex} + L_{en}\,\Delta W + T_{en} + \Delta\pi_{en}$$

Of course, an explicit solution for P_{en} is

$$\Delta P_{en} = \left[I - A'_{12} \right]^{-1} \left[A'_{12}\,\Delta P_{ex} + L_{en}\,\Delta W + \Delta T_{en} + \Delta\pi_{en} \right]$$

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10 *Ibid.*, p.75.

Given a set of WPI weights and the vectors, ΔP_{en} and ΔP_{ex}, other changes in the overall WPI may be computed and decomposed in terms of (a) the amount directly due to the exogenous sector (including labor), (b) the amount indirectly due to the exogenous sectors (i.e. $W_{en}\ \Delta P_{en}$ where W is the vector of WPI weights for the endogenous sector prices and assuming $\Delta T_{en} = \Delta\pi = 0$.) and (c) the unexplained residual.

Nordhaus and Shoven applied this technique to three periods since 1970 to identify the sources of change of the aggregate WPI. The results in terms of the percentage contribution by the exogenous sectors are shown in Table VIII-2. Columns (2) and (3) show dramatically the "grain inflation" of 1973 and "oil inflation" of 1974. The results of the last period are somewhat disturbing for the rather large percentage of the total increase that cannot be explained. Nordhaus and Shoven suggest two reasons for the discrepancy: (1) the final lifting of the price controls in the spring of 1974 and (2) price movements in the endogenous sector that were influenced more by world markets than simply domestic cost factors. However, it is likely that some of the price increases in 1974 resulted from shortages of petroleum (petrochemical feedstocks) which had an overall price impact above and beyond its effect through standard cost pass-through.

The Nordhaus and Shoven paper is important in that it throws some light on the extraordinary increases of the WPI in 1973 and 1974, but, of course, was never intended to serve as a complete model of industrial pricing. We turn now to some attempts to blend the econometric and input-output analysis of industry pricing within full-scale disaggregated models.

TABLE VIII-2

Decomposition of 1970-1974 Wholesale Inflation
by Nordhaus and Shoven

		(1)	(2)	(3)
Period		Nov. 1970-Aug. 1971	Nov. 1972-Aug. 1973	Oct. 1973-July 1974
Total Percentage Change of WPI		3.61	17.73	16.58
Total Percentage Contribution by:				
Agriculture, Forestry and Fisheries	direct	14.3	33.3	-1.3
	indirect	22.9	33.1	-2.7
Mining & Domestic Fuels	direct	2.4	1.0	6.8
	indirect	3.9	2.7	13.5
Imports		14.7	10.0	37.1 (mostly oil)
Labor		29.6	5.2	8.0
Total		87.7	86.3	61.3
Residual		12.1	13.7	38.7

Industry Price Studies for Use in Complete Models

The work by Charles Schultze and Joseph Tryon in the early 1960's was intended to be a part of the original large-scale Brookings quarterly model and was the first to specify general price equations for a large number of two-digit SIC industries.[11] Of particular interest is their effort to construct quarterly indexes for industry value-added prices. Unfortunately, attempts to interpolate annual series for current and constant dollar gross-product-originating lead to rather implausible series for the implicit deflators. They found that their value-added prices had "systematic" cyclical errors in some industries, rising in recessions and falling in recoveries. This might be consistent with pure target-return pricing but Schultze and Tryon do not elaborate on the problem in their discussion.

Because of presumed measurement errors in their value-added prices, Schultze and Tryon present their final results in terms of gross output prices from the WPI. The specifics of their specification and empirical findings are reviewed by Earl and the interested reader is referred to Earl's book or the original study. An important point is that successful implementation of the value-added price concept would have led naturally to identification of corporate profits by industry. The use of selling price indexes allowed only total corporate profits to be determined in a residual fashion by comparison of the income and product sides of the accounts.

There have been, however, three more recent studies which have used the value-added prices in connection with income determination. The

[11] Charles Schultze and Joseph Tryon, op. cit.

first of these is the Wharton Annual and Industry Forecasting Model.[12] The Wharton model is one of the few disaggregated models for which investment, employment, and pricing decisions are consistent within a theoretical framework. The concept of output is again real gross product originating by industry. A production function of the Cobb-Douglas form, $Q = a L^{\infty} K^{\beta} e^{\lambda t}$, is assumed where α and β are estimates from observed factor shares. The approach taken considers long-run normal prices, which include capital and other costs fixed in the short run, in the pricing decision. Thus, for pure competition and profit maximization, the marginal conditions of the Cobb-Douglas production function lead to

$$\frac{\partial Q}{\partial L} = \frac{W}{P} = \alpha \frac{Q}{L} \quad \text{and thus} \quad P = \frac{1}{\alpha} \frac{WL}{Q}$$

Here the full markup factor is about 1.5, but note that this is an equilibrum property which accounts for both labor and capital costs in the long run. This may be contrasted to the strictly short-run version of markup pricing assumed in the Haig and Wood study. It is quite easy to demonstrate that the above expression for P is equivalent to

$$(8.5) \qquad P = \frac{WL}{Q} + \frac{rK}{Q}$$

when the factor ratios are adjusted to their cost minimizing proportions.

The 1972 Wharton price equation used normalized unit labor costs and capacity utilization within a Koyck lag formulation. However, the

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[12] Ross S. Preston, The Wharton Annual and Industry Forecasting Model, Economics Research Unit, Department of Economics, University of Pennsylvania, (1972).

industry detail was not great. Five price equations were estimated: (1) manufacturing and mining, (2) transportation, (3) communication, (4) other regulated industries, and (5) commercial. The conversion of the sector prices to final demand prices follows the original approach by Fisher, Klein, and Shinkai in the Brookings model.

The CANDIDE model of the Canadian economy follows a similar procedure to that in the Wharton model by explaining annual value-added deflators for one-digit SIC sectors.[13] The primary variable is a distributed lag on actual unit labor costs, with capacity utilization and unit capital cost (unit CCA) included in some equations. The prices for 18 manufacturing industries at the two-digit level are explained with reference to the total manufacturing price using an autoregressive specification. The determination of the industry value-added deflators is one part of a four-tier procedure in CANDIDE structure for obtaining some 150 final demand deflators. This process uses input-output information, indirect tax rates, and import prices, within a "bridge model" approach. It would appear that greater structual detail for the industry gross product originating deflators would be a substantial improvement in the CANDIDE procedure.

Another model which integrates the industry price equations within a complete system is that of Lawrence Officer, who constructed a quarterly model of supply relationship in the Canadian economy. Officer uses quarterly value-added prices as the dependent variable in his

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[13]M. D. McCracken, An Overview of CANDIDE Model 1.0, Economic Council of Canada, (Ottawa, 1972), pp. 72-74.

price equation stating that "our basic data situation is better than that of Schultze and Tryon."[14] The basic specification (without a Koyck lag) is

$$(8.6)\ VAP = a_o + a_1\ WT + a_2\ PMAT + a_3\ PRT + a_4\ (\bar{V}/\bar{V}A^a)_{-1} + a_5\ WPC + \text{quarterly dummies}$$

where

VAP = value-added price

WT = wage rate

PMAT = unit material price

PRT = labor productivity

$(\bar{V}/\bar{V}A^a)_{-1}$ = ratio of stock of inventories for four-quarters average of value-added, both in constant dollars.

WPC = world price of competing products.

The wage rate, productivity, and inventory "sales" ratio are standard cost and demand regressors. Officer rationalizes the role of the material price variable by stating that a rise in material prices may provide a convenient opportunity for raising the value-added price. Loss of good will may be minimized since an observable shift in supply curve has occurred. This argument is, of course, identical to that proposed by Eckstein and Wyss for the unexpectedly high wage-rate coefficients which they obtained. Officer also argues that an increase in

[14]Lawrence Officer, Supply Relationships in the Canadian Economy (East Lansing: Michigan State University), 1973.

material prices requires a larger portion of working capital to be devoted to inventories, and thus induces firms to raise prices. The world price of competing products is introduced in the mining and forestry equations to reflect the export orientation of these Canadian primary sectors.

The quarterly regressions are performed for broad industry divisions: mining, construction, nondurable manufacturing, durable manufacturing, trade, public utilities, transportaton; finance, insurance and real estate; and services. The most disturbing results of the regressions for manufacturing are the very high long-run elasticities with respect to materials prices. For nondurable manufacturing, the material price elasticity is larger than that for labor productivity; and in durables, about 80 percent as large. One might grant the first Officer argument for material prices having a short-run positive influence on the <u>value-added</u> price, but the size of the larger elasticities would indicate that material prices are picking up the effect of some other omitted variable. A marginally significant effect for the inventory variable is found, somewhat unexpectedly, for nondurable goods rather than for durable goods.

Industry selling price (or gross output price) equations are then estimated for manufacturing. These linear equations include the value-added price index, the material price index, and the inventory variable described above. A regression approach was used to compensate for possible data discrepancies as well as shifting weighting patterns of the three price indexes.

Corporate profits by sector are explained in a stochastic framework rather than residually. Officer develops quarterly equations using current dollar value added, the change in current dollar value added, labor productivity, and a four-quarter distributed lag of wage rates as explanatory variables. Regression equations are used as well to explain CCA, unincorporated business income, IVA and wages and salaries (by wage rates and productivity) by sector. Officer's model is quite different from the Wharton or CANDIDE models (other than being quarterly) in that within a simultaneous framework real output (i.e., real value added) is determined after the fact. That is, real gross product is defined as the ratio of the sums of stochastically determined components of current dollar value added and the value-added price. Thus, it breaks away from the price -- real output dichotomy present in most econometric models. Whether such a procedure would reasonably forecast real outputs in the long run is open to queston.

8.2 Gilmartin-INFORUM Price Model

The INFORUM price model operating at the outset of this study grew out of a doctoral dissertation by David Gilmartin.[15] Its aim was to model on a monthly basis industry price behavior with full attention to material requirements as shown in the U.S. input-output tables. The industry detail considered was at the 200-sector level of the INFORUM model. The price equations took the following form:

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[15]David Gilmartin, "Forecasting Prices in an Input-Output Framework," (Unpublished Ph.D. dissertation, University of Maryland, 1976.)

$$(8.7)\quad P_t^i = \alpha + \sum_{k=1}^{n1} \alpha_k^i \cdot UC_{t-k}^i, + \sum_{k=1}^{n2} \beta_k^i \cdot Q_{t-k} + \text{seasonal dummies}$$

where

P_t^i = gross output price for sector i in month t,

UC_t^i = variable unit costs for sector i in month t (to be defined below),

Q_t = output for sector i in month t,

and α, β are distributed lag weights such that

$$\text{and } L_c < \sum_k^{n1} \alpha_k^i < U_c, \quad L_q \leq \sum_k^{n2} \beta_k \leq U_q$$

The unit cost variable is taken to be the sum of material costs with weights from a single (1967) input-output matrix and actual unit labor costs. Thus

$$UC_t^i = \Sigma a_{ij} P_{i,t} + \frac{WL_t}{Q_t}$$

where

a_{ij} = interindustry coefficients

WL = the wage bill for each sector computed by multiplying wage rates for production workers times <u>total</u> manhours in each industry (source: BLS <u>Employment and Earnings</u> data)

Q = FRB Monthly output indexes scaled by 1967 Census shipments.

Polynomial distributed lags were employed in estimating the lag structures on both the unit cost and output variables. The usual lag lengths were 12 months on the cost variable, 24 months on the output variable. As shown above, the equations were constrained to produce reasonable long-run elasticities for the cost and "demand" variable.

L_c and U_c were generally .75 and 1.25, respectively; and L_q and U_q were −.25 and .25.

Lack of data prevented estimation of equations for nearly 50 industries. The data also determined the starting period for regressions: generally in the period 1954 to 1958. The final observation as of this writing was December 1972.

For the regression results themselves, the interested reader is referred to the Gilmartin thesis. The use of levels rather than differences makes evaluation in terms of goodness of fit very difficult. A disturbing feature of the results was that nearly all the coefficients sums were constrained at either the lower or upper limits.

The Gilmartin approach was found deficient for our purposes on several counts. The first is purely practical. To avoid the problem of simultaneity in solving for output prices and material prices in the I/O system, the model was designed to operate recursively on a monthly basis. Thus, the current values of unit costs were omitted in the estimates of eq. (8.7). A full year's solution required computation of the distributed lag variables for the 150 or so equations for all twelve months. As a result, a single ten-year forecast required over six minutes of memory time on a UNIVAC 1108, over twice the time spent for the <u>entire</u> real model. This cost, even with generous support by the University of Maryland Computer Science Center, inhibited thorough testing of the model. One can make some argument for the monthly time interval in a two or three year forecasts, but its hardly illuminating ten years hence when the model is tracing out rather stable paths.

The second deficiency relates directly to the specification chosen for price equations. Although Gilmartin's model was well suited to analyze the commodity inflation of 1973 and 1974, its implications for longer run factor shares were dubious. Thus, these results share with the previous econometric work at an industry level, the feature of not being consistent in a complete system. Part of the problem lies in the fact that most of the cost "elasticities" in equation (8.7) were constrained at the boundaries of either .75 of 1.25. For industries with elasticities greater than 1.0, an increase in material costs -- with unit labor costs constant -- leads to a proportionately greater output price and, implicitly, a rise in the profit markup over unit labor costs. Trial simulations with the Gilmartin model lead to precisely the phenomenon of rising profit markups in 1973 and 1974, which persisted in the following years. That is, in spite of declining real outputs from the INFORUM real model during the 1975 recession, the meager demand effects allowed for in equation (8.7) were swamped by the peculiar cost pass-through behavior, resulting in rising profit shares in many industries.

In addition, the presence of non-zero coefficient sums on the output variables implies increasing or decreasing returns to scale in the long run. How much these deviations from zero coefficient sums contributed to the strange relative shares behavior is difficult to say, but it would be more reasonable to require a demand variable to have only a short-run effect.

Although some of the problem here stems from lumping together of material and labor costs, it is not at all evident that separating these two for estimation would help matters. Consider the simple input-output structure with a Cobb-Douglas production function for value added. Then the equilibrium price vector, p, may be defined as

$$(8.8)\ p = A' p + (I + M) \frac{WL}{Q}$$

when M, of course, is a diagonal matrix of markup factors upon solution of the cost-minimization problem of the sectoral Cobb-Douglas production functions. Breaking the simultaneity for material costs and introducing distributed lags for both cost items, one arrives at a possible estimation specification for each sector of the form

$$(8.9)\ p_j = \sum_{k=1}^{n} U_k \left(\sum_i a_{ij}\, p_j\right)^{t-k} + (1 + M') \sum_{k=1}^{n} V_k \frac{(WL)}{Q_{(t-k)}}$$

We would expect the markup factor to be different depending on the length of the lags involved; thus, m' is substituted for m (m is an element of M above.) Equation (8.9), of course, represents the "normal price hypothesis," for industrial prices; i.e. they do not react to temporary changes in demand. Even if demand should have an impact, we would expect it to be only a temporary one, which would be reflected in fluctuations in the markup factor.

If (8.9) presented an adequate explanation of price behavior at the disaggregated industry level, and if there were no observation errors in the independent variables, the only point in estimating (8.9) would be to identify the appropriate lags. The sole permissable values for U_k and V_k would be unity.

Unfortunately, there are observation errors in trying to estimate (8.9) and they are likely to be significant. First and foremost, is the lack of information on input coefficients, a_{ij}, over time. Obviously the use of fixed weights in constructing the material cost measure is likely to lead to upward bias for this measure. If price substitution among inputs has taken place, and thus imparts a downward bias to U_k. One may, of course, interpolate between the various input-output tables that have been constructed for the U.S to achieve a variable weighting scheme. As a practical matter, however, one must always be suspect of the comparability between the tables and the fact that, as of this writing, this last published table is nearly ten years old.

The data available for use in constructing unit labor cost is probably more reliable, but also may have serious errors. If one is attempting a quarterly regression for a SIC product below the two-digit level, a number of imputations are required. First, there is no quarterly data for earnings of non-production workers, or for wage supplements for both production and non-production workers at this degree of disaggregation. Second, as the degree of industry detail becomes finer, one is more likely to encounter a "secondary products problem" where, of course, no single wage bill can be classified exclusively with a single product price.

Finally, in terms in the econometric estimation of (8.9) in level form, there is likely to be severe multicollinearly between the unit labor and unit material cost variables, especially during a period with relatively stable raw materials prices. (This is probably relevant for most industries in the U.S. from 1960 until 1973.) Avoiding multicollinearly is probably the reason for the aggregation of the cost variable in the Gilmartin model.

8.3 A Temporary Specification for Industry Prices

The approach taken to model industry prices -- prices whose behavior should be consistent with observed secular and cyclical factor shares -- combines elements of the deterministic I/O models discussed above as well as the econometric studies of price behavior. Value-added "price" equations are estimated at the two-digit SIC level which explain the markup over labor costs in terms of a short-run demand variable and long-run trend. The markup behavior at the two-digit level is then imputed to the I/O sectors included in the two-digit group and material costs are added to determine industry selling prices. Some provision for dynamic adjustment is made on the basis of evidence in previous econometric studies.

On theoretical grounds, the preferable approach to modeling price behavior is by means of an explicit production function. Nordhaus has derived long-run price equations solely in terms of factor prices on the basis of assumed production and demand functions.[16] The Wharton markup price equations are consistent with long-run cost minimization in a Cobb-Douglas framework. The Cobb-Douglas form is restrictive, however, and previous INFORUM work has used a CES function in implementing a neoclassical specification for explaining investment. Is there some way to generate a "markup" price specification which has some relationship to an underlying CES production function?

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[16] W.D. Nordhaus "Recent Developments in Price Dynamics," in Otto Eckstein, ed., The Econometrics of Price Determination, (Washington, D.C.: Board of Governors of the Federal Reserve System, 1972).

Consider the purely factor-augmenting form of the CES function under constant returns to scale,

$$(8.10)\quad X = \{[\alpha(t) K]^{-\rho} + [\beta(t) L]^{-\rho}\}^{-1/\rho}$$

where $\alpha(t)$ and $\beta(t)$ are efficiency indexes of capital and labor, and where

$$-\rho = [1 - 1/\sigma] \quad \text{and } \sigma = \text{the elasticity of substitution.}$$

Note first the omission of materials as separate input; i.e. X here is real gross product originating. There is little empirical evidence regarding the partial elasticities of substitution between K or L versus intermediate inputs. A recent study by David Humphrey for six manufacturing sectors (using a Diewert cost function) found only one case out of 12 where the primary factor-intermediate input elasticities were statistically different from zero, but K and L were substitutable in every case.[17] The separability results of this study suggests that existing two-input capital-labor substitution elasticities are probably not biased by excluding intermediate inputs from the estimation. Such a finding implies that a dollar increase in the cost of intermediate inputs shifts the long-run average cost curve by precisely a dollar -- the standard Leontief case.

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[17] David B. Humphrey, "Estimates of Factor-Intermediate Substitution and Separability," Southern Economic Journal, Vol. 41, No. 3, (January 1975), pp. 531-534.

Under perfectly competitive factor and input markets, Ferguson has shown that the rate of change of labor's relative share, $\dot{s}/s$ ($s = \frac{WL}{pX}$, is[18]

$$(8.11)\quad \dot{s}/s = -\,[(1-s)\ (\sigma - 1)/\sigma]\ \ [\dot{\alpha}/\alpha + \dot{K}/K) - (\dot{\beta}/\beta + \dot{L}/L)]$$

If factor augmentation is assumed to proceed at a constant exponential rate where

$\dot{\alpha}/\alpha = \lambda_1$ and $\dot{\beta}/\beta = \lambda_2$, then (8.11) reduces to

$$(8.12)\quad \dot{s}/s = -\,(1-s)\ [(\sigma - 1/\sigma]\ \ [\dot{k}/k - (\lambda_2 - \lambda_1)]$$

where $k = K/L$.

In the case of $\sigma = 1$, relative shares are constant from (8.12). If $\sigma < 1$ and $\dot{k}/k$ 0, then relative shares are constant if the bias of the technological change ($\lambda 2 - \lambda_1$) matches the growth of the capital-labor ratio. As Ferguson describes this case, "relative shares will remain constant if, and only if the decrease in the relative demand for labor attributable to capital using technological progress is exactly offset by the decrease in the relative quantity of labor attributable to capital deepening and inelastic substitutibility.[19]

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[18]C.E. Ferguson, "Neoclassical Theory of Technical Progress and Relative Factor Shares," Southern Economic Journal, Vol. 34, No. 4, (April 1968), p. 497.

[19]Ibid, p. 493

For the manufacturing sector as a whole and in most two-digit industries $\dot{s}/s$ over the post-war period has a small positive value. As an approximation to (8.12) we may take s on the right hand of (8.12) as equal to its mean value, ($\bar{s}$) and obtain:

$$(8.13)\quad \dot{s}/s = v[\dot{k}/k - (\lambda_1 - \lambda_2)]$$

where $v = -(1 - \bar{s})\ [\sigma - 1)/\sigma\ ]$

Integrating (8.13) we obtain

$$(8.14)\quad \log s = v[\log k - (\lambda_1 - \lambda_2)\ t] + C$$

where C is a constant of integration.

If we return to the production function in (8.10) with factor augmentation at exponential rates we have,

$$(8.15)\quad X = [\ (\alpha_o\ e^{\lambda_1 t}\ K)^{-\rho} + \beta_o\ e^{\lambda_2 t} L^{-\rho}\ ]^{-1/\rho}$$

Assuming perfectly competitive factor markets, the first order condition for cost minimization is

$$(8.16)\quad F_L/F_K = [\ \beta_o/\ \alpha-\ C^{(\lambda_1 - \lambda_2) +}\ ]^{-\rho}\ (K/L)^{1+\rho} = w/r$$

Since the capital-labor ratio is the decision variable of the firm, (8.16) is rearranged to give.

$$(8.17)\quad k = K/L = \left(\frac{w}{r}\right)^{\sigma}\ [\ (\beta_o/\ \alpha_o)\ e^{(\lambda_2 - \lambda_1)\ t\ (1-\sigma\ )}$$

Taking logs of both sides of (8.17) and substituting into (8.15) we obtain the following expression for s:

$$(8.18)\ \log s = v\ [\sigma \log \frac{w}{r} + (1 - \sigma)\ \log \beta_o/\alpha - \sigma [\lambda_2 - \lambda_1]\ t\ ] + C$$

Recalling that $S = \frac{wL}{pX}$, then a value-added price markup (over unit labor cost) is

$$(8.19)\ \frac{1}{S} = \frac{pX}{wL} = \frac{p}{wL/X)} = f(w/r,\ \text{time})$$

Specifically,

$$(8.20)\ \log \frac{pX}{wL} = \alpha_o + \alpha_1 \log w/r + \alpha_2 t$$

where $\alpha_1 = - v\,\alpha$, and $\alpha_2 = v\ \alpha[\lambda_2 - \lambda_1]$

The reader should bear in mind that equation (8.20) is an approximation to the markup over labor costs when factor quantities are fully adjusted to any change in the wage-rental ratio. Thus, it is a long-run relationship which may not be observed at any particular time. Equation (8.20) does, however, show that there is a role for the wage-rental ratio and for a time trend in a markup specification.

The trend variable from the derivation above serves to measure the bias of the technological change; however, time may also pick up changing industry market structure as well as possible effects of import competition.

In the short run, (8.20) may not hold, as well, because of demand effects and deviations of actual labor productivity from the cost-minimizing level of productivity. In addition, there are <u>short-run</u> dynamic effects of wage rate changes apart form the longer-run adjustments to optimal factor proportions. A specification explaining the value-added price incorporating the elements just discussed would be the following:

$$(8.21)\quad \log p_t = \alpha_o + \alpha_1 \log (w/r)_t + \alpha_2 \text{ time} + \alpha_3 \text{ Demand}_t + \alpha_4 \log (wL^*/X)$$

$$+ \alpha_5 \log (L/L^*) + \alpha_6 \log (w_t/w_{t-1})$$

where L* is the "equilibrium" labor input associated with X_t. The coefficient on the term L/L*, indicates the extent to which short-run deviations in productivity from equilibrium are passed forward into prices. If we assume that changes in "equilibrium" unit labor costs, <u>ceteris paribus</u>, are fully reflected in prices ($\alpha_4 = 1$), then upon adding $\log \frac{X}{wL}$ to both sides of (8.21) and collapsing terms, we obtain:

$$(8.22)\quad \log \frac{pX}{wL} = \beta_o + \beta_1 \log \frac{w}{r} + \beta_2 \text{ time} + \beta_3 \text{ Demand} + \beta_4 \frac{L^*}{L}$$

$$+ \beta_5 \log (w_t/w_{t-1})$$

If short-run productivity deviations do not show up in pricing decisions, then β_4 will be unity. To the extent that actual productivity has some effect, β_4 will be less than one. β_4 may be greater than one if productivity deviations serve as a proxy for excess demand and to the extent that they reflect the effect of fixed costs on observed profit margins. One would generally expect β_5 to be negative, as firms adjust to changes in wage rates only after a lag. However, if changes in mark-ups are keyed to negotiated wage changes, then β_5 may presumably be positive.

Empirical Specification

There are several more issues to be discussed before we can proceed to the estimation of (8.22). The first is simply the precise definition of the dependent variable. We have taken $\frac{pX}{wL}$ to be

$$(8.23) \quad \left[\frac{\text{GPO - indirect business taxes - IVA}}{\text{labor compensation} * \left(\frac{\text{MHE + MHP}}{\text{MHE}}\right)}\right]_t = MU_t$$

GPO = Gross Product Originating

IVA = Inventory Valuation Adjustment

MHE = Manhours of employees, and

MHP = Manhours of self-employed

The subtraction of IVA is inspired by the discussion of William Nordhaus in a recent article in the Brookings Papers on Economic Activity (1974:1).[20] The Commerce Department makes the inventory valuation adjustment in order to measure profits on the basis of the replacement cost of inventories. Nordhaus writes "Perhaps the Wall Street Journal exaggerated when it asserted that most businessmen have never heard of IVA; it seems safer to assume that most of them base their actual calculations of prices, sales, and profits on historical cost, whatever their knowledge of IVA.[21] Nordhaus argues through a simple example that a typical firm is unlikely to be aware of what fraction of any year's return is genuine and what fraction was capital gains.

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[20]William D. Nordhaus, "The Falling Share of Profits," Brookings Papers on Economic Activity (1974:1), pp. 169-219.

[21]Ibid., p. 180.

In proceeding to analyze the markup ratio for nonfinancial corporations, he then redefines current dollar value added to a "businessman's basis" by subtracting the IVA. The new (typically higher, since the IVA is normally negative with rising prices) value added is used to define a new deflator by dividing into it unaffected constant-dollar output.

This procedure is followed here since it makes sense not to include the IVA as part of a behavioral relationship.[22] In the integrated model, our measure of annual corporate profits, by industry, will still implicitly be the NIA concept of "corporate profits plus IVA" since we evaluate material costs at their current annual average. Since we build into the model fixed lags in passing through material costs, the ex ante profit markups as projected in these equations will differ from the ex post "corporate profits plus IVA" depending upon the rate of inflation of material costs.

The adjustment to the denominator of (8.23) implies that in determining unit labor costs in sectors where self-employment is large, we have imputed to these self-employed the same wage rate as employees.

The second point which we have not addressed thus far is how to specify demand pressure in (8.22). There appear to be three candidates for "Demand" that are currently (or potentially) generated as part of the INFORUM standard model.

The first is some function of observed real output. The particular construction chosen here is the ratio of output to a three-year moving

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[22]The trade sectors are an exception to this treatment; their special case is discussed along with the estimation results.

average of output (Q/AVEQ). This quasi-first difference of output performed generally better than the simple year-to-year change in some preliminary regressions. There is always the danger of encountering identification problems with this measure, as the change in observed output may arise from either movements in the demand curve or supply curve (or both). A preferable measure is, of course, the change in demand at the current price (or "excess" demand), but measurement of such an entity has usually involved the use of proxy variables which the real model does not generate. It can be argued that demand curves may be sufficiently inelastic in the short-run that we can safely ignore this problem. Whether this be the case or not, we shall follow the practice of previous researchers and consider the use of observed output change as a factor influencing the size of price markups.

The second measure is theoretically preferable since it takes into account the supply side of the model. It is simply the ratio of current real output to equipment capital stock (Q/K). Stocks of equipment for 88 industries are available from 1947 through the forecast period of the standard INFORUM model.[23] The aggregation is sufficient to provide separate series for about 30 industries of the income model, including each of the 21 manufacturing sectors.

We expect Q/K to be highly correlated with outside measures of "capacity utilization," but would expect to find cases where these movements differed. The problem, again, would be to forecast capacity utilization, if it were incorporated into the markup equations. For the

[23]Stocks of structures are available for only a few industries; only one series is used for all structures in manufacturing.

moment, we are interested in adequacy of using exclusively the INFORUM data base to generate our demand variable.

The third source as a measure of demand-supply disequilibrium is the stock of inventories and the derived inventory change. Both changes in inventories and the ratio of inventories to output (or shipments) have been used by previous researchers in studying price behavior. The use of inventories are mentioned as more of a potential of the full model, rather than being currently available. The data on inventory stocks by product at this writing extends from only 1960-1972, and there are plans to revise substantially the methodology for generating the historical data. Considering the temporary nature of the current inventories data, it seemed wise to delay testing demand measures related to inventories intensively in the price equations here.[24]

Equilibrium Manhours

As a final step before (8.22) can be estimated we need to outline how we generate L*, the equilibrium level manhours associated with the current level of output. Two methods were used and the results of both were tested in (8.22). The first method has aesthetic appeal since it relies directly on the dynamics implied in an equation explaining the industry's level of manhours. Such an approach has been used in several macroeconomic models (BEA, Wharton). To emulate that procedure the following simple specification was estimated for each (two-digit SIC)

[24] The change in inventories was tried in the 21 manufacturing sectors for a sample period 1961-1972, but this measure proved, on the whole, to be inferior to simple changes in constant-dollar output.

income sector (in the remainder of the chapter we refer to this as the "auxiliary" equation).

$$(8.24)\quad \log L^i_t = a_o + a_1\ \text{TIME58} + a_2\ \text{TIME64} + a_3 \log Q^i_t + a_4 \log L^i_{t-1}$$

such that $a_3 = 1 - a_4$.

and where L^i = total manhours employed by sector i (includes nonproduction and self employed workers, source: NIA, same as described in Chapter VI).

TIME58 = time trend beginning in 1958,

TIME64 = time trend beginning in 1964, and

Q^i = unweighted sum of gross outputs in income sector i.

The constraint on a_3 and a_4 in this Koyck specification ensure that the long-run elasticity of manhours with respect to output is unity. The time trend beginning in 1964 was intended to capture crudely the slowdown in productivity that occurred in the aggregate in the mid-1960's.

The equilibrium level of manhours is found by setting L^i_{t-1} and L^i_t both equal to L^{*i}_t. The variable L*/L in equation (8.22) is then calculated simply by dividing the observed level of manhours into L^{*i}_t.

Equation (8.24) was estimated from 1958 through 1974 for each of the 21 manufacturing sectors. For our purposes, the empirical results were highly satisfactory with most of the R^2's in the range .90 - .99. The speed of adjustment parameter, a_4, was generally around .3, implying a mean lag of about half a year (mean lag = $\frac{a_4}{1-a_4}$). The slowest adjustment was in Food and Kindred Products (a_4 = .663), and the fastest was in Electrical Machinery, (a_4 = .07).

The other measure of L*/L is generated with much less effort. It follows the lead of previous researchers in taking a three-year (i.e. consistent with a 12-quarter) moving average of productivity to represent "normal" or equilibrium, productivity. L*/L can then be shown to be approximately equal to actual productivity divided by this moving average. This is an approximation only because there is usually underlying productivity growth which mades the moving average less the "true" normal productivity for the final period (i.e. the third year). However, when productivity trends are constant, this discrepancy is also constant and will be absorbed into the coefficient on L*/L in the estimation.

Although this second procedure is less attractive from a theoretical viewpoint, it makes the solution procedure for the complete model substantially less complex. The ratio-to-moving-average term can be generated easily with the real model's forecasts of output and manhours. The real model's manhours equations are not currently of the Koyck variety and so the procedure used to generate L* would differ from that described here. Moreover, the computation of L* in the real model would add significant computer requirements which are not easily incorporated. On the other hand, using equation (8.24) in the forecast period may generate levels of manhours quite inconsistent with those coming from the more sophisticated employment functions in the real model. On the basis of these points, our bias is toward using the second method unless the empirical results are greatly inferior to those of the first.

Empirical Results

The estimation of the markup equation (8.22) was divided into two stages: (1) manufacturing and (2) nonmanufacturing. The availability as well as the reliability of the data was greater in the 21 manufacturing sectors and so most of the effort was concentrated on manufacturing.

The initial fitting of (8.22) to the manufacturing sectors led to the dropping of several variables. The first is the change in the wage rate. In only three sectors was the sign for this term negative; and in only two was it significantly (at the 10 percent level) negative. Presumably, the effects of lagged reactions to wage increases on observed profit margins is highly attenuated by the use of annual data. One of the sectors with the correct negative sign was Motor Vehicles, which could be explained by infrequent adjustments in price (say, every model year) where the timing is not keyed to major changes in wage rates. The predominance of positive signs on the wage change terms could be explained by the ability (as well as conventional practice) of the industry to key major price changes to wage changes or, perhaps more likely, the fact that the wage inflation rate is a proxy for market conditions. If the latter explanation is correct, we wished not to dilute the explanatory value of the already included demand term and so the wage change term was omitted.

The relative factor price term (w/r) was also dropped as a result of its empirical performance and several other considerations. First, for most industries its simple correlation with time was very high (usually exceeding .90) and this fact helps to explain an unreasonable range of coefficients that was obtained across industries. As we showed in the derivation of (8.22), this coefficient should be functionally related to the labor's share of value added and the capital-labor elasticity of substitution. Using the approximate value of labor's share, many of the implied elasticities of substitution were unreasonable. Some exceeded unity and others were negative.

To have pursued a successful implementation of the factor price ratio would have required, in my opinion, undue resources at this stage of the model's development. In addition to the estimation difficulties described above, there is a considerable problem in simply defining the rental rate, r. The computation of the Jorgenson rental rate in the current INFORUM investment work requires a value for the "real" rate of interest (i.e. "capital cost"). The method of imputing price expectations on the basis of declining-weight averages of past price changes works satisfactorily through the early 1970's, but seems to fall apart when the 1973-1975 period is added. The INFORUM investment work, as of this writing, is about to undergo extensive revision; and the appropriate empirical construct for the rental rates is at the top of the list of items to be investigated.

If a more satisfactory rental rate variable can be developed for the investment equations, then it should receive a thorough testing in the markup equations.

Although the relative factor price term served to make the price equations theoretically more attractive, its omission should have a minor effect on the equation's short-run forecasting ability. What trends there were in this variable are, of course, absorbed into the time trend proper. As a result, for periods up to five, six, or seven years into the future, one would normally expect these factor adjustment effects on relative shares to be small.

Since we wished to make full use of the available data which extended through 1974, some provision for the price and wage controls period (1971-1974) was required. After some experimentation of alternative dummy variable specifications was made, the following specification was chosen and applied uniformly to all sectors:

1971: CNTROL = .17

1972: CNTROL = 1.00

1973: CNTROL = 1.33

1974: CNTROL = 1.0

The rationale for the values chosen derives from several quarterly aggregate price determination studies which used values of unity for the dummy variable measuring the effect of Phases I and II (August 1971 - January 1973). These studies used the rate of change of prices as the dependent variable. Thus, in conversion to levels the controls program was modeled as a continually depressing price with respect to unit labor costs over this six-quarter span. For Phases III and IV, the assumption here is that price levels with respect to unit labor costs remained constant at their 1972:4 values. Thus, the sequences of (hypothetical) quarterly dummies, beginning in 1971:2 and ending in 1974:4 is:

1,2,3,4,5,6, 6,6,6,6,6, 0,0,0.

Computing calendar year averages of these values and normalizing to 1972 we obtain the dummy variable applied in the regression. For 1974 the presence of controls in the first quarter was ignored. Accordingly, the general specification that was formally estimated was the following:

$$(8.25)\quad \log \frac{pX}{wL} = b_0 + b_1 \text{ time} + b_2 \text{ Demand} + b_3\, L^*/L + b_4 \text{ CNTROL}$$

The regression results for (8.25) for manufacturing are shown in Table VIII-3. Three equations are shown for each industry. The first uses the auxiliary equation, (8.24), to define the equilibrium manhours to actual manhours ratio. The second equation defines L*/L with actual labor productivity divided by three-year monthly average of labor productivity. The third equation is our final equation, to which we arrive by constraining selected coefficients of equation two.[25]

The preceding statement implies that we have chosen the ratio-to-moving average method of defining our manhour disequilibrium variable. Although there are several instances where the auxiliary manhour equation approach is superior, the results from the moving average procedure are generally similar and provide equally good fits.

We have not reported preliminary regressions which tested the alternative demand variables for every sector. As Table VIII-3 shows, the ratio-to-moving average output term was judged sufficiently superior to use it as the demand variable only for Apparel, Lumber, and Rubber and Miscellaneous Plastics. This is a fortunate result, and it means that abnormal deviations in profit shares will be eventually eroded, as the model's investment equations work toward maintaining constant capital-output ratios.

The most diappointing aspect of the results is that it appears nearly impossible to reach any clear-cut conclusion about the extent to which cyclical variations in the markup are due to deviations between actual and standard costs (as represented by L*/L) rather than direct

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[25] The constraints imposed are explained in the following section describing the empirical results by industry.

TABLE VIII-3[a]

PRICE MARKUP EQUATIONS FOR MANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L•/L	CONTRL	RSQ	S.E.	D-W
* * * * * * * * * * * * * *								
8 FOOD AND KINDRED PRODUCTS								
Q/K	.981	-.031	-.274	-.085	-.013	.289	.0166	1.39
	(1.85)	(.69)	(1.23)	(.55)	(1.34)			
Q/K	2.191	-.005	-.331	.463	-.018	.442	.0147	1.66
	(2.71)	(1.95)	(2.35)	(1.85)	(2.16)			
Q/K	.911	-.001	-.291	.033	-.014	.268	.0169	1.43
	(1.90)	(.67)	(1.30)	(.00)	(1.46)			
* * * * * * * * * * * * * *								
9 TOBACCO MANUFACTURES								
Q/K	2.203	.011	.799	-.035	-.080	.884	.0561	2.37
	(9.37)	(7.65)	(6.05)	(.14)	(4.52)			
Q/K	1.869	.010	.605	.252	-.078	.892	.0543	2.29
	(4.33)	(6.24)	(2.40)	(.80)	(4.74)			
Q/K	2.200	.011	.799	-.035	-.080	.884	.0561	2.37
	(9.37)	(7.65)	(6.05)	(.14)	(4.52)			
* * * * * * * * * * * * * *								
10 TEXTILE MILL PRODUCTS								
Q/K	-.468	-.003	.483	-.395	-.022	.820	.0231	1.19
	(3.33)	(.18)	(5.15)	(1.57)	(1.78)			
Q/K	-.690	-.001	.634	-.513	-.016	.857	.0179	1.47
	(5.65)	(.53)	(7.26)	(2.48)	(1.45)			
Q/K	-.565	.000	.533	.003	-.028	.777	.0224	1.58
	(4.07)	(.09)	(5.49)	(.00)	(2.11)			
* * * * * * * * * * * * * *								
11 APPAREL								
Q/AVEQ	.189	.001	.183	-.138	.010	.537	.0133	1.12
	(1.45)	(1.68)	(.71)	(.75)	(.77)			
Q/AVEQ	.234	.002	.135	-.105	.009	.538	.0133	1.38
	(1.47)	(1.53)	(.68)	(.75)	(.63)			
Q/AVEQ	.205	.002	.114	.003	.000	.439	.0135	1.13
	(2.12)	(3.24)	(1.24)	(.00)	(.00)			
* * * * * * * * * * * * * *								
12 LUMBER AND WOOD PRODUCTS								
Q/AVEQ	.213	.010	.373	-.935	.398	.902	.0517	1.42
	(.56)	(4.50)	(.21)	(2.57)	(3.00)			
Q/AVEQ	.416	.013	.333	-.918	.391	.892	.0543	1.55
	(.94)	(5.38)	(.79)	(2.24)	(2.62)			
Q/AVEQ	.751	.014	.626	-1.335	.000	.806	.0728	1.31
	(1.69)	(5.20)	(1.57)	(2.12)	(.00)			

TABLE VIII-3

PRICE MARKUP EQUATIONS FOR MANUFACTURING

DEP. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
13 FURNITURE AND FIXTURES								
Q/K	-.476	.003	.258	-.193	-.019	.830	.0164	1.68
	(5.12)	(3.69)	(6.46)	(.75)	(.58)			
Q/K	-.488	.003	.263	-.186	-.005	.830	.0164	1.77
	(4.87)	(3.28)	(6.32)	(.75)	(.29)			
Q/K	-.449	.003	.248	.000	.000	.783	.0186	1.35
	(4.64)	(3.11)	(6.25)	(.00)	(.03)			
14 PAPER AND ALLIED PRODUCTS								
Q/K	.243	-.004	.455	-.358	-.009	.443	.0454	.58
	(2.70)	(2.07)	(2.22)	(.46)	(.35)			
Q/K	.222	-.005	.323	-.261	-.015	.436	.0457	.60
	(1.05)	(1.12)	(.87)	(.22)	(.61)			
Q/K	.266	-.004	.394	.000	-.014	.435	.0457	.62
	(3.48)	(2.12)	(2.48)	(.00)	(.57)			
15 PRINTING AND PUBLISHING								
Q/K	-.737	.008	.405	.067	.002	.714	.0197	2.20
	(2.84)	(4.77)	(3.35)	(.24)	(.15)			
Q/K	-.846	.008	.463	-.116	.007	.715	.0196	2.04
	(1.78)	(3.59)	(2.35)	(.26)	(.44)			
Q/K	-.737	.008	.405	.067	.002	.714	.0197	2.20
	(2.84)	(4.77)	(3.35)	(.24)	(.15)			
16 CHEMICALS AND ALLIED PRODUCTS								
Q/K	.572	-.016	.547	.155	-.022	.879	.0351	1.56
	(16.81)	(6.75)	(4.33)	(.65)	(.97)			
Q/K	.633	-.008	.087	.619	-.014	.911	.0301	1.80
	(13.95)	(1.86)	(.37)	(2.26)	(1.01)			
Q/K	.569	-.016	.541	.250	-.025	.879	.0351	1.51
	(19.15)	(7.77)	(5.39)	(.33)	(1.51)			
17 PETROLEUM REFINING								
Q/K	-1.546	.049	.274	-.564	.021	.737	.2100	1.11
	(1.47)	(3.45)	(.66)	(.19)	(.14)			
Q/K	-.944	.039	.103	1.518	-.014	.742	.2076	1.33
	(.57)	(1.53)	(.13)	(.50)	(.03)			
Q/K	-1.546	.049	.274	-.564	.021	.737	.2100	1.11
	(1.47)	(3.45)	(.66)	(.19)	(.14)			

TABLE VIII-3

PRICE MARKUP EQUATIONS FOR MANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
18 RUBBER AND MISC. PLASTICS								
Q/AVEQ	.491	-.001	.223	.396	-.038	.575	.0236	1.83
	(3.33)	(.90)	(1.47)	(1.60)	(.41)			
Q/AVEQ	.499	-.003	.187	-.063	.010	.479	.0261	2.11
	(2.99)	(2.24)	(1.12)	(.22)	(.45)			
Q/AVEQ	.491	-.001	.223	.396	-.038	.575	.0236	1.83
	(3.33)	(.90)	(1.47)	(1.60)	(.41)			
19 LEATHER AND LEATHER PRODUCTS								
Q/K	-.479	.004	.194	-.025	.032	.704	.0112	1.69
	(3.75)	(4.21)	(4.77)	(.15)	(.27)			
Q/K	-.481	.004	.194	-.024	.032	.704	.0112	1.68
	(3.76)	(4.17)	(4.75)	(.20)	(.25)			
Q/K	-.459	.004	.187	.003	.000	.699	.0113	1.66
	(3.91)	(4.21)	(5.05)	(.00)	(.00)			
20 STONE, CLAY, AND GLASS PRODUCTS								
Q/K	.306	-.010	.237	.553	.035	.928	.0246	1.34
	(2.38)	(8.51)	(1.62)	(1.77)	(.27)			
Q/K	.267	-.010	.307	.033	.021	.909	.0277	1.54
	(1.44)	(8.31)	(1.44)	(.05)	(1.14)			
Q/K	.306	-.010	.237	.559	.035	.928	.0246	1.34
	(2.38)	(8.51)	(1.62)	(1.77)	(.27)			
21 PRIMARY METALS								
Q/K	2.803	.006	.486	-.626	-.025	.830	.0359	1.65
	(6.46)	(3.16)	(5.67)	(1.75)	(1.10)			
Q/K	.706	-.001	.366	.933	-.054	.863	.0323	1.55
	(1.10)	(.35)	(.52)	(2.71)	(3.11)			
Q/K	2.061	.004	.333	.253	-.056	.727	.0455	.92
	(5.20)	(1.79)	(4.34)	(.00)	(2.31)			
22 FABRICATED METAL PRODUCTS								
Q/K	-.419	.005	.293	.266	-.038	.682	.0253	1.33
	(2.07)	(3.06)	(4.01)	(1.06)	(2.10)			
Q/K	-.331	.004	.303	-.058	-.025	.655	.0263	1.35
	(1.93)	(2.99)	(2.70)	(.14)	(1.22)			
Q/K	-.418	.005	.239	.266	-.038	.682	.0253	1.33
	(2.87)	(3.06)	(4.01)	(1.06)	(2.10)			

TABLE VIII-3

PRICE MARKUP EQUATIONS FOR MANUFACTURING

DEP. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
* * * * * * * * * * * * * *								
23 MACHINERY, EXCEPT ELECTRICAL								
Q/K	-.067	-.002	.221	.417	-.012	.756	.0198	1.76
	(1.11)	(1.44)	(5.12)	(1.44)	(.97)			
Q/K	-.004	-.001	.186	.385	-.013	.748	.0201	1.85
	(.06)	(1.10)	(3.43)	(1.28)	(.96)			
Q/K	-.067	-.002	.221	.417	-.012	.756	.0198	1.76
	(1.11)	(1.44)	(5.12)	(1.44)	(.97)			
* * * * * * * * * * * * * *								
24 ELECTRICAL MACHINERY								
Q/K	.082	-.000	.052	-.352	.032	.329	.0394	1.18
	(.65)	(.13)	(1.13)	(1.32)	(1.30)			
Q/K	.098	.002	.054	.469	.008	.413	.0369	1.11
	(.83)	(.77)	(.71)	(1.67)	(.35)			
Q/K	.071	.002	.061	.250	.000	.113	.0454	.91
	(.49)	(.97)	(.57)	(.00)	(.00)			
* * * * * * * * * * * * * *								
25 TRANS. EQUIP. & ORDNANCE								
Q/K	.472	.005	.135	.348	-.013	.634	.0213	1.41
	(3.76)	(2.41)	(3.33)	(2.18)	(.88)			
Q/K	.374	.003	.093	.530	-.028	.681	.0122	2.06
	(5.01)	(2.59)	(3.47)	(6.11)	(3.12)			
Q/K	.501	.004	.142	.316	.000	.611	.0220	1.58
	(3.99)	(2.20)	(3.12)	(1.97)	(.00)			
* * * * * * * * * * * * * *								
26 MOTOR VEHICLES								
Q/K	-.712	-.025	.533	-.609	-.032	.918	.0691	2.38
	(5.16)	(7.15)	(3.76)	(1.79)	(.93)			
Q/K	-.899	-.026	1.042	-.727	-.015	.920	.0683	2.56
	(4.69)	(6.87)	(7.24)	(1.93)	(.42)			
Q/K	-.530	-.022	.785	.250	.000	.840	.0961	2.07
	(3.17)	(6.07)	(7.36)	(.00)	(.00)			
* * * * * * * * * * * * * *								
27 INSTRUMENTS								
Q/K	1.843	.011	.594	.013	-.028	.852	.0311	.84
	(6.24)	(6.23)	(5.56)	(.34)	(1.49)			
Q/K	1.586	.010	.497	.337	-.032	.868	.0294	1.05
	(5.44)	(4.53)	(4.56)	(1.31)	(1.94)			
Q/K	1.696	.011	.545	.250	-.034	.842	.0322	.87
	(7.27)	(6.02)	(6.31)	(.00)	(1.87)			

TABLE VIII-3

PRICE MARKUP EQUATIONS FOR MANUFACTURING

DEN. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
* * * * * * * * * * * * * *								
28 MISC. MANUFACTURING INDUSTRIES								
Q/K	.284	.001	-.047	-.185	.059	.443	.0244	2.71
	(1.03)	(.41)	(.34)	(.59)	(1.96)			
Q/K	.379	.002	-.101	.070	.042	.431	.0247	2.34
	(1.75)	(1.08)	(.94)	(.37)	(1.57)			
Q/K	.331	.004	-.094	.275	.000	.300	.0274	1.81
	(1.40)	(1.75)	(.79)	(1.39)	(.00)			

[a]Note:

The three regressions for each industry are:

(1) L*/L defined in auxiliary equation, 8.24, see text
(2) L*/L defined by using ratio to moving average
(3) "Final" equation using L*/L from (2) and constraining certain coefficients

pressure of demand. The likely source of the problem is the collinearity between these two variables and there are several instances where even sign changes occur with alternative definitions of the manhour disequilibrium term. The coefficients on L*/L are generally less than .4 which on the face of it, suggests that 60 percent of any actual unit labor cost deviation is passed into the value-added price. But in many of these same industries the coefficient on Q/K is highly significant, and the evidence seems to be that Q/K serves very adequately as a proxy for short-run productivity deviations as well as an indicator of demand pressure. Of course, the equations here are estimated from <u>annual</u> data and it is not clear to what extent we can compare the results with previous quarterly formulations. That is, studies which have indicated that little of the <u>quarterly</u> deviation of actual unit labor cost from standard unit labor cost is passed into prices may not be of much help in suggesting the appropriate coefficients for a similar annual specification. We would generally expect that, as the time period is lengthened, long-run and short-run unit labor costs would converge and more of the actual unit labor cost would show up in the output price.

Empirical Results by Industry

We turn next to examining some of the results in more detail. We will be especially concerned to see to what extent these estimates are consistent with several of the quarterly WPI industry studies.

Food and Kindred Products (8)

Food and Kindred Products (8) is unfortunately one of the sectors for which the results appear more plausible with L*/L defined in the auxiliary manhours equation. We have left the demand variable negative, as it appears that there is some percentage (rather than dollar for dollar) markup behavior with respect to raw farm commodity prices. That is, in short crop years (for instance, 1966), farm prices are abnormally high and the profit margins of processors are positively related. Of course, real output is low, (and thus Q/K) and this would explain the negative coefficient obtained. The price control dummy is significant for both definitions of L*/L and indicates value-added prices were squeezed about two percent in 1972.

The results for Food are consistent with those obtained by Eckstein and Wyss. They found only input prices to be significant in their regression equation and state that industry "seems to follow a competitive model." That is, their results were consistent with a "stable demand curve or relatively flat demand curve, and little measurable market disequilibrium." In spite of the low percentage of variance explained by our final equation, we should point out that the markup ratio remained very stable (consistent with a flat supply curve) in the last few years of the data period. Simply put, there was little variance to be explained. The average markup from 1967-1974 (excluding controls year 1972) was 1.361 with a standard deviation of only .004.

Tobacco (9)

Both Earl and Eckstein-Wyss find tobacco to follow a so-called "target-return" pricing policy. That is, prices respond primarily to industry profits. In periods where profits are low, the firms act to raise prices. They absorb costs in periods when profits are high.

Our equation was not designed to test for such behavior and it seems to show the contrary: the markups respond positively (and significantly) to changes in the output-capital ratio. There is, however, a strong positive time trend, consistent with the Eckstein-Wyss results, which may be reflecting changes in market structure or product mix.

Textile Mill Products (10)

The L*/L terms in Textile Mill Products displayed perverse behavior in that they were only weakly correlated with both the dependent variable and Q/L. There were several substantial residuals in the auxiliary manhours equation, which could not be explained. Accordingly, L*/L was dropped and Q/K in the final specification serves both as a demand pressure indicator and a proxy for short-run productivity deviations. Capacity utilization used as a demand measure in the Eckstein-Wyss results was highly significant (t = 5.1) which is consistent with the results here. The price controls dummy is statistically significant in this sector. Q/K increased by .07 from 1971 to 1972 while the markup fell from 1.284 to 1.271.

Apparel (11)

Apparel is one of the least concentrated of the manufacturing industries. Eckstein and Wyss found it to conform to a competitive pricing model; only input prices were significant in their regression. Likewise, we found no measurable demand influence on price markups in our results here. As in the case of Food, the industry seems to operate along a fairly elastic supply curve. The range of markups was only .035 (1.117 in 1958, 1.152 in 1966); the standard error of the regression is only .0139 in spite of the low R^2.

Lumber and Wood Products (12)

In spite of testing a number of alternative demand and output variables, the results for Lumber remain *a priori* unsatisfactory. The major problem is the behavior of the L*/L term; it remained significantly negative in all of the specifications tested. A related problem shows up in INFORUM labor productivity equations in that productivity *rises* with short-run declines in output. This problem persists when the Federal Reserve production index is substituted for INFORUM's deflated shipments series for a measure of output.

As a result, we have made an exception for this sector and have temporarily left in the negative coefficient for L*/L. Hopefully, this empirical relationship will be stable enough to allow the equation to be used for forecasting purposes. With the dropping of the controls dummy, the ratio-to-moving output term approaches statistical significance. The strong influence of the time trend is probably picking up long-run demand-supply shifts for this basically raw materials industry. Eckstein-Wyss, and Joel Popkin[26] also report strong trend effect in their results. Popkin states that "in equilibrium, with capacity utilization at its mean, prices drift upward at a rate of almost one

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[26] Joel Popkin, "Price Behavior in Primary Manufacturing Industries. 1958-73, "NBER Working Paper No. 136, June 1976.

percent per year."[27] This is not far from our value-added price trend of 1.4 percent per year in our final equation.

Furniture and Fixtures (13)

The alternative formulations of L*/L gave very similar results for furniture; but unfortunately with the incorrect sign. The simple correlation between L*/L (auxiliary equation) and the markup ratio was only .097 versus .770 between Q/K and the markup ratio. As a result, L*/L was dropped from the final specification. The strong performance of Q/K in the final equation was not matched by Eckstein and Wyss. They found only labor and material costs to be significant in their reported regression.

Paper and Allied Products (14)

Paper is one of the sectors in which it is impossible to distinguish the productivity deviation from the demand effects. The simple correlation between L*/L (moving-average) and Q/K is .742. For the time being we have resorted to simply omitting L*/L. That Q/K also reflects demand pressure is suggested by the results of both Eckstein-Wyss and Popkin. They both find significant t-ratios for a capacity utilization variable.

Printing and Publishing (15)

Printing and Publishing yields satisfactory regression estimates with the exception that the coefficient of L*/L may be a bit too low. Price data for this sector is unavailable from the WPI, so previous studies have not included it.

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[27] Ibid., p. 26.

Chemicals and Allied Products (16)

The alternative definitions of L*/L yield quite different results for Chemicals. On the face of it, the first equation indicates that the markup fluctuates solely as a result of prices being keyed to standard unit labor costs -- demand plays no role. However, the speed of adjustment parameter in the auxiliary manhours equation is implausibly high, .645. This two-year implied mean lag is quite out of line with the rest of manufacturing. Its result is that L*/L fluctuates over a wider range than in most sectors. When L*/L is defined by means of the moving average of productivity, the demand term enters significantly. This result is consistent with the demand effects, via capacity utilization variables, found by Eckstein-Wyss, Earl, and Popkin.

Since the L*/L term seems too low in version (2), we constrained it to .25 in the final equation. This reduces the fit only slightly.

Petroleum Refining (17)

The reported profits of the Petroleum Refining sectors have fluctuated widely over the sample period and this is reflected in the high standard error of our equation. We have paid no special attention to this sector as gross output prices for refined petroleum products (and fuel oil) are specified exogenously in the price model.

Rubber and Miscellaneous Plastics (18)

This sector displays more plausible coefficients and a better fit when L*/L is defined with the ratio-to-moving average approach. It is difficult to compare the results here with those of Eckstein and Wyss. They found significant capacity utilization effect, but also a negative coefficient on the change in shipments. The latter is rationalized on grounds that the higher productivity resulting in a positive change in shipments is reflected in lower prices. Such an effect, if it exists, also occurs in this equation in that about half of any productivity deviation (from three-year moving average) is passed into prices.

Leather and Leather Products (19)

There is only a slight correlation between L*/L and Q/K; as a result, L*/L is dropped from the equation. The demand term is highly significant, although its magnitude is smaller than for most manufacturing. This sector was not included in any of the quarterly studies to which we have been comparing.

Stone, Clay and Glass Products (20)

The results for Stone, Clay, and Glass are reasonably consistent with those obtained by Eckstein-Wyss and Popkin. Neither found important demand pressure effects for this industry and the demand term in our equation is not particularly strong. The L*/L coefficient of .555 is the highest of any in manufacturing and indicates that much of the profit fluctuations are due to short-run productivity effects. The fact that this is a heterogenous sector almost precludes the interpretation of the hefty negative trend of one percent per year.

Primary Metals (21)

Much of the difficulty in achieving reasonable results for this sector may lie in aggregation of iron and steel with primary nonferrous metals. The market structures are quite diverse among the three-digit SIC's comprising this category. In any event, alternative definitions of L*/L lead to very unstable results. My disposition is to prefer the first equation which attributes to the entire sector standard cost pricing behavior -- demand plays no role. Since we have decided to use the ratio-to-moving average method of defining L*/L, the final equation constrains its coefficient to be a modest .25. This may be on the low side, but even this procedure yields a substantial deterioration of the regression fit.

Fabricated Metals (22)

Fabricated metals shows very consistent behavior with respect to alternative definitions of L*/L. With either definition, the Q/K term dominates the productivity deviation; we have left L*/L in the final regression in spite of its low t-statistic. Eckstein and Wyss aggregated this industry with Instruments and, slightly contrary to these results, found capacity utilization to have only borderline significance. The time trend in our equation is small, but highly significant. Because the products of this industry are quite varied in their capital intensity and homogeneity, no interpretation can be made for this result.

Machinery, Except Electrical (23)

Industry (23) displays one of the highest R^2's of any "non-trending" series of our sample. As with Fabricated Metals, the results are relatively insensitive to the definition of L*/L and the demand and productivity deviation coefficients are similar.

Electrical Machinery (24)

Unfortunately (and unexpectedly), the results for this industry did not match the very satisfactory results of industries (22) and (23).

As in Fabricated Metals and Non-electrical Machinery, there are high markups in the mid 1960's. However, our demand term does not correlate well the year-to-year movements of the markup, especially a jump from 1.220 to 1.303 between 1964 and 1965.

Eckstein and Wyss found in their quarterly work that the coefficient on wages was more than twice the proportion of wages in production costs. They state that "Apparently the industry keys its price changes to wage changes." We found no evidence of such a phenomenon in our early regressions employing the change in compensation. In addition, they found a significant effect of capacity utilization on output prices.

A possible explanation for the discrepancies in these results is the quality of both the WPI and profit data. The profit data here probably need further examination in light of several suspicious-looking jumps. Perhaps, there are some classification or enterprise-to-establishment-adjustment problems with the BEA data. The measurement problems with the WPI for this sector are particularly acute and there is the likelihood of divergence between transactions and list prices.

Transportation Equipment and Ordnance (25)

This sector is one of the few in which we find a significant decline in the goodness of fit with the use of the moving average approach for defining L*/L. Even so, the resulting equation is satisfactory with a highly significant demand coefficient (although its size is not large). The products of this industry do not lend themselves to easy price measurement. There is no coverage of this sector by the WPI. Obviously, therefore, previous short-run price studies have omitted analysis of this industry.

Motor Vehicles (26)

Incorrect signs were obtained for L*/L under both of our definitions and so we have resorted to constraining its coefficient a priori, to .25. The output-to-capital ratio is a powerful explainer of the fluctuations in profit margins; it has the largest t-statistic of any industry in manufacturing. Again, however, the size of this coefficient cannot be interpreted as meaning that price behavior is highly sensitive to demand. There is a variety of evidence that such is not the case for this oligopolistic industry. Rather, the Q/K variable dominates the productivity deviation term, since Q/K serves as (1) a proxy for the latter, (2) a proxy for the effects of other fixed costs on profit margins (i.e. cyclical changes in "overhead" type I/O coefficients), as well as (3) a measure of demand pressure influencing output prices.

There is a significant negative time trend of about two percent per year in the markup ratio. It seems unlikely that this trend reflects a decrease in capital intensity of this sector; it is more probable that margins have been squeezed due to increasing foreign competition. As a result of the recent devaluations, one should diminish the magnitude of this trend for long-run forecasts.

Instruments (27)

It appears likely that the Q/K variable dominates the productivity-deviation term in this sector for the same reasons as listed for Motor Vehicles. We constrained the coefficient on L*/L in the final version to be .250 with only a slight drop in the R^2. This sector is not well sampled by the WPI and so previous short-run studies have usually not included it.

Miscellaneous Manufacturing Industries (2)

We did not find a satisfactory equation for this heterogenous sector. The most significant variable in the unconstrained versions was the price control dummy -- but with the incorrect sign. Dropping the dummy variable in the final version gives an equation that has small positive trend and some slight sensitivity to L*/L. As one would expect, this sector has not been included in previous short-run industry price studies.

Nonmanufacturing

For the nonmanufacturing sectors we have only a few industries with reliable capital stock data. In addition, for the relatively labor intensive sectors (especially in the services), we might expect a tight labor market to exert a greater influence on price behavior than a capital constraint. In view of the manufacturing results, we have assumed here the ratio of productivity to its three-year moving average to define L*/L adequately, and we display in Table VIII-4 alternative demand variables (except for Construction). The first line for each industry in the table shows the coefficients for an equation with the ratio-to-moving average (three-year) output term that was used in several of the manufacturing regressions. In the second line, we substitute for log (Q/AVEQ) the unemployment rate for men 25 and

TABLE VIII- 4

PRICE MARKUP EQUATIONS FOR NONMANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L•/L	CONTRL	RSQ	S.E.	D-W
7 CONTRACT CONSTRUCTION								
Q/AVEQ	.340	.000	.238	.077	-.010	.637	.0111	1.33
	(3.05)	(.02)	(2.05)	(1.63)	(.83)			
Q/AVEQ	.313	.003	.252	.249	-.019	.604	.0116	1.72
	(2.22)	(2.00)	(2.01)	(1.25)	(1.62)			
Q/AVEQ	.356	.000	.248	.000	.000	.425	.0140	.77
	(3.79)	(.00)	(2.86)	(.00)	(.00)			
29 RAILROADS								
Q/AVEQ	-.096	.001	-.226	1.575	-.073	.466	.0401	1.76
	(.16)	(.43)	(.48)	(1.50)	(1.63)			
UNEM25	.341	-.003	1.541	.628	-.030	.517	.0381	1.74
	(2.69)	(1.02)	(1.23)	(1.06)	(.72)			
Q/AVEQ	.195	.000	.000	1.134	-.060	.458	.0404	1.59
	(4.01)	(.08)	(.00)	(2.47)	(1.67)			
30 LOCAL, SUBURBAN, & HIGHWAY PASSENGER								
Q/AVEQ	1.314	-.002	.905	-.987	.014	.454	.0291	1.30
	(2.47)	(1.66)	(1.92)	(2.48)	(.52)			
UNEM25	.412	-.005	1.670	-.308	.005	.577	.0257	1.69
	(8.50)	(2.88)	(2.75)	(1.36)	(.22)			
UNEM25	.423	-.005	1.763	.000	.000	.511	.0276	1.64
	(9.02)	(3.30)	(2.83)	(.00)	(.00)			
31 TRUCKING AND WAREHOUSING								
Q/AVEQ	.501	-.001	.256	-.032	-.012	.349	.0156	1.70
	(2.84)	(.76)	(1.58)	(.12)	(.82)			
UNEM25	.275	-.00[illegible]	.723	.249	.001	.412	.0148	1.72
	(9.36)	(2.01)	(2.00)	(1.52)	(.05)			
UNEM25	.268	-.002	.657	.242	.000	.417	.0148	1.75
	(9.98)	(2.03)	(1.90)	(1.64)	(.00)			
32 WATER TRANSPORTATION								
Q/AVEQ	.721	.004	.595	-.916	-.060	.700	.0296	2.00
	(3.09)	(2.21)	(2.97)	(4.21)	(2.18)			
UNEM25	.081	.004	.629	-.434	-.068	.485	.0388	1.41
	(.90)	(1.19)	(.59)	(2.01)	(1.82)			
Q/AVEQ	.165	.001	.051	.000	.000	.018	.0535	.91
	(.51)	(.20)	(.19)	(.00)	(.00)			

TABLE VIII-3

PRICE MARKUP EQUATIONS FOR NONMANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
* * * * * * * * * * * * * *								
33 AIR TRANSPORTATION								
Q/AVEQ	1.075	.002	.833	.554	-.047	.729	.0591	1.35
	(3.43)	(.99)	(2.83)	(1.45)	(.98)			
UNEM25	.409	-.003	2.778	1.035	-.046	.627	.0693	1.15
	(2.94)	(.67)	(1.65)	(2.84)	(.79)			
Q/AVEQ	1.415	.001	1.132	.000	.000	.666	.0656	1.15
	(5.75)	(.58)	(4.68)	(.00)	(.00)			
* * * * * * * * * * * * * *								
34 PIPELINE TRANSPORTATION								
Q/AVEQ	2.096	.027	1.385	-.209	-.030	.915	.1740	1.67
	(2.11)	(7.74)	(1.60)	(.26)	(.50)			
UNEM25	.644	.026	1.790	.642	-.003	.899	.1894	1.66
	(3.35)	(5.14)	(.76)	(1.17)	(.05)			
Q/AVEQ	1.895	.026	1.204	.000	.000	.913	.1760	1.62
	(3.94)	(8.71)	(2.80)	(.00)	(.00)			
* * * * * * * * * * * * * *								
35 TRANSPORTATION SERVICES								
Q/AVEQ	1.601	-.009	1.003	-.638	-.086	.638	.0655	1.52
	(2.85)	(3.07)	(2.03)	(.88)	(1.12)			
UNEM25	.619	-.010	2.216	.317	-.108	.590	.0698	1.51
	(5.07)	(2.56)	(1.44)	(.56)	(1.35)			
Q/AVEQ	.948	-.010	.387	.000	.000	.410	.0837	.95
	(1.84)	(2.75)	(.89)	(.00)	(.00)			
* * * * * * * * * * * * * *								
36 TELEPHONE AND TELEGRAPH								
Q/AVEQ	2.769	-.006	1.910	-.612	-.048	.417	.0954	.95
	(2.23)	(1.65)	(1.62)	(.76)	(.84)			
UNEM25	.984	-.009	4.067	-.320	-.033	.609	.0781	.83
	(9.27)	(2.76)	(3.08)	(.48)	(.71)			
UNEM25	.985	-.009	4.060	-.333	-.033	.609	.0780	.83
	(9.27)	(2.77)	(3.08)	(.50)	(.70)			
* * * * * * * * * * * * * *								
37 RADIO AND TELEVISION BROADCASTING								
Q/AVEQ	.996	-.004	.496	-.690	.043	.228	.0591	1.64
	(.80)	(1.72)	(.43)	(.62)	(.99)			
UNEM25	.554	-.006	1.394	-.139	.053	.300	.0563	1.36
	(5.95)	(2.10)	(1.16)	(.42)	(1.25)			
UNEM25	.508	-.004	1.019	-.090	.000	.203	.0633	1.48
	(5.55)	(1.59)	(.82)	(.25)	(.00)			

TABLE VIII-4

PRICE MARKUP EQUATIONS FOR NONMANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L•/L	CONTRL	ΔWPI	RSQ	S.E.	D-W
38 ELECTRIC, GAS, AND SANITARY SERVICES									
O/AVEQ	.435	.002	-.374	2.734	-.037		.722	.0726	.89
	(.34)	(1.01)	(.32)	(2.42)	(1.21)				
UNEM25	.970	-.001	1.207	1.934	-.021		.752	.0686	.92
	(8.75)	(.43)	(1.22)	(3.05)	(.73)				
O/K	.862	-.001	.223	1.457	-.008		.842	.0547	.89
	(24.14)	(.78)	(3.75)	(3.56)	(.32)				
39 WHOLESALE TRADE									
UNEM25	.339	-.006	.152	.878	.002	1.079	.902	.0152	2.95
	(9.5)	(4.3)	(.4)	(3.2)	(.2)	(7.9)			
40 PETAIL TRADE									
UNEM25	.192	.001	1.841	.312	.005	-.441	.857	.0147	1.47
	(4.6)	(.6)	(1.8)	(1.0)	(.3)	(3.8)			
41 BANKING AND CREDIT AGENCIES									
O/AVEQ	-2.433	-.019	-2.824	11.613	-.033		.731	.0843	1.49
	(1.19)	(4.52)	(1.45)	(2.78)	(.41)				
UNEM25	.393	-.014	-2.123	7.609	-.027		.706	.0883	1.44
	(1.73)	(2.07)	(.68)	(2.61)	(.31)				
O/AVEQ	2.088	-.016	1.492	1.000	-.005		.613	.1012	.87
	(1.64)	(3.25)	(1.25)	(.00)	(.05)				
42 INSURANCE AGENTS AND BROKERS									
O/AVEQ	-2.537	.000	-2.506	1.555	.191		.480	.0470	1.72
	(1.31)	(.04)	(1.43)	(1.31)	(2.29)				
UNEM25	.162	-.002	-.858	.272	.105		.409	.0502	1.50
	(1.57)	(.56)	(.63)	(.37)	(2.13)				
O/AVEQ	.192	-.002	.000	.664	.000		.041	.0639	1.08
	(3.02)	(.52)	(.00)	(.68)	(.00)				

TABLE VIII-4

PRICE MARKUP EQUATIONS FOR NONMANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L°/L	CONTRL	RSQ	S.F.	D-W
* * * * * * * * * * * * * * *								
43 REAL ESTATE AND COMBINATION OFFICES								
Q/AVEQ	4.693	-.007	1.809	1.085	-.106	.722	.9263	.68
	(2.02)	(1.04)	(.81)	(1.01)	(1.39)			
UNEM25	3.172	-.017	5.200	1.303	-.035	.880	.6097	.98
	(24.79)	(3.75)	(4.00)	(1.88)	(.69)			
UNEM25	3.098	-.015	4.480	1.256	-.053	.872	.6282	1.24
	(18.88)	(2.46)	(3.23)	(1.72)	(1.10)			
* * * * * * * * * * * * * * *								
44 HOTELS AND OTHER LODGING PLACES								
Q/AVEQ	-.158	-.004	-.297	.018	.032	.561	.0236	1.17
	(.39)	(3.25)	(.81)	(.04)	(1.26)			
UNEM25	.206	-.005	.581	-.250	.037	.563	.0235	1.30
	(3.94)	(3.06)	(.88)	(.75)	(1.42)			
UNEM25	.185	-.005	.486	.143	.000	.485	.0256	1.02
	(3.38)	(2.45)	(.67)	(.41)	(.00)			
* * * * * * * * * * * * * * *								
45 PERSONAL SERVICES								
Q/AVEQ	.331	-.007	.140	-.493	-.007	.887	.0151	1.37
	(1.44)	(5.30)	(.63)	(2.23)	(.37)			
UNEM25	.236	-.009	.622	-.563	.006	.901	.0141	1.56
	(6.13)	(6.40)	(1.47)	(2.65)	(.31)			
Q/AVEQ	.239	-.006	.080	.000	-.026	.844	.0177	1.39
	(.88)	(3.99)	(.30)	(.00)	(1.40)			
* * * * * * * * * * * * * * *								
46 MISC. BUSINESS SERVICES								
Q/AVEQ	.931	-.003	.568	-.467	.009	.597	.0202	1.74
	(3.78)	(3.02)	(2.42)	(1.94)	(.54)			
UNEM25	.403	-.005	.910	-.197	.028	.514	.0222	1.46
	(9.54)	(3.19)	(1.73)	(.93)	(1.38)			
Q/AVEQ	.637	-.002	.293	.000	.000	.460	.0234	1.13
	(3.04)	(2.50)	(1.46)	(.00)	(.00)			
* * * * * * * * * * * * * * *								
47 AUTOMOBILE REPAIR AND GARAGES								
Q/AVEQ	.760	.004	.478	-.356	-.040	.439	.0314	1.34
	(1.61)	(2.90)	(1.05)	(.74)	(1.52)			
UNEM25	.400	.000	1.853	-.077	-.011	.733	.0217	1.32
	(10.31)	(.00)	(3.82)	(.45)	(.64)			
UNEM25	.388	.000	1.718	.080	-.010	.733	.0217	1.46
	(9.80)	(.13)	(3.47)	(.52)	(.56)			

TABLE VIII-4

PRICE MARKUP EQUATIONS FOR NONMANUFACTURING

DEM. TYPE	CONST	TIME	DEMAND	L*/L	CONTRL	RSQ	S.E.	D-W
48 AMUSEMENT AND RECREATION SERVICES								
Q/AVEQ	.350	-.004	.071	.274	-.039	.592	.0356	1.39
	(.78)	(2.02)	(.17)	(.78)	(1.25)			
UNEM25	.379	-.007	1.450	.205	-.025	.689	.0311	1.88
	(5.69)	(2.92)	(1.83)	(.71)	(.88)			
UNEM25	.360	-.006	1.345	.413	-.018	.715	.0298	1.76
	(5.47)	(2.57)	(1.76)	(1.26)	(.65)			
49 MEDICAL AND OTHER HEALTH SERVICES								
Q/AVEQ	1.028	-.021	.157	-.379	-.071	.942	.0498	.80
	(.96)	(7.19)	(.16)	(.41)	(1.84)			
UNEM25	1.063	-.026	3.057	-.070	-.035	.989	.0217	2.02
	(30.33)	(21.89)	(6.93)	(.38)	(2.14)			
UNEM25	1.061	-.026	3.080	.000	-.033	.989	.0220	2.05
	(30.49)	(22.73)	(7.01)	(.00)	(2.09)			
50 EDUCATIONAL SERVICES								
Q/AVEQ	.775	-.000	.283	-.125	-.005	.788	.0038	2.05
	(2.95)	(.74)	(3.06)	(1.71)	(1.26)			
UNEM25	.017	-.002	.424	-.014	-.000	.815	.0036	2.11
	(1.92)	(5.82)	(3.51)	(.30)	(.09)			
UNEM25	.017	-.002	.411	.000	-.000	.813	.0036	2.06
	(1.89)	(5.84)	(3.63)	(.00)	(.10)			

older in the following form: log (1.0 - UNEM25). All of the equations were estimated from 1958 through 1974.

Transportation

Most of the transportation sectors are regulated and so we would expect the fluctuations in factor shares to reflect mainly short-run productivity movements. This was apparent for only two industries; Railroad (29), and Airlines (33). In the final equation for Railroads, the L*/L term exclusively explains the fluctuations in the markup. For Airlines, about half of the deviation of actual unit labor cost from its medium term average is passed into prices, but this sector displays, as well, an unexpectedly high demand coefficient. The latter phenomenon may be due to difficulties in defining the real output for Airlines. The current source is a weighted average of passenger-miles and freight ton-miles. However, in a recession one finds the number of passenger-miles declining much more than the number of scheduled flights; thus, revenues are more elastic with respect to this measure of output than are costs. Accordingly, profit margins are highly sensitive to our constructed demand variable, even if prices remained stable.

With the exception of Pipelines (34), the results for the remaining transportation sectors are generally poor. Water Transportation (32) and Transportation Services (35) displayed incorrect signs on the productivity term. We dropped L*/L in both equations with the most disastrous results (in terms of R^2) for Water Transportation. We leave the development of better equations for these sectors to future work.

For both Local, Suburban, and Highway Passenger (30), and Trucking (31), the <u>em</u>ployment rate (1.0 - UNEM25) as a demand variable performed better than the output term. This is especially the case in Sector 30. The demand term may be picking up price responsiveness in both these industries since substantial portions of each are not regulated.

<u>Communication and Utilities</u>

Satisfactory equations were obtained for Telephone and Telegraph (36) and Electric, Gas, and Sanitary Services (38). For (36), our hope was that a capital stock variable would provide the most explanatory power as a demand term. This was not the case and as Table VIII-4 shows; our final equation uses the employment rate. Further work is probably required to determine the reason for the failure of the Q/K variable.

<u>Trade</u>

Two key sectors in the model are wholesale and retail trade. The output prices for the trade sectors are important links in the determination of consumer prices as we will discuss in Chapter IX (section 5).

For both of the trade sectors we defined value added -- in the computing price markup -- to include the inventory valuation adjustment. This was done to maintain consistency with the published I/O tables where the sum of (current dollar) trade margins for all products is balanced to equal total gross output of trade. The gross output of trade includes the IVA.

To approximate the effect of the IVA, I have included simply the change in the overall WPI in the equations for Wholesale trade and Retail trade. Since these equations were done specially, only the final estimates are shown in Table VIII-4.

If the price change term were only picking up the IVA, then we would expect the sign of its coefficient to be negative. However, for Wholesale trade, the coefficient on the WPI is significantly positive. This result suggests that in the short run profits in Wholesale trade are influenced by the cost of goods flowing through wholesale trade channels. Although the demand term the employment rate for men 25 and older; was statistically insignificant, the price change may also be serving as a demand pressure variable. Productivity fluctuations do not show up in price behavior, the coefficient on L*/L is not significantly different from 1.0.

Surprisingly, the equation for Retail trade turned out to be quite different. The coefficient on WPI was -.441 and statistically significant at the 5 percent level of confidence. The employment rate has an elasticity of 1.84 and this variable, too, is significant at the 5 percent level. The equation catches every turning point in the markup series with the exception of 1970-71. For that interval, the equation predicts a decline from 1.152 to 1.149, while the actual markup rose from 1.154 to 1.168.

Finance and Services

The sectors in finance and services appear to display the same variance of failures and successes as those previously discussed. Sector 42, Insurance Agents and Brokers, is the worst of this group. When we constrained the individual coefficients to reasonable value, the R^2

dropped to a negligible magnitude. No explanation comes to mind for this unsatisfactory result and we shall leave the development of a better equation to future work. Banking and Credit Agencies also showed equally perverse coefficients in the unconstrained version; but constraints here left the fit of the data at a reasonable level. Most of the instability of the markup comes from the Credit Agencies and Security and Commodity Brokers which are aggregated into this sector.

Reasonable equations were estimated for the other eight sectors, (43) through (50). For all but two of these, the employment rate proved to be a more effective demand measure than the output deviation. This was especially the case in Real Estate (43) and Auto Repair. For the latter, the $\bar{R}^2$ jumps from .439 to .733 with the substitution of UNEM25 for Q/AVEQ.

These sectors also display little trend movement with the exception of (49), Medical and Other Health Services. Our formulation of a markup specification is not well suited to this particular sector. The markup consists primarily of the noncorporate income of private physicians and dentists. This magnitude did not rise in proportion to the wage bill as salaried employees in this sector began receiving large wage increases in the latter part of the 1960's. Since a large part of these wage increases were to achieve parity with other sectors (i.e. "once-and-for-all"), the trend coefficients as estimated should probably be diminished for long-run forecasts.

CHAPTER IX

EMPIRICAL IMPLEMENTATION: PRICE-WAGE SUBMODEL

With the parameters of the value-added price markup equations available from the previous chapter, we can turn in this chapter to describing the mechanics of the complete price-wage system. Among the topics covered here are the linkage of the price-wage model to the real model, the specification of the lags in the gross output price relations, indirect business taxes, and the treatment of exogenous prices.

9.1 Linkage to the INFORUM Real Model

As we mentioned in Chapter I, the solution procedure for the complete system begun by Gilmartin continues to be followed, meaning that the price-wage and real models are run separately. Some thought has been given to solving both systems simultaneously on a year-by-year basis, but the computer programming requirements to implement such a feature are enormous. Probably, the most difficult problem would be to maintain the quarterly disequilibrium nature of the price-wage model within the confines of the annual real model. Accordingly, at this stage of development it seems more prudent to run each model over a designated forecast period of ten to fifteen years in sequence. A consistent overall solution is obtained iterating between block solutions until outputs and prices are stable from one iteration to the next.

Chart IX-1 shows the major information flows between the real and price-wage models. The middle section shows the various interpolation, aggregation, and imputation procedures that are required before the real model's output can be used in the price-wage block.[1]

Considering first the unemployment rate in box 1, we have from the real model a ten to fifteen year "forecast" of the annual overall unemployment rate.[2] Interpolation of the values with overlapping (five-year) polynomial functions provides quarterly estimates (box 2). Both the absolute wage-change equations and those explaining relative wages use the unemployment rate for men 25 and older (UNEM25). UNEM25 also serves as an indirect excess demand measure in many of the nonmanufacturing price-markup equations. The labor supply side of the real model is now undeveloped, so UNEM25 is now linked to the overall unemployment by simply subtracting a constant from the overall rate. A more satisfactory treatment will be pursued as equations for labor force participation are developed.

Product outputs (box 5) are used to compute demand variables in the price markup equations and in computing labor productivity. The first step is to aggregate the 200 constant-dollar outputs to the fifty

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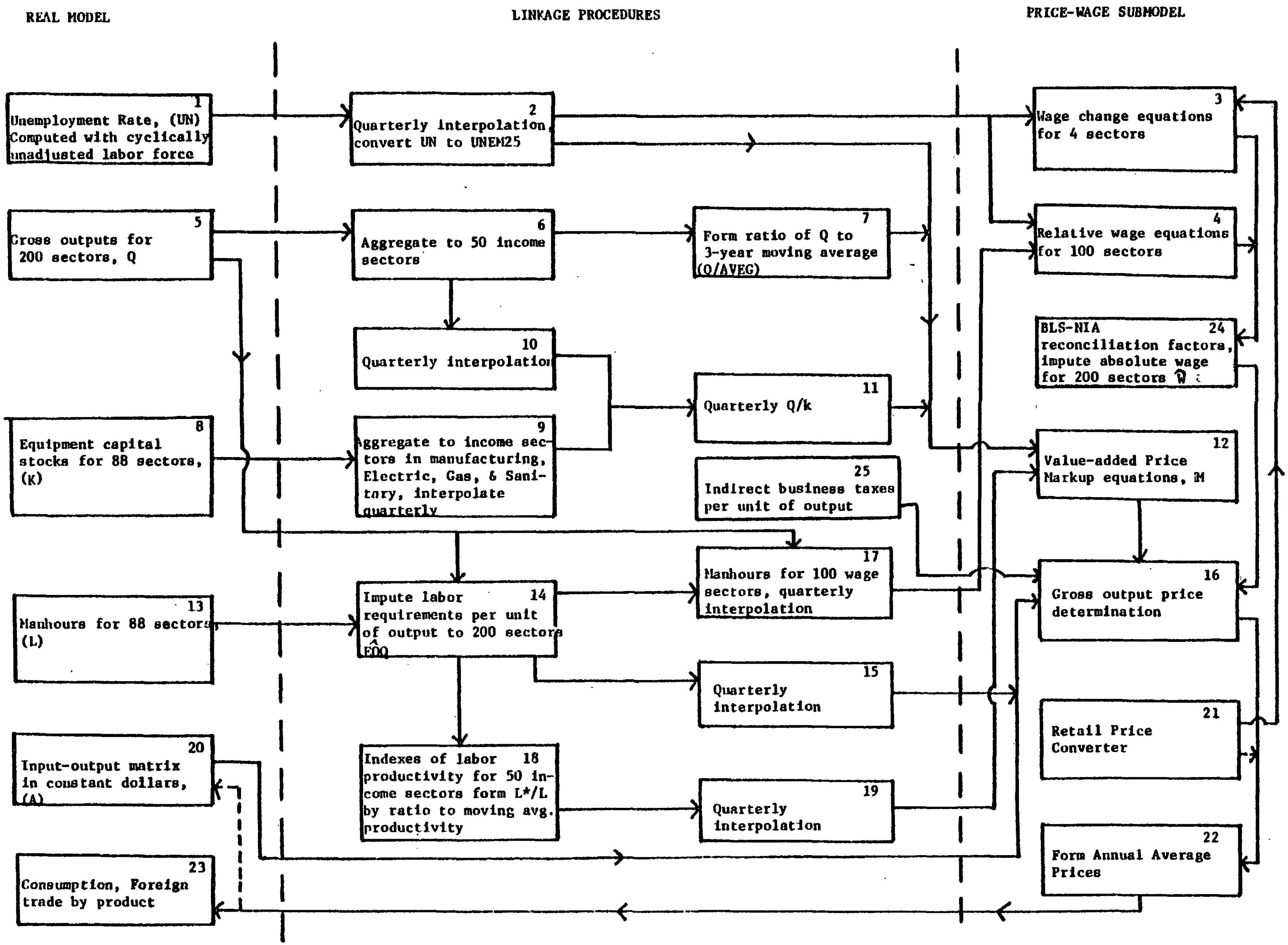
[1]Most of these computations are performed with a separate computer routine (REALQTR). Thus, these steps need not be repeated to test the price-wage system several times for a single execution of the real model. The quarterly values are saved on mass storage and are used in the price-wage routine as they are needed for each successive quarter.

[2]The word forecast is in quotes because we usually manipulate fiscal policy (implicitly or explicitly) to reach a target unemployment rate in the later years of the forecast.

Chart IX-1

Linkage Procedures between the Real Model and Price-Wage Submodel



sectors of the income model (box 6).[3] The ratio of current output to a three-year moving average of output (Q/AVEQ) is formed in box 7, and polynomial interpolation is performed as in the case of the unemployment rate.

The computation of quarterly output/capital ratios (Q/K) proceeds a bit differently since the equipment stocks from the real model (box 8) are end-of-year constant-dollar stocks rather than the average over the year. Therefore, the change in capital stocks from year to year is computed and then interpolated quarterly. The resulting quarterly increments are then added to the "known"[4] capital stock at the end of the year prior to the base year of the model. Quarterly values of Q/K are obtained by simply dividing quarterly outputs (box 10) by the quarterly capital stocks. With the previous quarterly estimates of UNEM25 and Q/AVEQ already in hand, we have now generated the three demand pressure variables for use in the price markup equations (box 12).

The INFORUM real block forecasts manhours for only 88 sectors (matched with the equipment investment aggregation). The price-wage model requires estimates of productivity and manhours at three different levels of aggregation; namely, one of 100 sectors for use in the relative wage equations, one of 50 sectors for the value-added price markup equations, and one of 200 sectors for the gross output price relations.

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[3]As we mentioned previously, there are actually only about 185 sectors, numbered from 1 to 200 (i.e., 15 "empty" sectors). For convenience, however, we shall continue to speak of 200 outputs, bearing this fact in mind.

[4]These stocks are generated as part of the estimation procedure of the investment functions.

We have been careful to maintain consistency between total manhours (rather than productivity) at the various levels of aggregation. To begin with, to get employment at the 200-sector level, the forecasts of employment for each of the 88 sectors in box 13 is broken down into its subcomponent sectors (where needed) by assuming that productivity growth from the base year is the same for each of the detailed sectors within one of the 88 sectors. The proration is made by using a set of base year detailed (at the 200-sector level) employment-output ratios (in box 14). Thus, the manhours in sector i in year t is given by

$$(9.1) \qquad MH_i(t) = \left(\frac{Q_i(t)(E_o/Q_o)_i}{\Sigma Q_i(t) \cdot (E_o/Q_o)_i} \right) MH_j\ (t)$$

where the summation on i runs over the number of 200-order sectors within the real model's employment sector j.

Using equation (9.1) is, of course, equivalent to saying that we assume labor productivity growth is the same for all output (200-order) sectors within the same employment sector, after allowing for shifts in the output mix. These detailed manhours are then aggregated into the 100 sectors (box 17) and into the 50 sectors (box 18). Similar aggregations of outputs are then used to compute productivity at the 50-sector aggregation (box 18).

The final major piece of information supplied by the real model is a matrix of input-output coefficients, A (box 20). This is used directly in the determination of the gross output prices in box 16. The I/O coefficients are not the same for every year, for INFORUM projects change in certain parts of the base year matrix. There is no attempt to interpolate I/O coefficient change quarterly; i.e., the 1977 projected annual matrix is used for the four calendar quarters of 1977 in box 16. The potential for discontinuities in the gross output prices (from the fourth quarter of the previous year to the succeeding quarter) is small both because of the lags used throughout the price-wage system and because coefficient changes are slow.

The feedback from the price-wage to the real model is much easier to explain. The quarterly gross output prices are aggregated to calendar year averages (box 22). The most important use of the disaggregated price forecasts in the real model is in the consumption equations. Up to the present the consumption equations have generally been used in gross output prices (i.e., WPI's) to define the relative price terms. Although the rudimentary retail price conversion scheme is operational,[5] we have shown dotted lines emanating from the retail price converter block to indicate that retail prices are not yet used by the real model. At present, the aggregate retail price is used in the wage equations and to deflate personal incomes in the income model.

The annual gross output prices are used in the foreign trade equations and in modifying certain "price-sensitive" I/O coefficients. Many of these coefficients relate to energy substitution or to mode of transportation. Because the basic energy prices are pegged exogenously in the price-wage block, there is only very limited feedback on the prices from the coefficient changes they cause.

9.2. Mechanics of the Gross Output Price Relations

In the previous chapter we presented in detail our empirical results describing value-added markup behavior by two-digit income sectors. We

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[5] See Section 9.5.

stated briefly that gross output prices would then be determined by a classical input-output method, or implicitly

$$(9.2) \quad p(t) = f[A(t), p(t), p(t\text{-}1), v(t), b(t)]$$

where

p = vector of gross output prices

A = matrix of input-output coefficients

v = value-added per unit of output

b = vector of indirect business taxes per unit of output

t = time subscript

In this section we pull together the various strands discussed in the previous chapter and in Section 9.1 and weave our procedure for forecasting p(t). In other words, we describe the function f in equation (9.2).

Although the eventual system we wish to outline is dynamic in character, our presentation is made simpler if we consider first a simultaneous input-output price system. In such a system, (9.2) formally may become:

$$(9.3) \quad p(t) = A\, p(t) + [\hat{M}(t)\ \hat{W}(t)\ \hat{E}OQ(t)\ E/Q(0) + b(t)]$$

where

$\hat{W}$ = diagonal matrix of labor compensation rates (per manhour) by industry

$\hat{M}$ = diagonal matrix of markup factors to be applied to actual unit labor costs to cover capital costs, to reflect demand conditions, and to account for fluctuations in markups arising from the fact that prices may not fully adjust to cyclical productivity changes

E/Q(O) = vector of labor requirements in the base year; manhours divided by constant-dollar gross outputs

EOQ(t) = diagonal matrix of indexes of labor requirements for period t

p,A,b = have been defined in (9.2).

The dimensionality of each of these vectors is 200 (and 200 x 200 for $\hat{M}$, $\hat{W}$, and $\hat{EOQ}$), which matches the number of sectors (including the fifteen or so undefined) in the real model. The maximum number of independent values in M (box 12 in Chart IX-1) is only 50. The index of $\hat{M}_i(t)$ for input-output sector i is the same as the two-digit SIC sector to which i belongs. The same type of imputation is made in the case of compensation rates by industry, where the spreading goes from the 100 relative wage sectors to the 200 input-output sectors (box 24 in Chart IX-1).

Equation (9.3) is commonly written as

$$p(t) = A' p(t) + v(t)$$

but our presentation here showed the value-added vector, v, broken down into the parts in which we forecast it. Any factor influencing an element of the diagonal matrix of markup factors ($\hat{M}$) or of the labor compensation rate matrix ($\hat{W}$) or an indirect business tax rate (b_i) will result in most, if not all, prices changing.

Material and Labor Cost Lags - General Issues

In equation (9.3) we assumed that all the effects of a change in any price are fully worked out during the time interval chosen for solution. Simultaneous solutions are commonly employed in models using annual time frames. There are difficult estimation problems with respect to the linkages between prices and wages when annual observations are employed. To circumvent the simultaneous equation bias in an estimated annual (aggregate) wage equation, one may resort to using only the lagged price change. However, the U.S. experience indicates that a significant amount of the response of wages to prices occurs within one year. There is also the problem of determining the effects on the overall price level for certain raw material price increases that may occur in the middle of a calendar year.

The quarterly time interval chosen for this model answers a number of these problems without becoming computationally burdensome. The quarterly time period has the further advantage, as we have mentioned previously, of being consistent with the majority of price and wage studies that have been made.

A dynamic model of interindustry prices and wages contains four types of lagged relationships:

(a) lags in passing material costs to gross output prices

(b) lags in passing labor costs to gross output prices

(c) lags in the trade sector; i.e., from manufacturing to retail prices

(d) lags between retail (and/or possibly manufacturing prices) and wages.

The lags involved in (d) have been treated quite thoroughly in Chapter V. Lags within the trade sectors (c) are dealt with in Section 9.5. The lags (a) and (b) have relevance in generalizing equation (9.3). For ease of presentation, let us assume that all sectors have identical lag distributions. Thus, (9.3) becomes:

$$(9.4)\quad p(t) = \left[\sum_{i=0}^{\ell_1} x_i \; (A' p_{t-i}) + \hat{M}(t) \sum_{i=0}^{\ell_2} y_i \; \hat{W}(t-i) \; E\hat{O}Q_{t-i} \; E/Q(0)\right] + b(t)$$

where

$\Sigma x_i , \Sigma y = 1.0$

In equation (9.4) we have the desirable feature that a once-and-for-all increase in all wages by Ø percent _eventually_ results in a rise of all prices by Ø percent, _ceteris paribus_. (For simplicity, we assume here that b(t) = 0.) The sequence of solution vectors - p(t), p(t+1), ... p(t+n) traced out by (9.4) is analogous to the familiar "rounds" solution of the output side of the I/O system. That is, on the first round only the direct effects of increased unit labor costs are reflected in prices, on the second round is the additional effect as these output prices are first reflected in material costs, and so on. As opposed to the solution of the real side, the "rounds" here may be taken to roughly correspond to actual time intervals.

Equation (9.4) in conjunction with the wage functions may also be shown to generate price _inflation_ rates exactly matching wage inflation rates (_ceteris paribus_) when the latter are constant. Disequilibrium is now more broadly defined as the acceleration or deceleration in either wages or prices independently of each other.

Initial Conditions

The lagged elements in (9.4), introduce an irritating logical inconsistency which we may term "initial conditions imbalance." The basic problem is reconciling an accounting identity with our imposed behavioral relationship.

The intermediate input requirements in the coefficient matrix, A, are in terms of one dollar's worth of output, evaluated at base year prices. Of course, the relevant accounting identity requires that the output price exactly cover the cost of intermediate inputs and the "cost" of value added; these costs (per dollar of output) are those given by the input-output table for a one year period. A desirable property of the price-wage submodel is that our set of imposed behavioral relations generates a vector of prices which all equal unity in the base quarter. Given the usual upward trend of prices in the U.S., the prices in the vectors p(t-1), p(t-2), . . . $p(t - \ell_1)$ to be used in solving for the base quarter prices would be generally less than 1.0. However, a glance at (9.4) readily shows that if we used the I/O coefficients for the base year balanced table, the solved for prices in the starting quarter would be all less than 1.0.

To force all the prices to equal one in the base quarter, we define for each sector, j, a scalar S_j, such that

$$(9.5) \qquad 1.0 - \sum_{m=o}^{\ell_1} x_m \sum_{i=1}^{n} a^{\circ}_{ij}\, p_i(t-m)$$

$$= S_j \left\{ \hat{M}_j(0) \left[\sum_{m=o}^{\ell} y_m\, \hat{W}_j(t-m)\, \hat{EOQ}_j(t-m)\, E/Q(0)_j \right] \right\} + b_j(0)$$

where a°_{ij} is, of course, an element in the base year matrix A and $\hat{W}_j$ and $\hat{EOQ}_j$ are diagonal elements of the matrices W and EOQ, respectively. S_j is evaluated in (9.5) when t=0 (base quarter) and $\hat{EOQ}_j(0) = 1.0$.

Consider the simple case where $x_1 = 1.0$; that is, there is a one quarter lag in passing on intermediate input costs. In this case, if the base-year ratio of value added to price is .30 (the term within the curly brackets in (9.5) = .30) and if all intermediate input costs increased by one percent from the quarter preceeding the base quarter to the base quarter, the value-added coefficient would be adjusted to $1.0 - (.70 * .99) = .307$ and, thus, S_j would be $.307/.300 = 1.023$. One way to approach this revised value added "share" is to think of it as describing the way producers behave in setting prices. It is an unobserved, _ex ante_ construct. The observed _ex post_ value-added share is obtained when the entire system is solved simultaneously; or in other words, value added is the residual of revenue minus material costs when material costs are evaluated at _current_ prices. Note that the above procedure would yield precisely the base-year observed value-added shares in the base quarter, since each of the initial prices is unity. We require that the accounting relationships for the base quarter be the same as for the corresponding year since we do not have quarterly balanced I/O tables. The procedure here calibrates the effect of the inflation rate on observed value added to the inflation rate occurring at the beginning of the model simulation. In our example above, as long as the inflation rate of intermediate inputs (for Sector j) is near one percent at a quarterly rate, the share of value added (evaluated by using all current period prices) will remain near .30. Any disturbance which accelerates input costs beyond this rate will then, of course, temporarily depress the observed value-added share.

An estimate of the distribution of the value-added components is required to set the price-wage system into motion. The reader will remember from Chapter III that the INFORUM input-output table has been converted to be a product-to-product table. Our procedure is to draw upon the work described in that chapter to make estimates for the current base year (here 1972) of labor compensation, profit-type income, and indirect taxes for each of the input-output sectors on an establishment basis. A direct "purification" of each of the updated components is then made in order to approximate what they would be for each product to be consistent with the INFORUM table.

Once estimates of the value-added components are in hand, they are used to derive the parameters to initialize the model. To initialize the model with respect to unit labor cost the following relationship is set up.

$$(9.6) \qquad \left(\frac{\text{labor compensation}}{\text{total value added}}\right)^{j}_{\text{base year}} * S_j$$

$$= C_j \left[\sum_{m=o}^{\ell_2} y_m \hat{W}_j (t-m) * \hat{EOQ}_j (t-m) * E/Q(0)_j\right]$$

The scalar C_j, of course, serves to make our independent projections of the wage bill per unit of output - $[\hat{W}_j(t)\ \hat{EOQ}_j(t)\ E/Q(0)_j]$ - an index extrapolating the base year I/O table unit labor cost (adjusted for material cost lags with S_j). Note that showing this relationship specifically implies that our forecasts for establishment wage rates and manhours are used to move our constructed "product" unit labor cost. We have no simple alternative to making such an assumption, and in most instances it should cause little harm.

The markup factor, M_j, is defined in the base period to be

$$\left(\frac{\text{Value added less indirect taxes}}{\text{labor compensation}}\right)^j_{\text{base year}}$$

The value-added markup equations serve to extrapolate this magnitude in the forecast.

Finally, the indirect business tax parameter, $b_j(0)$, is defined as

$$(9.7) \qquad b_j(0) = \left(\frac{\text{total indirect taxes}}{\text{value added}}\right)^j_{\text{base year}} * (1.0 - \sum_{i=1}^{n} a^{\circ}_{ij})$$

No adjustment is made for the problem in material cost lags since we deem b_j to have a relationship to real output (rather than value added), similar to any other input-output coefficient. We will treat business taxes in further detail in Section 9.4.

When the price-wage submodel is initialized as just described, all prices in the base quarter are computed to be 1.0. The first computation of the second quarter is updating the vector of wage rates along with the values of labor productivity from the real model. Unit material costs using the previous period's prices are then computed. With these vectors in hand, the third step is the calculation of a new vector of output prices in the price routine proper. The price routine needs only to compute the vector of markup factors (or more exactly, indexes of the markup factors) and indirect business tax rates to completely determine each price. The price-wage submodel is itself closed when the gross output prices are converted to an aggregate consumer price index which is used on a lagged basis in the wage functions.

9.3 Lags Chosen for Current Model

In the previous section we left the lag distributions on intermediate inputs (x) and unit labor cost (y) numerically undefined, as well as requiring these distributions to be the same for every sector. If the reader here expects the usual statement that such a restrictive assumption (in the case of identical lag distributions) is now about to be relaxed, he will be disappointed. For the model described in this report, we are using a one-quarter lag for all intermediate inputs and .500, .333, .166 weights for unit labor costs; these are uniformly applied across sectors.

This treatment suffers in comparison to having stable lag distribution estimated for every sector. However, current knowledge regarding cost lags from regression methods is very limited and, for now, a more reasonable standard of comparison is a completely simultaneous system. Although a simultaneous solution may be satisfactory for an annual time frame, our intuition suggests it would not be on a quarterly interval. It would imply, for instance, that all the effects of, say, a rise in the price of steel are fully worked out within one quarter (ignoring feedbacks through cost-of-living effects in wages).

What I have chosen to do here is to use a set of plausible lag parameters which are in _general_ agreement with available econometric evidence, rather than using a restrictive simultaneous approach.

Before retreating to this procedure, I tried to see if there was any _consistent_ evidence available as to the length of the cost lags for particular industries. If this were the case, these parameters might be simply borrowed for use in our work here. Table IX-1 shows a comparison of cost lags estimated for three recent industry studies of short-run (quarterly) price behavior.[6] The Earl and Popkin results are easy to interpret since their dependent variable is a standard quarterly percentage change. Eckstein and Wyss, however, define their dependent variable as

$$P/(.4\ P_{t-1} + .3\ P_{t-2} + .2\ P_{t-3} + .1\ P_{t-3})$$

where this variable is a two-quarter change on average. Eckstein and Wyss are also the only authors to have tested a Koyck transformation. The coefficients on the lagged dependent variable are listed under their specifications using either an Almon polynominal lag or no lag at all.

Some study of Table IX-1 will demonstrate that the differences of specification, variable definitions, (and sample periods) makes it nearly impossible at this stage to say anything definitive about lag distribution for a given industry. Eckstein and Wyss define a peculiar dependent variable and so just how we could use the information embodied in their Koyck lag specifications is unclear. Earl, as mentioned in the previous chapter, searched over discrete lag lengths and picked the regressor having the highest simple correlation. Popkin's linear lags grew out of earlier regressions with polynomial lags. Thus, the regression strategies pursued would have led to different results even with the same data and other variables in the equations.

[6](1) Paul H. Earl, Inflation and the Structure of Industrial Prices, (Lexington, MA: D.C. Heath, 1974): (2) Otto Eckstein and David Wyss, "Industry Price Equations" in Otto Eckstein (ed.) The Econometrics of Price Determination, (Washington, D.C.: Board of Governors of the Federal Reserve System, 1970): (3) Joel Popkin, "Price Behavior in Primary Manufacturing Industries, 1958-73", NBER working paper No. 136, June 1976.

TABLE IX-1

Cost Lags in Three Recent Industry Price Studies

	Eckstein-Wyss		Earl		Popkin	
	Materials	**Labor**	**Materials**	**Labor**	**Materials**	**Labor**
Food & Kindred Products SIC 20	.413 - .161 beginning in t-o (Lagged dependent, λ = .325)	Not in equation (eq.)	Not estimated		Not estimated	
Textiles SIC 22	Not in equation (Lagged dependent, λ = .471)	(Dist. lag, ML not available)	Not in equation	Current hourly earnings	(.5 -.4 -.3 -.2 -.1) Starting t-o, ML = 1.33 Qtr.	Same as Materials
Apparel SIC 23	ML = "2.6 Qtr." (Lagged dependent, λ = .700)	ML = "4.7 Qtr."	Not in final equation	Average hourly earnings (t-2)	Not estimated	
Lumber SIC 24	Not in equation (Lagged dependent not estimated)	Dist. lag ML not available	Not in equation	Average hourly earnings, (t-3)	Not in equation	(.25 -.25 -.25 -.25) Starting t-2 ML = 3.5
Furniture SIC 25	QFD (Lagged dependent, λ = .729)	ML ' "2.4 Qtr."[c]	Materials cost (t-2)	"Normalized" unit labor (12 Qtr. moving average)	Not estimated	
Paper SIC 26	Not in equation (Lagged dependent variable would not enter)	QFD[a]	Not estimated		(.4 -.3 -.2 -.1) starting in t-0, ML = 1 Qtr.[b]	Same as Materials lag
Chemicals SIC 28	Dist. lag, ML not available (Lagged dependent, λ = .568)	QFD	Not estimated		(.4 -.3 -.2 -.1) beginning in t-o ML = 1 Qtr.	Same as Materials lag

TABLE IX-1 (Continued)

	Eckstein-Wyss		Earl		Popkin	
	Materials	Labor	Materials	Labor	Materials	Labor
Stone, Clay & Glass SIC 32	Not in equation (Lagged dependent, λ = .718)	QFD[d]	Not estimated		(.5 -.33 -.77) beginning in t-o, ML = .67	Same as Materials lag
Steel SIC 331	Not estimated (Lagged dependent, λ = .639)		Materials Cost (t-1)	"Normalized" (12 Qtr. moving average) Unit labor cost	(.5 -.33 -.767) beginning in t-o, ML = .67	Same as Materials lag
Non-ferrous Metals SIC 333	Not in equation (Lagged dependent not estimated)	QFD	Not in equation	Unit labor Cost (t-4)	(.667 - .333) beginning in t-o	(.25 -.25 -.25 -.25) beginning in t-2, ML = 3.5
Electrical Machinery SIC 36	QFD (Lagged dependent not estimated)	QFD	ML = 2 Qtr.	"Normalized" unit labor cost (t-2)	Not estimated	

Footnotes: – [a]QFD = "quasi first difference" of X = $X_t/(.4X_{t-1} + .3\,X_{t-2} + .2\,X_{t-3} + .1\,X_{t-4})$

[b] ML = "Mean Lag"

[c] Where ML is given in quotes, it is that reported by authors

[d] This is a strange result. E-W reported an unlagged QFD of average hourly earnings with coef ≃.216 together with .816 times the the mean of QFD (hourly earnings) from quarters t-1 through t-4.

There are two industries where superficially it appears that a rather similar pattern with regard to labor costs lags was found by both Earl and Popkin. In Lumber and Nonferrous metals, the most current average hourly earnings term enters with a two-quarter lag. Whether this is a genuine result is open to question, however. Both of these industries are competitive and prices fluctuate in them more than in any of the other sectors listed in Table IX-1. With price movements being dominated by disequilibrium forces, it is reasonable to find that the cost lags are not well determined.[7]

If there is any generalization we can make about the lag lengths displayed in Table IX-1, it is that the lags are nearly all less than a year and the majority less than two quarters. For six of Popkin's industries, the mean lag on materials is around one quarter, with the labor cost lags the same or slightly longer. The mean lags in Eckstein and Wyss' results are hard to ascertain, and Earl's lags (for hourly earnings) range from 0 to 3 quarters.

We also have some evidence from our annual price markup equations in the previous chapter. We found there that there were only a few significant negative correlations between changes in the wage rate and the annual markup <u>level</u>, suggesting that labor costs are passed on within several quarters at most.

Summing up, it appears that the arbitrary lag pattern we have temporarily chosen is at least consistent with most available econometric evidence, while we cannot point to any particular set of statistical results which would lead to the exact parameters chosen.

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[7]The t-statistic on Popkin's unit cost regressor is only .7.

There is one further topic to be touched upon before we leave the subject of lags. The material cost lag applies only to inputs purchased from other sectors. The cost of inputs purchased from the same industry are assumed to be passed forward instantaneously. In other words, the output price for Sector j is:

$$(9.8) \quad P_j(t) = \frac{1}{1-a_{jj}} \sum_{\substack{i=1 \\ i \neq j}}^{n} a_{ij} P(t-1) + V(t) + b(t)$$

where V(t) is a shorthand method of expressing the unit labor and unit profit components.

9.4 Indirect Business Taxes

In equation (9.3) we have, as most authors, included indirect business taxes as if they were exclusively excise taxes. That is, the tax rate, b, is treated as if it were a specific tax on output. In reality, for most industries, the major business taxes are property taxes, licenses, and fees. These taxes, of course, are only loosely related to output in the short run.

Developing equations to explain business taxes by industry is difficult since we have no means of generating the appropriate tax base(s) for each industry. Moreover, we cannot identify a single statutory tax rate, since we are aggregating across thousands of state and local tax jurisdictions.

There is the further complication that tax payments by each industry are not constructed from primary sources for each year. BEA does a good bit of prorating of the total revenues of various types of taxes for inter-censal years.

The purpose of this section is to outline a simple, stop-gap procedure for incorporating business taxes into gross output prices. Our aim is to maintain some general consistency between the tax rates (effective or statutory) in price-wage submodel and tax payments in the income model. We also wish at this stage to keep our procedure relatively simple in terms of its computational requirements.

Stage one at our procedure begins by developing regression equations for (1) state and local general sales taxes, (2) property and other state and local taxes, (3) federal excise and customs duties. Items (1) and (2) are done at an aggregate basis. Since data and the approximate tax bases are available for federal and state excise taxes, we generate separate equations for the major excises (including customs). The remaining small element making up total indirect business taxes and nontaxes, federal nontaxes, is treated exogenously.

Allocation by industry of the state and local taxes (plus federal nontaxes) is handled in stage two. Exogenous portions of aggregate payments from both (1) and (2) (and the federal nontaxes) are combined, and then split among the income model industries by a regression shares model. For the price-wage submodel, the tax rate by industry is implicitly defined by dividing the current dollar tax liability (given total payments and the sector's share) by the period's real output.

This approach generally follows that proposed in the Brookings model project.[8] However, the share equations in that study, (which were

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[8]Michael D. McCarthy, "Analysis of Nonwage Income Components," The Brookings Model: Some Further Results, ed. James Duesenberry and others (Amsterdam: North Holland, 1969), pp. 177-80.

estimated for only broad industry groups) applied to total indirect business taxes. Substantial improvement is achieved here by separating out more volatile excise and sales taxes before the shares are applied. The shares approach has appeal since it is relatively easy to program into the model and it is consistent with how the data are constructed.

First, we present our empirical results for two simple specifications to explain state and local tax receipts. State and local general sales taxes are related to simply current dollar consumption of goods and a weighted average of state sales taxes rates constructed by BEA. I have constrained the rate elasticity to one and obtained the following equation:

$$(9.9) \quad \ln(SLSALE/STR) = -4.70 + \underset{(33.3)}{1.151} \ln(PCEG)$$

$$1959 - 1975, \bar{R}^2 = .989, \text{ S.E.} = 713.8, \text{ D.W.} = .65$$

where

SLSALE = state and local general sales taxes, millions of dollars

STR = weighted average of state sales tax rates

PCEG = current dollar nondurable and durable goods consumption, millions of dollars

The base elasticity which is greater than one reflects the shift of consumption toward taxed goods. Many states levy no sales taxes on food items, which have generally less than average income elasticities.

Equations for the state excise taxes have not been estimated. Base years receipts for gasoline, liquor, and tobacco excises are extrapolated by the appropriate constant dollar output item.

The remaining state and local indirect business tax and nontax receipts are collected mainly through property taxes, motor vehicle licenses, occupational and business taxes, and nontaxes. We estimated a single equation for these items together, although property taxes are by far the largest single item (48 percent of the total in 1972).

Of course, an immediate difficulty is constructing an appropriate tax base for such revenues. Moreover, data on property tax rates are of little help; they may reflect a particular locality's preference for high statutory rates and low assessed valuations or vice versa. One approach might be to take the capital stocks that are available from the real model and construct an implicit tax rate. This implicit rate, in turn, would be made a function of the prices state and local government paid for goods and services. This approach is postponed for future work since explicit capital stocks are not currently generated in the estimation of all the construction equations. Even if stocks were available, it is not clear on what basis they should be aggregated.

One possible explanation of state and local property tax revenues was given in 1965 by Ando, Brown, and Adams[9] and later by Dick Netzer.[10] They suggest that municipalities determine their purchases of goods and services, and then decide how much to borrow and how much to raise by property taxes. Accordingly, equations estimated by Ando, Brown and Adams and later by Paul Taubman[11] used both state and local expenditures and

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[9] A. Ando, J. Brown, and G. Adams, "State and Local Taxes and Expenditures," The Brookings Quarterly Econometric Model, ed. James Duesenberry and others (Chicago: Rand McNally, 1965), pp. 240-245.

[10] Dick Netzer, Economics and Urban Problems (2nd ed.) (NY: Basic, 1974), p. 255.

[11] Paul Taubman, "State and Local Taxes and Expenditures," The Brookings Model: Some Further Results, ed. James Duesenberry and others (Amsterdam: North Holland, 1969), pp. 120-125.

municipal bond rates as explanatory variables. Similar specifications were tried here, but with generally poor results. However, equations estimated by these authors were quarterly with very short lag structures. They were also estimated in a period of low inflation rates. It seems plausible to assume that property taxes may increase because of rising cost of government expenditures, but not strictly as a budget-balancing item for a given period. With substantial collection costs, property tax bases are usually adjusted slowly. Given the possibility of long lags, a Koyck lag was introduced in the following specification:

$$(9.10) \quad \ln TXPRPO = .367 + \underset{(1.8)}{.199}\ SLPUR + \underset{(1.84)}{.0143}\ MUNRAT + \underset{(5.3)}{.750} \ln TXPRPO_{-1}$$

$$1959 - 1975 \quad \bar{R}^2 = .999, \ S.E. = 542.8, \ D.W. = 1.31$$

where

TXPRPO = state and local property taxes, other business taxes, and nontaxes; millions of dollars

SLPUR = state and local government expenditures of goods and services

MUNRAT = municipal bond yield, percentage

The bond rate enters with the *a priori* correct sign, implying that higher tax rates are legislated when borrowing costs rise. The long term elasticity of this revenue series to expenditure is about .8, which is consistent with the increased reliance on income and sales taxes by state and local governments.

As a check to determine whether the explanatory value of this specification was due solely to the lagged dependent variable, the two explanatory variables in (9.10) were replaced by constant dollar private GPO and the state and local price deflator, (as rough proxies for base and rate variables). The signs on both these variables were negative when the equations included the 1974 and 1975 observations.

Once we have derived the control totals by means of the above equation, we are ready to apportion total liabilities among industries. Table IX-2 shows the derivation of the total to be allocated for 1972. Excise taxes are deducted from the grand total since they are estimated individually. General sales taxes are next deducted. BEA makes an industry proration of sales taxes that are collected outside of wholesale and retail trade. Separately distinguishing these taxes from property and other taxes at an industry basis is unnecessarily burdensome for the model. Therefore, we have just deducted those taxes collected in the trade channels proper. For forecasting purposes the ratio of total sales taxes collected outside of trade is fixed exogenously.

In 1972, nearly half of the resulting magnitude ($60570 million as seen in Table IX-2) is accounted for by indirect taxes in real estate. Much of this sum is property tax on owner occupied housing. Share equations for the other 49 industries of the income model are likely to be dominated by movements of the (mainly) residential property taxes in this sector. As a result, our procedure here is to allocate on a shares basis the nonexcise, nonsales (but including sales taxes outside trade) taxes for all sectors excluding real estate (a magnitude we shall term TXER). For forecasting applications the amount of real estate taxes is determined by an exogenous proportion of the total tax generated in equation (9.10).

Our specification for the share equations is the following:

$$(9.11) \quad \log\left(\frac{TX_j}{TXER}\right)_t = a_o + a_2 \text{ Time} + a \log \frac{\sum_{i=o}^{2} QTW^j_{t-i}}{\sum_{i=o}^{2} QTW_{t-i}}$$

TABLE IX-2

Derivation of Aggregate Indirect Business Taxes

for Industry[a] Allocation, 1972

Total indirect business taxes	111,077	
less excise and customs (federal and state)	18,606	
	92,404	
less sales taxes[b]	36,933	
	55,471	
plus sales taxes collected outside trade	7,756	
	60,570	
less indirect taxes in real estate	27,919	
Total to be distributed by share equations	32,651	
Property		17,599
Sales taxes outside trade		7,756
Motor Vehicle Licenses		1,517
Corporate Franchises		1,054
Occ. & Business		1,057
Severance		801
Other		557
Non tax (State and Local plus Federal)		1,690
TOTAL		32,651

[a]Source: Tables 3.2 and 3.4 in the Survey of Current Business and unpublished BEA data.

[b]Sales taxes in Table 3.4, SCB, includes public utilities taxes.

where

TX_j = indirect business tax, excluding sales (trade only) and excise tax, in income sector j.

QTW^j = "tax-weighted output;" i.e., constant-dollar industry outputs aggregated to the income sector level, using 1972 Tax/Output values as weights

QTW = same as QTW^j but aggregating over all industries (excluding real estate)

In defining the output share we have exploited the differences in tax rates (per unit of output) that were apparent in the 1967 I/O table (and updated to 1972).[12]

Since most of the taxes in TXER are likely to respond slugglishly to sharp changes in output, we have induced the output share variables as (approximately) a three-year moving average. We wished to keep the dynamics simple here to avoid excessive computation in the price-wage system. Time in the equation serves as a proxy for property tax bases which are likely to move very smoothly.

The share equations were estimated from 1959 through 1974 and the results are shown on Table IX-3. The results for the vast majority of industries are reasonable enough to show that our overall procedure is a feasible one. The R^2's should be viewed in conjunction with the standard errors of estimate (and the 1972 actual shares). A number of industries have shares that have varied little over the sample period.

To ensure reasonable behavior in the overall model, I have constrained the output elasticities to fall between zero and 2.0. The output terms drop out in seventeen sectors, and in four they hit the upper limit

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[12]This procedure was described briefly in Chapter II.

TABLE IX-3

INDIRECT BUSINESS TAX SHARE EQUATIONS

#	INDUSTRY	1972SHARE	CONST	T-VAL	TIME	T-VAL	Q-SHARE	T-VAL	RSQ	S.E.	DW
1	FARMS	.0642	-2.6960	(202.7)	-.0380	(20.5)	-.0000	(.0)	.970	.0028	.65
2	AG. SERVICES, FORESTRY, & FISHERIES	.0039	-5.4827	(425.8)	.0023	(1.3)	-.0000	(.0)	.113	.0001	1.24
3	METAL MINING	.0063	-5.2158	(124.2)	-.0215	(3.7)	-.0000	(.0)	.555	.0007	.46
4	COAL MINING	.0036	-5.6273	(276.6)	.0018	(.6)	-.0000	(.0)	.036	.0002	1.22
5	CRUDE PETROLEUM & NATURAL GAS	.0353	-3.2493	(66.4)	-.0241	(3.5)	-.0000	(.0)	.506	.0056	.88
6	NONMETALLIC MINERAL MINING	.0032	-5.7393	(202.1)	-.0104	(2.6)	-.0000	(.0)	.353	.0002	.65
7	CONTRACT CONSTRUCTION	.0329	-3.4341	(184.1)	.0022	(.8)	-.0000	(.0)	.056	.0025	.40
8	FOOD AND KINDRED PRODUCTS	.0391	-3.2209	(28.6)	.0176	(1.1)	-.0000	(.0)	.023	.0115	.43
9	TOBACCO MANUFACTURES	.0024	-5.3340	(1.4)	.0385	(1.7)	.1183	(.2)	.792	.0002	.81
10	TEXTILE MILL PRODUCTS	.0056	.4061	(.2)	.0011	(.9)	1.1179	(2.3)	.294	.0001	2.27
11	APPAREL	.0041	-1.7006	(.9)	.0322	(6.0)	.6999	(1.9)	.897	.0002	1.23
12	LUMBER AND WOOD PRODUCTS	.0066	-5.0452	(309.9)	.0105	(4.6)	-.0000	(.0)	.638	.0003	1.39
13	FURNITURE AND FIXTURES	.0027	-5.8901	(346.9)	-.0066	(2.8)	-.0000	(.0)	.366	.0001	1.09
14	PAPER AND ALLIED PRODUCTS	.0099	-2.6846	(1.2)	-.0019	(1.6)	.4279	(.9)	.207	.0002	2.08
15	PRINTING AND PUBLISHING	.0083	-4.3943	(1.8)	.0024	(.5)	.0865	(.2)	.072	.0002	1.57
16	CHEMICALS AND ALLIED PRODUCTS	.0175	-3.4144	(2.9)	.0032	(.5)	.1599	(.5)	.828	.0003	1.73
17	PETROLEUM REFINING	.0120	.4890	(.2)	-.0064	(1.7)	1.0809	(1.7)	.189	.0005	2.55
18	RUBBER AND MISC. PLASTICS	.0056	4.6424	(42.3)	-.0561	(3.7)	2.0000	(INFIN.)	.047	.0010	1.49
19	LEATHER AND LEATHER PRODUCTS	.0011	-6.8011	(376.1)	.0012	(.5)	-.0000	(.0)	.018	.0001	1.76
20	STONE, CLAY, AND GLASS PRODUCTS	.0067	-2.0565	(1.2)	-.0038	(1.1)	.5992	(1.6)	.727	.0002	.67
21	PRIMARY METALS	.0195	-2.4393	(4.0)	-.0019	(.6)	.4117	(2.4)	.716	.0006	1.98
22	FABRICATED METAL PRODUCTS	.0139	-1.3125	(.8)	.0071	(3.3)	.6689	(1.9)	.473	.0005	.98
23	MACHINERY, EXCEPT ELECTRICAL	.0211	-3.8648	(7.8)	.0183	(8.6)	.0035	(.0)	.927	.0005	.66
24	ELECTRICAL MACHINERY	.0159	-3.7263	(4.1)	.0310	(5.3)	.1020	(.5)	.935	.0006	1.31
25	TRANS. EQUIP. & ORDNANCE	.0175	-4.1388	(6.7)	.0335	(7.4)	.0290	(.2)	.774	.0011	2.06
26	MOTOR VEHICLES	.0094	-4.3543	(51.0)	.0127	(1.1)	-.0000	(.0)	.086	.0027	2.72
27	INSTRUMENTS	.0036	-4.5124	(1.7)	.0105	(.8)	.1858	(.4)	.646	.0002	.83
28	MISC. MANUFACTURING INDUSTRIES	.0031	-5.9333	(132.0)	.0058	(.9)	-.0000	(.0)	.369	.0003	.45
29	RAILROADS	.0155	-4.1340	(195.5)	-.0635	(21.6)	-.0000	(.0)	.970	.0014	.61
30	LOCAL, SUBURBAN, & HIGHWAY PASSENGE	.0057	-3.4345	(2.0)	.0025	(.1)	.3397	(1.0)	.927	.0002	2.07
31	TRUCKING AND WAREHOUSING	.0312	-.0585	(.0)	-.0289	(3.2)	1.0120	(1.9)	.838	.0010	1.64
32	WATER TRANSPORTATION	.0033	-5.7044	(572.7)	-.0257	(18.5)	-.0000	(.0)	.962	.0001	1.70
33	AIR TRANSPORTATION	.0070	-4.5132	(1.3)	.0285	(.6)	.0697	(.1)	.262	.0013	.23
34	PIPELINE TRANSPORTATION	.0022	-6.1300	(486.1)	-.0302	(17.2)	-.0000	(.0)	.954	.0001	1.46
35	TRANSPORTATION SERVICES	.0015	5.3021	(162.9)	.0369	(8.1)	2.0000	(INFIN.)	.538	.0002	1.49
36	TELEPHONE AND TELEGRAPH	.0643	-1.9019	(1.7)	-.0038	(.3)	.3174	(.8)	.533	.0022	.83
37	RADIO AND TELEVISION BROADCASTING	.0026	-2.1393	(1.3)	.0187	(6.0)	.6363	(2.4)	.827	.0001	1.71
38	ELECTRIC, GAS, AND SANITARY SERVICE	.1299	2.0596	(127.8)	-.0269	(12.0)	2.0000	(INFIN.)	.505	.0051	.29
39	WHOLESALE TRADE	.0371	.8994	(.2)	-.0141	(.7)	1.2110	(.8)	.142	.0020	2.36
40	RETAIL TRADE	.0862	.0361	(.0)	.0092	(3.1)	.8175	(1.5)	.659	.0017	1.00
41	BANKING AND CREDIT AGENCIES	.0492	-3.0303	(130.9)	.0176	(5.5)	-.0000	(.0)	.684	.0027	.81
42	INSURANCE AGENTS AND BROKERS	.0737	-1.3002	(1.0)	.0069	(2.4)	.4860	(1.1)	.321	.0028	2.42
44	HOTELS AND OTHER LODGING PLACES	.0153	-4.1807	(152.3)	-.0081	(2.1)	-.0000	(.0)	.280	.0012	.38
45	PERSONAL SERVICES	.0133	-3.0553	(3.2)	.0164	(2.5)	.2892	(1.3)	.645	.0004	2.63
46	MISC. BUSINESS SERVICES	.0145	-.0930	(.0)	.0084	(.7)	1.0418	(1.7)	.935	.0005	2.02
47	AUTOMOBILE REPAIR AND GARAGES	.0068	-.9902	(.2)	.0024	(.1)	.8753	(.9)	.753	.0003	1.34
48	AMUSEMENT AND RECREATION SERVICES	.0455	-1.0926	(1.5)	.0177	(3.9)	.6466	(2.6)	.669	.0012	1.41
49	MEDICAL AND OTHER HEALTH SERVICES	.0096	2.6466	(.3)	-.0074	(.3)	1.5253	(.9)	.296	.0013	.42
50	EDUCATIONAL SERVICES	.0096	6.3240	(170.3)	.0624	(12.1)	2.0000	(INFIN.)	.906	.0006	2.19

of 2.0. The general predominance of the time trends reflects the property tax portion of the total indirect tax liability.

Perhaps future work on the model can experiment with various types of capital stocks as explanatory measures. The reader should bear in mind, however, that in most industries the indirect business tax portion of total output is around one percent. Thus, the use of trends here will have little effect on the sensitivity of relative prices to quite different economic scenarios. That is, with an assumption that such taxes are fully shifted forward, a fifty percent error in the tax bill will result in (approximately) only a one-half percent error in the gross output price.

The results of stages one and two are current dollar tax liabilities for each income sector. Our procedure for translating these liabilities into changing the tax <u>rates</u> (the b_j in Section 9.2) is the following. First each income sector's tax is divided by a base-year tax weighted average of output. This variable is, of course, the same as was used in the equation explaining the sector's tax share. For most sectors such an implicit rate would vary cyclically, outputs declining or rising more rapidly than the tax payment. It seems unlikely such "increases" or "decreases" in tax rates are passed forward in the short run; therefore, as simple expedient, three year moving averages of the effective tax rate are computed. These moving average values are converted to indexes and each INFORUM sector within the same income sector has its 1972 base tax rate extrapolated with this index.

The above procedure ensures that, in the long run, prices by sector are consistent with aggregate tax revenues. We proceed on the assumption that the incidence of such taxes is not on property incomes. The long-run relative income shares in the model are independent of the level of the property and other taxes considered here.

Federal Excise and Customs

From a theoretical standpoint, the treatment of excise taxes is more appealing than the property and other business taxes since we need not compute effective rates. Thus, we may leave the incidence of changes in such tax rates to be the result of interactions within the complete model. As an example, consider a doubling of the excise tax rate on tires and tubes. The full model then may proceed to work out a textbook sequence of events. On iteration one of the price model, the price of tires rises and so do the prices of all products that use tires as inputs. In the real model, consumption of tires falls, as does the consumption of goods that are relatively "tire" intensive. Naturally, the output of tires falls, and in the return to the price model, the demand pressure variable depresses the price markup ratio in the tire sector. This reduction in the value-added price, of course, results in a smaller profit share. On the return again to the real model, consumption recovers somewhat due to the now lower price (but if all our parameters are reasonable -- a price still higher than before the tax rise). With sufficient computer time, a stable solution is achieved and we may determine the eventual effects on output, tax revenues, profits, and price.

As long as we are entranced by this ideal model, we may as well continue. In the periods following the tax increase, the demand measure in the price equation would eventually return to its normal value. Prices would rise slowly to the before-tax level of markups (over labor cost) plus the increased tax. Thus, the incidence in the long run would fall solely on the consumers of tires and related products.

Whether the integrated model would, without special attention to such a particular problem, trace out exactly this sequence of events is questionable. But, at least, it contains all the relevant functions to make such an analysis.

More important to our purposes here is the recognition that we may divorce the revenue function for the excise taxes from the price model proper. Accordingly, a discussion of revenue equations should possibly belong with our development of the income block. However, I wished to treat all the issues relating to indirect business taxes together; and so, we make a brief digression from our discussion of the price-wage system. We have estimated revenue functions for 10 excise tax items and one for customs duties. Even with the INFORUM disaggregated data, we still have to make approximations for the appropriate tax bases. The data for the tax receipts and tax rates are taken from unpublished BEA worksheets.

All of the equations have been estimated in logarithmic form. We may expect the base elasticities to differ from one due to our use of only approximations for tax bases. The estimated base elasticity may be less than, greater than, or equal to 1.0 depending upon the elasticity of the taxable items with respect to the series we have chosen.

The regression results are shown in Table IX-4; the table is generally straightforward. With changes in tax laws it became necessary to use different sample periods in different sectors; the estimation period is noted to the right of the table. The estimated base and rate elasticities are generally quite reasonable and the R^2's are usually above .95.

Some of the regressions deserve special comment. Since it was impossible to determine, a priori, the percentage reduction in the tax base upon the removal of the automobile excise tax in 1971, a dummy variable (DUM71) was used in the equation.[13] The high standard error should be guaged relative to pre-1971 collections which were over 2 billion dollars. The same approach was used in the equation for Airlines (no. 8). In July 1970, the excise tax on passenger fares was increased from 5 to 8 percent. In addition, air freight was subject to tax which had previously been repealed.

In three sectors, gasoline and oil, tires and tubes, and communication, there was sufficient variation in the tax rates to make possible estimation of rate elasticities. The rate elasticity for communications is set equal to unity for forecasting application. Under current law, this tax rate is declining at one percentage point intervals until its complete removal in 1982. (For 1977, it is 5 percent.) The rate elasticity coefficients for the other two sectors are both less than one and have small standard errors.

The federal taxes attributed to retail trade are mainly excises on special fuels (diesel and aviation fuel). Therefore, I used constant

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[13]The excise tax remained on busses, for instance, which are included in our sector for motor vehicles.

Table IX - 4

Federal Excise Taxes and Customs Duties Regressions

Taxable Item	1974 Collections (millions)	Equation Results
1. Alcoholic beverages	4,612.0	TX_1 = 1.55 + .726 Q(31) 1954-74 R^2 = .984, S.E. = 87.3, D.W = 1.10, specific
2. Tobacco	2,307.0	TX_2 = 4.652 + 1.223 C(35) 1954-74 (31.1) R^2 = .976, S.E. = 36.8, D.W = 1.29, specific
3. Gasoline and oil	3,987.0	TX_3 = -2.058 + .871 * Q(76) + .879R(76), 1947-74 (15.1) (15.8) R^2 = .992, S.E. = 111.1, D.W = 2.41, specific
4. Tires and tubes	820.0	TX_4 = 6.069 + 1.086 Q(80) + .684R(80), 1947-74 (16.1) (8.8) R^2 = .982, S.E. = 31.5, D.W = 1.91, specific
5. Motor vehicles	621.0	TX_5 = -2.795 + .822 V(145)+ 1.718 DWM71, 1954-74 (7.1) (14.5) R^2 = .876, S.E. = 214.8, D.W = 1.72, ad valorem
6. Other transportation equipment	57.0	TX_6 = -.169 + .550 V(152) 1954-74 (19.9) R^2 = .970, S.E. = 2.4, D.W = .93, ad valorem
7. Trucking (highway use licenses)	74.0	TX_7 = -6.873 + 1.075 V(169) 1959-74 (7.3) R^2 = .926, S.E. = 6.4, D.W = .63
8. Airlines	1,022.0	TX_8 = -3.645 + .985 V(172)+.867 1963-74 (7.2) R^2 = .954, S.E. 79.8, D.W = 1.57, ad valorem
9. Communications	1,861.0	TX_9 = -4.111 + .869 V(174) + 1.147 R(174) 1954-74 (30.4) (5.5) R^2 = .985, S.E. = 59.4, D.W = 1.89, ad valorem
10. Wholesale trade (primarily customs duties)	4,507.0	TX_{10} = 3.698 + 1.069 IMP72$ 1959-74 (29.8) R^2 = .974, S.E. 175.2, D.W = 1.90
11. Retail trade	484.0	TX_{11} = -11.692 + 1.698 Q(76) 1966-74 (5.8) R^2 = .955, S.E. = 23.3, D.W = 2.31

List of Symbols:

TX_1	= (logarithm of) tax collections of item -i, listed under column due.
Q(i)	= (logarithm of) 1972 constant dollar gross output of sector i, i refers to sector numbers of detailed INFORUM model but correspond to titles listed here.
v(i)	= same as for Q(i), but current dollar output (see Appendix II-A for sources for outputs).
c(i)	= (logarithm of) constant - (1972$) dollar consumption of INFORUM sector i.
R(76)	= exicse tax rate on gasoline, cents per gallon.
R(80)	= (logarithm of) index of tax rates on rubber products, 1958 = 100.0, source BEA.
R(172)	= (logarithm of) federal tax rate on communication services, percentages.
OUMAUT	= Dummy for Pre-1971 excise tax on automobiles, 1954-1970 = 1.0, 1971 = .5, 1972-74 = 0.0
IMP72	= (logarithm of) total imports in 1972 dollars from NIA, billions of dollars.
DUMAIR	= Dummy for pre-1970 excise tax rate (and base) on air freight and passengers, 1963-1969 = 0.0, 1970 = .5, 1971-1974 = 1.0

dollar output of the petroleum refining sector. The base elasticity of 1.68 implies growing use of these fuels relative to total petroleum output. Customs duties are assumed to be collected by wholesalers and make up the major portion of the federal indirect taxes in wholesale trade. The other large item paid by wholesalers is alcoholic beverage taxes on imports, not a customs duty, *per se*. I have estimated an equation for these two items along with several other minor taxes. As a stop-gap measure, total constant dollar imports provide a good fit for these taxes with a base elasticity near one.

The excise tax collections in the sectors not considered here amount to only 110 million dollars in 1974. These taxes are, of course, treated exogenously for simulation and forecasting.

9.5 Retail Price Conversion

The gross output prices to which we have been referring up to this point may generally be thought of as wholesale prices. The most important aggregate price in terms of the complete model, however, is an index of consumer prices. A consumer price index is used in explaining changes in wages as well as defining real personal income derived from the income block. Moreover, INFORUM's current work on disaggregated consumption functions will require consumer prices at a product level.

Analyzing price impacts through the trade sectors is the subject of a major study in itself, so the rudimentary procedure used here can be described as a temporary measure. Still, this treatment is superior to the assumption that each consumer price is proportional to the corresponding wholesale price in every quarter.

We first consider lags through the retail sector. We take this lag to be equal to the normal inventory turnover period for the most appropriate type of retail establishment. The most typical annual sales-inventory ratio is about 6.0; therefore, the average turnover period is around two months and the weights assigned to the current and lagged quarterly wholesale prices are .333 and .666, respectively. Data for sales-inventory ratios are found in Current Business Reports - Retail Trade, Annual Summary, U.S. Bureau of the Census. Presently, no lag is assumed for the wholesale sector.

The second consideration is the behavior of wholesale and retail margins. We have not investigated in detail the alternative hypotheses of margins determined by ("rule of thumb") a constant percentage markup on the cost of goods sold or whether margins reflect only the cost (including cyclical fluctuations in profits) of distributing a unit of real output. Undoubtedly, the behavior varies by the nature of the product and the market structure of the particular kind of retail outlet. Our markup equations in the previous chapter for aggregate retail and wholesale trade shed some light on this question, especially in the case of retail trade. We found that the value-added markup over labor cost in retail trade was explained quite adequately by a function of the unemployment rate and productivity fluctuations. The explosion of manufacturing and farm prices in 1974 and 1975 caused no apparent increase in the retail margins over what would have been expected. However, as we noted in the previous chapter, alternative behavior in the short run (i.e., percentage markup on cost of goods) cannot be ruled out in the case of wholesale trade. The margins there rose substantially in the 1973-74 period.

In any event, a reasonable assumption is that, in the long run, competitive forces will result in the "price" of trade reflecting the long run average costs of distribution of unit of real output. Thus, for the purposes here, I have maintained a strict input-output accounting structure which assumes that the retail price is a fixed-weight average of three component deflators: 1) the wholesale or manufacturer's price; 2) the "price" of wholesale trade; and 3) the "price" of retail trade. The prices for the trade sectors are derived as other prices in the model; they reflect the prices of intermediate inputs (heat, power, insurance, etc.) plus labor and capital costs. Neither the input-output table nor NIA data provide any disaggregation for either trade sector, thus the change in margins is the same for every product.

The price conversion may now be laid out formally for the consumption price of output i:

$$(9.12)\quad p_i^c\,(t) = \alpha_i p_i^{eff}\,(t) + \beta_i\, p^{wt}\,(t) + \gamma_i\, p^{rt}\,(t) \qquad \alpha_i + \beta_i + \gamma_i = 1$$

where

p^{wt} = price of wholesale trade margins (=1.0 in the base period)

p^{rt} = price of retail margins (=1.0 in the base period)

$P_i^{eff} = k_i p(t) + k_2 p_i(t-1),\ k_1+k_2 = 1.0$

and

k_1 and k_2 are lag weights taken from inventory-sales data in the retail sector.

The α, β, and γ weights are taken from data in the 1967 input-output table on trade margins by consumption product.

The prices defined by (9.12) are aggregated with fixed 1972 consumer expenditure weights to the three major subgroups -- durables, nondurables, and services -- of the personal consumption deflator. In early runs of the model, we found that given known WPI's and the prices for trade, our procedure for generating the durables component produced a large positive bias (approximately 7 percent by the end of 1975 on the 1972 base). Apparently, the sampling of commodities and pricing methodology are different for consumer durables that are priced in both WPI and CPI. One source of error is that our sector Motor Vehicles includes trucks and busses which are not part of the Consumer Price Index. The prices for these producer durables grew faster than automobiles in the early 1970's.

As a means of correcting for this bias, a linkage regression was performed. Annual data were used to construct a synthetic durables goods fixed-weight deflators from 1958 through 1972. This synthetic deflator (DURSYN) was constructed by means of the same formula as shown in (9.12). On the price (and 0-1 dummy variable for the 1965 excise tax cuts), the published fixed-weight PCE price for durable goods (DURFIX) was regressed. The results are shown below as equation (9.14):

$$(9.14)\quad \log(\text{DURFIX}) = .0265 + \underset{(23.3)}{.731}\log(\text{DURSYN}) - \underset{(5.0)}{.024}\,\text{EXCISE}$$

$$\text{1958-72}\qquad \bar{R}^2 = .987,\ \text{S.E.} = .0050,\ \text{DW} = 1.58$$

The elasticity of the published index with respect to our constructed one is significantly less than unity over the historical period. The equation accurately predicted the published indexes for 1973 and 1974, so it appears reasonably stable. For long run forecasts we would naturally prefer some other solution to this problem, but until we can devote more time to studying the CPI and WPI series on a product-by-product basis, this equation will have to serve in the interim.

Consumer Price Index

After the construction of the total fixed-weight PCE deflator, an additional equation is employed to derive the BLS Consumer Price Index. The CPI is used in the wage functions described in Chapter V.

Mortgage interest rates and used automobiles are two important items included in the CPI, but excluded in the PCE deflator. For the moment only mortgage interest rates were considered in our linkage equation. The equation was estimated (quarterly) in first different form from 1958:2 through the end of 1975:

$$(9.15) \quad \Delta CPI/CPI = \underset{(48.7)}{1.039}\,\Delta PCDFIX/PCDFIX + \underset{(.9)}{.0057}\,\Delta MORGRT/MORGRT$$

$$1958{:}2\text{–}1975{:}4 \qquad \bar{R}^2 = .927, \; S.E. = .0019, \; D.W. = 1.24$$

Note that we obtain a very high fit on quarterly-to-quarterly changes, even though there is a slight positive bias of the CPI with respect to the fixed-weight PCE index. The mortgage interest rate is retained in the equation, although its t-statistic is not quite one.

The reader may question why a step couldn't have been eliminated by use of the PCEFIX directly in the wage function. This deflator, however, is available only from 1958 forward and, in addition, I wished to maintain some comparability with other published wage determination studies which have used the CPI.

There are at least two possible refinements to the approach used here. Neither is incorporated, for lack of data. The first concerns the treatment of retail sales taxes. The γ weight in (9.12) is inclusive of all retail taxes. Ideally, we should take the tax portion out of the margin and apply the implicit tax rate to the gross selling price (since most retail taxes are ad valorem taxes). Unfortunately, the detailed breakdown of the 1967 margin is available from BEA only on a workfile tape; this tape has not been read in connection with the overall INFORUM model. The current treatment is deficient in that it attributes slightly incorrect weights to the retail deflator in constructing the consumption price.[14]

Secondly, the wholesale price to which we have been referring thus far is the domestic one only. To incorporate import prices, each element, p_k, in the p vector should be redefined in the following way:

$$(9.13)\quad p_j(t) = s_j^{dom} p_j^{d}(t) + s_j^{imp} p_j^{i}(t), \qquad s^{dom} + s^{imp} = 1.0$$

where

$p^{d}(t)$ = domestic wholesale price as an output of the price-wage submodel

$p^{i}(t)$ = average import price of good j, s^{dom}, s^{imp} = shares of domestic demand satisfied by domestically produced and imported goods, respectively.

Both of these refinements are future work.

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[14] If we could assume that the sales tax rate was the same for every product, we could remove the tax by referring to aggregate value-added component data for retail trade. However, many states do not tax certain items and the geographic incidence of sales taxes may also differ by product.

9.6 Quarterly Wage Levels by Industry

In Chapter V we estimated equations for relative wages and equations to reconcile BLS to BEA wage concepts. Both used annual observations. For the price-wage system we require quarterly wage levels by industry to construct unit labor costs.

If no lags were in the annual equations, one might simply use the same coefficients with quarterly values of the independent variables. Since lags are involved in both the above equations, I propose as a method of interpolating quarterly values that overlapping annual observations be used. That is, for the "year" 1977:3-1978:2 the current and lagged values of the unemployment rate in the relative wage equation be defined as the average of quarters beginning in the third quarter of one year and ending in the succeeding year's second quarter. Quarterly values are implied by knowledge of the previous three quarters together with the new, equation-generated, four-quarter average.

To get this system started for the relative wage equations, for, say 1972:1, actual values for quarters 1971:1-1971:4 are read into the model. In 1972:1 an "annual" value is computed covering the period 1971:2-1972:1 ($RW^{Ann}_{1972:1}$). As an example of one of the independent variables in the relative wage equations, the current "years" unemployment rate would be $U^{Ann}_{1972:1} = (U_t + U_{t-1} + U_{t-2} + U_{t-3})/4$. Thus, the quarterly relative wage for 1972:1 is simply

$$RW_{1972:1} = 4 * RW^{Ann}_{1972:1} - \left(\Sigma_{t=1971:2}^{1971:4} RW_t\right)$$

In the computer program the 1972:1 value of RW replaces that for 1971:1 and we are ready to go on to the new period. Note that this procedure generates the same annual results as if we had an annual model. This is because in every fourth quarter we use calendar year averages as independent variables. Then we know the calendar year value of the relative wage and the fourth quarter relative wage becomes a balancing entry. However, since the previous three quarters' values have been computed to the four-quarter moving averages of the explanatory variable, there is no jump in the fourth quarter values as compared to any other quarter of the year.

9.7 Exogenous Prices

For the majority of industries, we have followed the classical input-output approach of letting prices be determined by value added. That is, when we decompose the system as a whole, each price can be "explained" by current and lagged values of its value-added and the value added of supplier industries. For farm and other primary commodities, it is more reasonable to expect that, in the short run, prices are determined mainly by competitive forces and that value-added (or more correctly profit income) is the residual element.

Although the explanation of raw material prices is an important task, it is not one that is undertaken in this study. Many of the prices are set in world markets and so side models for each price would have to be built. Rather complex econometric models exist in the literature solely to explain one such price (particularly for nonferrous metals prices).

Accordingly, in the simulations to follow and forecasts in Chapter XI the prices for the following sectors are taken as exogenous:

(1)	Dairy farm products	(11)	Iron ores
(2)	Poultry and eggs	(12)	Copper Ores
(3)	Meat animals and other livestock	(13)	Other nonferrous ores
(4)	Cotton	(14)	Coal Mining
(5)	Grains	(15)	Natural gas
(6)	Tobacco	(16)	Crude petroleum (domestic)
(7)	Fruits, vegetables	(17)	Stone and clay mining
(8)	Forestry products	(18)	Chemical and fertilizer mining
(9)	Fishery products	(29)	Sugar
		(50)	Pulp mills

A few other important raw material prices which do not correspond to existing INFORUM sectors have also been inserted into the model. To utilize the current computer program, these prices have "borrowed" sector numbers which are currently empty in the INFORUM sectoring plan. These prices and their identification numbers (see Tables 2 and 3 in Chapter X) are:

61	Steel scrap	75	Crude petroleum (imported)
62	Oilseeds	127	Raw sugar
63	Cocoa beans	128	Green coffee

Each of these prices, with the exception of that for imported crude petroleum, is taken from the WPI. The source of the petroleum price is the Monthly Energy Review.

For periods beyond actual known data, we follow the Gilmartin procedure of having these prices move relative to the overall WPI (with a one period lag). Without specific knowledge to the contrary, our usual assumption will be simply to let these prices rise at the same rate as the WPI, thus neutralizing their effect on the aggregate price level. For energy prices this is unrealistic (as of 1977); we shall lay out our assumptions for these prices more carefully in Chapter XI.

CHAPTER X

TESTS OF THE PRICE AND INCOME MODELS: 1973-75

10.1 Overview of Chapter

Validation of the complex models developed in the previous chapters is difficult under any circumstances, but it is especially so when we test them relative to the extraordinary economic events of the most recent five years. Although this period provides a stringent test for the models, its choice is not altogether arbitrary. Most of the resources of the INFORUM staff have been devoted to producing industry forecasts ten or more years into the future. Although most of the individual equations in the real model have been simulated over post-sample regression periods, only one large-scale simulation tests of the complete model has been undertaken.[1] An historical simulation requires, at a minimum, a consistent set of input-output tables, the construction of which is a major research project in itself. An early, practical choice for the work in this thesis was whether to build the model to be integrated with the existing INFORUM model, with a 1972 base, or to undertake the building of a system capable of simulating any chosen period from 1958-72.

The former path was chosen on the grounds that substantial testing of the model will ultimately occur as the model is used in the years

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[1]Thomas C. Reimbold, "Simulation Testing of U.S. Input-Output Model," Unpublished Ph.D. Dissertation, University of Maryland, 1974.

ahead. An important objective of this project has been to construct the income and price-wage models, both conceptually and in their computer requirements, so as to enhance the likelihood of their use in the future. Satisfactorily tracking a longer period, say 1966-1971, with a model built especially for simulation might have given us slightly more confidence in the model; but, given the resources of this author, such an effort would have precluded the full integration of the models that give the INFORUM system, *a priori*, greater capabilities for policy analysis and forecasting for the remainder of the 1970's.

The tests described in this chapter generally take the predictions of the standard INFORUM model, with its 1972 base, as exogenous. However, the predictions of outputs, manhours, and capital stocks have been calibrated, to every extent possible, to match known values of these variables and to make the aggregates from the model match the historical aggregates in the national accounts. Most of these adjustments have been entered into the model by putting in the best available information on final demands by product. However, significant errors in some manufacturing sectors appeared to still be evident in spite of these adjustments. The two most likely sources of error seem to be in the inventory change (which was known only in the aggregate) and import components at final demand (serious problems with deflators, especially in 1974). Accordingly, I have made use of some recent INFORUM research that has linked constant-dollar outputs with Federal Reserve (FRB) production indexes. For about two-thirds of the manufacturing sectors, outputs for 1973 through 1975 were extrapolated by FRB indexes on the basis of simple (double-lag) regression model estimated over 1959-72. This procedure should substantially reduce the likelihood of significant errors in labor productivity by sector. For the INFORUM (investment and) employment sectors Wholesale and retail trade, and Finance and services, actual values of labor productivity were used to override the models (implicitly) predicted values.

In spite of these adjustments, errors for certain portions of the tests described in this chapter derive from the real model's output. Thus, the errors shown may, therefore, reflect the weakness in the complete system rather than in the price-wage and income models alone.

The remainder of the chapter is divided into three sections. In section 10.2 we test the price-wage model in isolation. Next, in section 10.3, we look at predicted GPO components by industry for 1973-75, first by using actual prices, and second, using prices (and wages) generated by the price-wage model. Finally, in section 10.4 we compare aggregate income components with published national accounts and study the accuracy of our real disposable income predictions.

10.2 Price-Wage Submodel Simulations

The reader might suppose that our price model was "tailor-made" for analyzing the particular type of inflationary shocks that were operating in the 1973-74 period, namely, dramatic increases in the (exogenous) prices of raw materials and farm products. This supposition is, of course, true in part; but there were also severe impacts on aggregate rates of inflation during the various phases of the price controls program and its eventual abandonment. Whether any disaggregated model can be fairly tested through this period without rather careful attention to the timing of controls measures in various industries is an open question. We should however, in our case expect that our model be capable of producing results that are at least broadly consistent with the observed acceleration and deceleration of inflation over the 1972-75 period.

The exercises for this section are (conventionally) termed "simulating the price-wage system in isolation." That is, we take as given all available actual values that are exogenous to the submodel. Industry gross outputs are either taken from the real model or "predicted" on the basis of FRB production indexes as explained above. Manhours by the 88 INFORUM employment sectors are actual data through 1975. Capital stocks through 1974 are read into the model. The 1975 stocks are taken from the model. The I/0 base year matrix is the INFORUM balanced matrix for 1972. In succeeding years it is modified according to the standard INFORUM extrapolation procedures and with other available information on particular coefficients. Three of the explanatory variables used in the wage-change equations, the primary unemployment rate, social security tax rate, and aggregate bargaining variable -- are actual values. The consumer price index is generated endogenously within the model.

Although a vast array of potentially interesting (counter/factual) simulations could be attempted, we can present only four here. The first is really more of a check on the quality of our available industry price indexes. We borrow from the Gilmartin price study a file of actual quarterly prices for the period 1972:2 through 1976:1. The WPI provides the majority of these prices, but the CPI provides quarterly data for selected service sectors. There are gaps in this data and I have attempted, as best as possible, to fill in the most important missing sectors. In some cases, annual data were used and interpolated to obtain quarterly observations. However, there remain a number of industries for which actual prices have not been inserted into the model: for these sectors predicted prices are obtained in the course of solving the model.

By checking the quality of our price series, I mean specifically that for this simulation we are checking how closely our computed aggregate price indexes match the published indexes. In particular, we check our computed aggregates against the WPI, the industrial component of the WPI, and a number of fixed-weight GNP deflators. Thus, we are making a general test of our aggregation weights and retail price conversion procedure as well as the individual price series.

In the second simulation we let the model compute quarterly vectors of prices, given a set of exogenous wages and our selected set of exogenous prices and other inputs from the real side. In the third simulation wages are endogenous as well as prices. The fourth simulation is the same as the third except we turn off all the price markup equations. They are left constant at their base period values. However, the default condition here is that the markup is constant relative to unit labor cost, where unit labor cost has been constructed with a three year moving average of labor productivity rather than actual labor productivity.

Results

Selected values from the simulations are shown in Table X-1 for eight aggregate price indexes. The reader may initially wish to look at the results of the first "quasi-simulation," where we insert our available price series ("Max-known"). Using the WPI weights developed by Gilmartin for aggregating the INFORUM sector prices, we find a slight

TABLE X-1

Comparison of Aggregate Price Indexes for Four Simulations*

Wholesale Price Index	1972:4	1973:4	1974:4	1975:4
Published Indexes	121.2 (4.8)	142.2 (17.3)	171.2 (20.4)	178.8 (4.4)
1) Available Known Prices	121.4 (5.1)	139.8 (15.1)	169.5 (21.3)	177.5 (4.7)
2) Exogenous Wages Predicted Markups	122.8 (6.7)	143.9 (17.1)	163.5 (13.7)	170.8 (4.4)
3) Endogenous Wages Predicted Markups	122.3 (6.0)	142.6 (16.6)	161.9 (13.6)	168.9 (4.3)
4) Exogenous Wages No Price Equations	122.1 (5.6)	141.5 (15.8)	159.3 (12.3)	169.6 (6.5)
Industrial Component				
Published	119.1 (3.1)	130.3 (9.4)	165.6 (27.1)	175.5 (6.0)
1) Available Known Prices	119.0 (3.0)	128.8 (8.2)	161.6 (25.5)	172.8 (6.9)
2) Exogenous Wages Predicted Markups	120.9 (5.2)	132.2 (9.4)	154.6 (17.0)	165.4 (7.0)
3) Endogenous Wages Predicted Markups	120.2 (4.4)	130.6 (8.7)	152.6 (16.8)	163.1 (6.9)
4) Exogenous Wages No Price Equations	120.1 (4.2)	129.3 (7.7)	149.5 (15.6)	164.4 (10.0)

*Values in parentheses are percent changes over four quarters.

TABLE X-1 (Continued)

<u>GNP Deflator</u> (Fixed Weight, domestic prices only)	1972:4	1973:4	1974:4	1975:4
Published	101.5 (3.6)	109.1 (7.5)	121.8 (11.6)	130.4 (7.1)
1) Available Known Price	101.0 (2.9)	109.9 (8.8)	124.7 (13.5)	134.0 (7.4)
2) Exogenous Wages Predicted Markups	103.0 (5.7)	112.7 (9.4)	124.4 (10.5)	132.8 (6.8)
3) Endogenous Wages Predicted Markups	102.4 (4.9)	111.6 (9.0)	123.7 (10.8)	131.2 (6.1)
4) Exogenous Wages No Price Equations	102.8 (5.5)	111.6 (8.5)	122.4 (9.7)	133.2 (8.9)

<u>PCE Deflator</u> (Fixed Weights)				
Published	101.2 (3.0)	109.1 (7.8)	122.4 (12.2)	130.2 (6.4)
1) Available Known Price	100.8 (2.6)	109.3 (8.4)	121.8 (11.5)	131.5 (7.9)
2) Exogenous Wages Predicted Markups	102.8 (5.3)	111.8 (8.8)	122.6 (9.6)	130.8 (6.7)
3) Endogenous Wages Predicted Markups	102.2 (4.5)	111.0 (8.6)	122.2 (10.1)	129.5 (6.0)
4) Exogenous Wages No Price Equations	102.7 (5.1)	111.4 (8.5)	121.5 (9.1)	131.4 (8.9)

TABLE X-1 (Continued)

PCE - Durables	1972:4	1973:4	1974:4	1975:4
Published	100.0 (.5)	102.6 (2.6)	113.9 (11.0)	120.4 (5.7)
1) Available Known Prices	99.5 (-.1)	103.2 (3.7)	111.6 (8.1)	118.3 (6.1)
2) Exogenous Wages Predicted Markups	102.7 (4.2)	106.1 (3.9)	112.4 (5.9)	118.8 (5.7)
3) Endogenous Wages Predicted Markups	101.5 (2.5)	105.1 (3.6)	111.5 (6.1)	117.3 (5.2)
4) Exogenous Wages No Price Equations	102.1 (3.4)	106.1 (3.9)	114.9 (8.3)	127.4 (10.9)

PCE - Non Durables				
Published	101.6 (3.3)	113.7 (11.9)	130.7 (15.0)	138.1 (5.7)
1) Available Known Prices	100.2 (1.9)	113.8 (13.6)	130.4 (14.5)	140.0 (7.4)
2) Exogenous Wages Predicted Markups	103.4 (5.7)	117.0 (13.1)	129.8 (11.0)	137.6 (6.0)
3) Endogenous Wages Predicted Markups	102.7 (5.3)	115.9 (12.8)	129.3 (11.6)	136.0 (5.2)
4) Exogenous Wages No Price Equations	102.5 (5.0)	113.6 (10.8)	125.2 (10.3)	134.6 (7.5)

TABLE X-1 (Continued)

PCE Services	1972:4	1973:4	1974:4	1975:4
Published	101.3 (3.5)	106.9 (5.5)	117.6 (10.0)	126.2 (7.3)
1) Available Known Prices	101.6 (4.0)	107.1 (5.3)	117.4 (9.5)	128.0 (9.1)
2) Exogenous Wages Predicted Markups	102.4 (5.0)	109.0 (6.5)	119.4 (9.6)	128.6 (7.7)
3) Endogenous Wages Predicted Markups	102.2 (4.7)	108.5 (6.3)	119.4 (10.0)	127.7 (6.9)
4) Exogenous Wages No Price Equations	102.0 (4.5)	107.2 (5.2)	117.4 (9.5)	129.3 (8.8)

Producer Durable Equipment				
Published	100.0 (1.1)	103.0 (3.0)	117.9 (14.5)	131.0 (11.1)
1) Available Know Prices	100.5 (1.6)	105.8 (5.3)	124.0 (17.2)	133.4 (7.6)
2) Exogenous Wages Predicted Markups	103.1 (5.2)	109.7 (6.3)	120.7 (10.1)	130.5 (8.1)
3) Endogenous Wages Predicted Markups	102.3 (4.2)	108.3 (5.8)	119.4 (10.2)	128.3 (7.4)
4) Exogenous Wages No Price Equations	102.1 (3.8)	105.9 (3.8)	115.5 (9.1)	128.2 (10.9)

negative bias in the constructed values for both the total WPI and its industrial component. Evidently, most of the problem is located in the industrial component, but I have not been able to locate the exact source(s). The constructions of the GNP deflators fare better except in the case of the producer durable goods component.

Actual and predicted PDE prices converge by the end of 1975, although their movements across four-quarter intervals of the previous two years were different. Part of the problem stems from the procedures used by BEA to account for delivery lags of various types of equipment. (The current WPI is assumed to reflect the price at which the equipment is ordered.) This helps to explain the slower increases in the published index over 1973 and 1974.

The GNP deflator is included in the tables for completeness only. As presently calculated, it is a fixed-weight aggregation (with final demand weights) of domestic prices exlusively. The omission of import prices (with a negative weight) helps to explain why our deflator is greater than the published index. A better treatment for this price awaits more work on specific import prices (including the price of crude petroleum which is now in the model but not entered in the calculation of the GNP deflator).

Without devoting a substantial effort toward reproducing the exact BEA methodology for constructing the GNP deflators, our treatment is not at all bad for a first try. The major feedback into other parts of the model is with the overall consumption deflator, and this specific result appears to be quite satisfactory.

Several alterations of the basic structure were made for the remaining simulations. Preliminary runs of the model showed serious deficiencies by the use of our price markup scheme for two important sectors: electric utilities and space rental of housing. The price increases of electric power in the 1974-75 period surpassed even the most generous assumptions about the pass through of fuel prices. The soaring construction (including pollution control) costs of new utilities and high interest rates for new bond issues have presumably affected the rate increases granted by the regulatory agencies. Without wishing to construct an explicit capital cost measure here, I have simply allowed the nonwage portion of value added to be extrapolated by the industral structures deflator. This seems preferable to a measure moved by unit labor cost: in this sector labor productivity growth has been above the average for the economy as a whole.

The space rental price index for housing also deserves a different treatment than that given by a (variable) markup over (real estate) labor costs. A more suitable treatment would be to estimate an equation explicitly incorporating demand pressures on the existing stock of housing. In lieu of this approach, the rent price is made exogenous in the current version of the model.

Simulation (2)

In simulation (2) actual hourly earnings were exogenous for most sectors; this simulation has been labeled "exog-wage." Looking first at the results for the total WPI, we find the rate of growth higher in 1973 than that given by known prices ("max-known"), but substantially less in 1974. Evidently, the crude dummy variables in the annual price markup equations are not able to adequately represent the dynamics of the controls and decontrol periods. This, of course, does not invalidate the results of the estimated equations for use in other periods.

The effects of agricultural prices are removed when we turn to the results for the industrial component. There, the model captures the acceleration and deceleration reasonably well, except for the under-prediction of the rate of change in 1974. The areas in which the errors in the price levels are generally concentrated are discussed in the next section.

The overall result that the errors are generally in sectors whose products are sold to intermediate or investment goods markets is suggested by examining the errors for the total PCE deflator. The predicted levels of the PCE deflators for 1974:4 and 1975:4 are both within one percent of their published values. On a percentage basis, the results for the three PCE sub-indexes are not as close: but considering the variance in the movement of these deflators across this four-year period, the results are quite satisfactory. The results for the nondurable components, of course, rest heavily on the exogenous prices for raw farm products and crude petroleum.

Simulation (3)

In simulation (3) both the price and wage equation are allowed to operate ("all-on"). Generally all the component deflators displayed are slightly lower than those in simulation (2) using exogenous wages. This result is due to the error build-up emanating from the feedbacks between the aggregate wage-change equations and the price equations. However, the overall results are very heartening in that entire price-wage system generally tracks the acceleration and deceleration of major indexes over the four-year period. The difference in the personal consumption deflator for 1975:4 in simulation (2) and (3) is less than one percent.

Simulation (4)

In the final simulation shown, we make a very crude sensitivity test of the price markup equations (which we have labeled "fixed VA/ULC*" to emphasize that the fixed value-added markup is relative to the moving average value of productivity). The levels of the aggregates indexes in 1975:4 in this simulation are generally similar to those obtained in the previous two simulations. Apparently the lack of the controls dummy is basically offset by no knowledge of the 1974-75 recession by the price markup equation. Looking at the four-quarter changes, however, reveals that the price equations provide a significant degree of forecasting accuracy in the short run. For instance, this simulation shows an overprediction of three percentage points for 1975 (relative to the "max-known" run) for the industrial component of the WPI.

Results for Individual Prices

In Table X-2 we compare predicted versus actual individual prices for simulation (2). In simulation (2) the reader will remember, actual annual hourly earnings (after adjustment for fringes and payroll taxes) are interpolated quarterly and are read into the model. We compare the model's prediction with the actual prices for 1973:4, 1974:4 and 1975:4.

The left-most column of the table identifies three types of prices. MODEL refers to a price which is determined endogenously in the simulation. EXOG, of course, denotes a price whose values are fixed for the entire simulation. NO ACT stands for "no actual data." The model computes values for such prices given wages and input prices: STD and ALT prices differ from each other in the comparision quarters only because the costs have changed for those sectors under the two runs. In the columns labeled DIFF we have zeroed out the difference in the predicted levels of such prices. Thus, nonzero entries in each triad of columns refers to errors in the model for products with available quarterly price indexes.

All of the individual product prices have been normalized to 1972:1, the base period of the model. This helps one to evaluate easily how the model has captured the changes in relative price over this fifteen quarter interval. The aggregate prices at the top of the table are normalized to their respective published values for 1972:1.

As we have come to expect in disaggregated models, canceling of individual errors usually makes the results of the aggregate better than those of the full detail in the model. The model here is no exception. I feel that the errors shown in Table X-2 fall into four general classes. The errors in the first class arise from the inability of the model to measure severe shortages that occurred in a number of basic materials sectors in 1973 and 1974. Second, large errors in some industries may be attributable to aggregation defects in the INFORUM model. Put simply, even with 200-sectors already in the model, we would require more sectoral detail to measure adequately input costs for certain sectors. The third class of errors arise from what we have come to believe are deficiencies in the reported prices themselves. One hesitates to explain away errors in the model due to an alleged deviance of "list" versus "transaction"

TABLE X-2

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (2): EXOGENOUS WAGES ("EXOG-WAGE")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	201	WHOLESALE PRICE INDEX	1.398	1.439	.041	1.695	1.635	-.060	1.775	1.708	-.067	201
MODEL	202	INDUSTRIAL COMPONENT	1.288	1.322	.034	1.616	1.546	-.070	1.728	1.654	-.074	202
MODEL	203	GROSS NATIONAL PRODUCT : DEFL	1.099	1.127	.028	1.247	1.244	-.003	1.340	1.328	-.012	203
MODEL	204	PERSONAL CONSUMPTION EXPEND	1.093	1.118	.025	1.218	1.226	.008	1.315	1.308	-.007	204
MODEL	205	DURABLES	1.032	1.061	.029	1.116	1.124	.008	1.183	1.188	.004	205
MODEL	206	NON-DURABLES	1.138	1.170	.032	1.304	1.298	-.005	1.400	1.376	-.025	206
MODEL	207	SERVICES	1.072	1.090	.018	1.174	1.194	.020	1.280	1.286	.006	207
MODEL	208	GROSS PRIVATE FIXED INVESTM	1.088	1.113	.025	1.287	1.254	-.033	1.361	1.341	-.020	208
MODEL	209	BUSINESS STRUCTURES	1.096	1.113	.016	1.335	1.281	-.055	1.391	1.366	-.026	209
MODEL	210	PRODUCERS' DURABLE EQUIP	1.058	1.097	.038	1.240	1.207	-.033	1.334	1.305	-.029	210
MODEL	211	RESIDENTIAL CONSTRUCTION	1.114	1.125	.012	1.297	1.285	-.011	1.358	1.357	-.001	211
MODEL	212	EXPORTS	1.209	1.246	.037	1.465	1.417	-.047	1.488	1.444	-.044	212
MODEL	213	GOVERNMENT EXPENDITURES	1.085	1.107	.022	1.259	1.244	-.014	1.361	1.345	-.016	213
MODEL	214	FEDERAL	1.091	1.109	.019	1.238	1.231	-.007	1.352	1.339	-.013	214
MODEL	215	STATE AND LOCAL	1.073	1.103	.030	1.251	1.240	-.011	1.350	1.333	-.017	215
EXOG	1	DAIRY FARM PRODUCTS	1.441	1.441	.000	1.416	1.416	.000	1.705	1.705	.000	1
EXOG	2	POULTRY AND EGGS	1.786	1.786	.000	1.719	1.719	.000	1.845	1.845	.000	2
EXOG	3	MEAT ANIMALS, OTH LIVESTK	1.335	1.335	.000	1.185	1.185	.000	1.457	1.457	.000	3
EXOG	4	COTTON	2.200	2.200	.000	1.261	1.261	.000	1.458	1.458	.000	4
EXOG	5	GRAINS	2.487	2.487	.000	3.030	3.030	.000	2.282	2.282	.000	5
EXOG	6	TOBACCO	1.189	1.189	.000	1.336	1.336	.000	1.342	1.342	.000	6
EXOG	7	FRUIT,VEGETABLES,OTH CROPS	1.525	1.525	.000	1.709	1.709	.000	1.550	1.550	.000	7
EXOG	8	FORESTRY PRODUCTS	2.058	2.058	.000	1.951	1.951	.000	1.704	1.704	.000	8
EXOG	9	FISHERY PRODUCTS	1.375	1.375	.000	1.293	1.293	.000	1.431	1.431	.000	9
NO ACT	10	AGR,FORESTRY+FISH SERVICES	1.154	1.149	.000	1.188	1.178	.000	1.275	1.266	.000	10
EXOG	11	IRON ORES	1.051	1.051	.000	1.374	1.374	.000	1.581	1.581	.000	11
EXOG	12	COPPER ORE	1.330	1.330	.000	1.542	1.542	.000	1.261	1.261	.000	12
EXOG	13	OTHER NON-FERROUS ORES	1.326	1.326	.000	1.872	1.872	.000	1.858	1.858	.000	13
EXOG	14	COAL MINING	1.218	1.218	.000	2.113	2.113	.000	1.916	1.916	.000	14
EXOG	15	NATURAL GAS	1.201	1.201	.000	1.551	1.551	.000	2.126	2.126	.000	15
EXOG	16	CRUDE PETROLEUM (DOMESTIC)	1.713	1.713	.000	2.000	2.000	.000	2.150	2.150	.000	16
EXOG	17	STONE AND CLAY MINING	1.038	1.038	.000	1.165	1.165	.000	1.317	1.317	.000	17
EXOG	18	CHEMICAL FERTILIZER MINING	1.283	1.283	.000	2.263	2.263	.000	2.840	2.840	.000	18
MODEL	19	NEW CONSTRUCTION	1.146	1.152	.005	1.374	1.359	-.015	1.415	1.470	.054	19
NO ACT	20	MAINTENANCE CONSTRUCTION	1.116	1.139	.000	1.323	1.327	.000	1.405	1.435	.000	20
NO ACT	21	COMPLETE GUIDED MISSILES	1.168	1.172	.000	1.328	1.327	.000	1.584	1.497	.000	21
MODEL	22	AMMUNITION	1.015	1.149	.133	1.136	1.336	.200	1.231	1.448	.217	22

TABLE X-2 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (2): EXOGENOUS WAGES ("EXOG-WAGE")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
NO ACT	23	OTHER ORDNANCE	1.139	1.151	.000	1.331	1.308	.000	1.460	1.430	.000	23
MODEL	24	MEAT PRODUCTS	1.323	1.527	.205	1.303	1.314	.010	1.615	1.508	-.107	24
MODEL	25	DAIRY PRODUCTS	1.196	1.164	-.032	1.247	1.286	.040	1.431	1.388	-.044	25
MODEL	26	CANNED AND FROZEN FOODS	1.217	1.234	.017	1.406	1.337	-.069	1.467	1.425	-.042	26
MODEL	27	GRAIN MILL PRODUCTS	1.706	1.670	-.036	1.947	1.894	-.054	1.752	1.808	.056	27
MODEL	28	BAKERY PRODUCTS	1.231	1.200	-.031	1.482	1.369	-.113	1.526	1.417	-.108	28
EXOG	29	SUGAR	1.192	1.192	.000	4.665	4.665	.000	1.679	1.679	.000	29
MODEL	30	CONFECTIONERY PRODUCTS	1.178	1.327	.149	1.517	1.640	.123	1.659	1.547	-.112	30
MODEL	31	ALCOHOLIC BEVERAGES	1.054	1.144	.090	1.200	1.225	.025	1.270	1.249	-.022	31
MODEL	32	SOFT DRINKS AND FLAVORINGS	1.006	1.124	.118	1.498	1.403	-.096	1.479	1.392	-.087	32
MODEL	33	FATS AND OILS	1.787	1.943	.156	2.103	1.822	-.281	1.664	1.653	-.011	33
MODEL	34	MISC FOOD PRODUCTS	1.148	1.269	.121	1.470	1.354	-.115	1.602	1.429	-.173	34
MODEL	35	TOBACCO PRODUCTS	1.046	1.144	.098	1.212	1.295	.083	1.305	1.360	.056	35
MODEL	36	BROAD AND NARROW FABRICS	1.272	1.192	-.080	1.327	1.297	-.029	1.423	1.370	-.053	36
MODEL	37	YARN AND THREAD AND FINS	1.379	1.213	-.166	1.291	1.386	.095	1.479	1.532	.053	37
MODEL	38	FLOOR COVERINGS	1.069	1.146	.077	1.209	1.294	.085	1.200	1.413	.213	38
MODEL	39	MISC TEXTILES	1.242	1.189	-.052	1.416	1.319	-.097	1.478	1.453	-.026	39
MODEL	40	KNITTING	.999	1.106	.106	1.150	1.248	.098	1.144	1.334	.191	40
MODEL	41	APPAREL	1.071	1.078	.007	1.175	1.209	.034	1.184	1.260	.076	41
MODEL	42	HOUSEHOLD TEXTILES	1.222	1.110	-.112	1.334	1.272	-.062	1.315	1.354	.039	42
MODEL	43	LOGGING CAMPS	1.424	1.483	.059	1.198	1.614	.416	1.310	1.475	.164	43
MODEL	44	SAW AND PLANING MILLS	1.424	1.272	-.153	1.198	1.455	.257	1.310	1.411	.101	44
MODEL	45	VENEER AND PLYWOOD	1.257	1.220	-.03.	1.186	1.381	.195	1.315	1.337	.022	45
MODEL	46	MILLWORK AND WOOD PRODUCTS	1.206	1.165	-.041	1.234	1.320	.086	1.298	1.307	.009	46
MODEL	47	WOODEN CONTAINERS	1.291	1.204	-.086	1.403	1.308	-.095	1.385	1.180	-.205	47
MODEL	48	HOUSEHOLD FURNITURE	1.084	1.094	.010	1.236	1.222	-.014	1.276	1.255	-.020	48
MODEL	49	OTHER FURNITURE	1.130	1.081	-.049	1.421	1.206	-.214	1.415	1.258	-.156	49
EXOG	50	PULP MILLS	1.319	1.319	.000	2.331	2.331	.000	2.541	2.541	.000	50
MODEL	51	PAPER AND PAPERBOARD MILLS	1.095	1.173	.077	1.487	1.425	-.062	1.537	1.514	-.023	51
MODEL	52	PAPER PRODUCTS, NEC	1.062	1.135	.073	1.510	1.294	-.216	1.682	1.396	-.287	52
MODEL	53	WALL AND BUILDING PAPER	1.140	1.163	.024	1.517	1.353	-.165	1.509	1.418	-.091	53
MODEL	54	PAPERBOARD CONTAINERS	1.127	1.140	.013	1.379	1.295	-.084	1.401	1.394	-.007	54
MODEL	55	NEWSPAPERS	1.049	1.104	.055	1.270	1.217	-.053	1.356	1.312	-.044	55
NO ACT	56	PERIODICALS	1.071	1.096	.000	1.196	1.194	.000	1.282	1.269	.000	56
NO ACT	57	BOOKS	1.078	1.083	.000	1.168	1.165	.000	1.237	1.227	.000	57
NO ACT	58	BUSINESS FORMS,BLANK BOOK	1.079	1.100	.000	1.231	1.217	.000	1.314	1.296	.000	58
NO ACT	59	COMMERCIAL PRINTING	1.071	1.088	.000	1.224	1.204	.000	1.314	1.278	.000	59
NO ACT	60	OTHER PRINTING, PUBLISHING	1.075	1.083	.000	1.180	1.173	.000	1.256	1.240	.000	60
EXOG	61	STEEL SCRAP	2.312	2.312	.000	3.098	3.098	.000	1.890	1.890	.000	61
EXOG	62	OILSEEDS	1.821	1.821	.000	2.373	2.373	.000	1.554	1.554	.000	62
EXOG	63	COCOA BEANS	2.837	2.837	.000	3.918	3.918	.000	2.683	2.683	.000	63

TABLE X-2 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (2): EXOGENOUS WAGES ("EXOG-WAGE")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	64	INDUSTRIAL CHEMICALS	1.044	1.133	.090	1.560	1.403	-.157	1.941	1.555	-.386	64
MODEL	65	FERTILIZERS	1.224	1.116	-.107	2.076	1.344	-.732	1.836	1.474	-.362	65
MODEL	66	PESTICIDES + AGRIC. CHEM.	1.012	1.104	.092	1.356	1.239	-.117	2.230	1.274	-.956	66
MODEL	67	MISC CHEMICAL PRODUCTS	1.177	1.101	-.075	1.842	1.247	-.594	1.789	1.310	-.479	67
MODEL	68	PLASTIC MAT'LS. + RESINS	1.043	1.196	.154	2.000	1.637	-.363	2.057	1.836	-.221	68
MODEL	69	SYNTHETIC RUBBER	1.015	1.090	.075	1.451	1.257	-.193	1.462	1.345	-.117	69
MODEL	70	CELLULOSIC FIBERS	1.030	1.098	.068	1.181	1.403	.222	1.263	1.513	.250	70
MODEL	71	NON-CELLULOSIC FIBERS	.996	1.109	.113	1.030	1.273	.244	1.021	1.365	.344	71
MODEL	72	DRUGS	1.025	1.087	.061	1.179	1.197	.019	1.260	1.251	-.009	72
MODEL	73	CLEANING + TOILET PROD.	1.021	1.110	.089	1.203	1.237	.033	1.269	1.315	.046	73
MODEL	74	PAINTS	1.090	1.146	.056	1.370	1.344	-.026	1.452	1.440	-.011	74
EXOG	75	EFFECTIVE CRUDE OIL PRICE	1.386	1.386	.000	2.373	2.373	.000	2.797	2.797	.000	75
MODEL	76	PETROLEUM REFINING	1.292	1.278	-.014	1.975	1.949	-.026	2.301	2.258	-.043	76
MODEL	77	FUEL OIL	1.426	1.291	-.136	2.451	1.968	-.483	2.779	2.280	-.499	77
MODEL	78	PAVING AND ASPHALT	1.064	1.097	.033	1.617	1.356	-.260	1.812	1.488	-.324	78
MODEL	80	TIRES AND INNER TUBES	1.063	1.107	.044	1.307	1.190	-.118	1.394	1.267	-.126	80
MODEL	81	RUBBER PRODUCTS	1.059	1.134	.075	1.249	1.220	-.029	1.316	1.289	-.027	81
NO ACT	82	MISC PLASTIC PRODUCTS	1.045	1.111	.000	1.351	1.304	.000	1.496	1.432	.000	82
MODEL	83	LEATHER + IND LTHR PROD	1.280	1.087	-.193	1.218	1.174	-.044	1.312	1.265	-.047	83
MODEL	84	FOOTWEAR(EXC. RUBBER)	1.145	1.090	-.055	1.239	1.156	-.083	1.269	1.184	-.105	84
MODEL	85	OTHER LEATHER PRODUCTS	1.029	1.109	.081	1.149	1.217	.068	1.163	1.276	.113	85
MODEL	86	GLASS	1.086	1.114	.027	1.248	1.204	-.044	1.388	1.270	-.117	86
MODEL	87	STRUCTURAL CLAY PRODUCTS	1.060	1.099	.039	1.224	1.183	-.041	1.284	1.248	-.036	87
MODEL	88	POTTERY	1.082	1.088	.006	1.280	1.125	-.155	1.394	1.171	-.223	88
MODEL	89	CEMENT, CONCRETE, GYPSUM	1.081	1.087	.006	1.305	1.173	-.132	1.421	1.242	-.180	89
MODEL	90	OTHER STONE + CLAY PROD.	1.032	1.095	.063	1.317	1.152	-.165	1.456	1.204	-.252	90
MODEL	91	STEEL	1.053	1.158	.106	1.490	1.461	-.028	1.594	1.515	-.079	91
MODEL	92	COPPER	1.264	1.175	-.088	1.438	1.406	-.032	1.239	1.348	.109	92
MODEL	93	LEAD	1.228	1.160	-.068	1.981	1.474	-.507	1.606	1.543	-.063	93
MODEL	94	ZINC	1.604	1.148	-.456	2.300	1.423	-.877	2.214	1.482	-.731	94
MODEL	95	ALUMINUM	1.068	1.121	.053	1.549	1.328	-.221	1.519	1.419	-.099	95
MODEL	96	OTH PRIM NON-FER METALS	1.439	1.129	-.309	2.103	1.294	-.809	1.973	1.346	-.628	96
NO ACT	97	OTH NON-FER ROLL + DRAW	1.253	1.112	.000	1.738	1.276	.000	1.734	1.328	.000	97
MODEL	98	NON-FERROUS WIRE DRAWING	1.124	1.127	.003	1.529	1.330	-.199	1.265	1.365	.100	98
MODEL	99	NON-FER CASTING + FORGING	1.225	1.118	-.107	1.621	1.291	-.330	1.662	1.361	-.301	99
MODEL	100	METAL CANS	1.075	1.130	.055	1.473	1.343	-.130	1.530	1.448	-.082	100
MODEL	101	METAL BARRELS AND DRUMS	1.034	1.102	.067	1.442	1.280	-.162	1.476	1.352	-.124	101
MODEL	102	PLUMBING + HEATING EQUIP.	1.064	1.098	.035	1.295	1.259	-.036	1.335	1.341	.006	102
MODEL	103	BOILER SHOPS	1.093	1.111	.018	1.456	1.298	-.158	1.469	1.377	-.093	103
MODEL	104	OTH STRUCTURAL METAL PRD.	1.066	1.106	.040	1.509	1.286	-.223	1.589	1.364	-.225	104
MODEL	105	SCREW MACHINE PRODUCTS	1.094	1.080	-.013	1.528	1.246	-.283	1.540	1.324	-.216	105
MODEL	106	METAL STAMPINGS EXC. AUTO	1.113	1.091	-.022	1.405	1.271	-.135	1.512	1.343	-.168	106
MODEL	107	CUTLERY,HAND TOOLS,HARDWR	1.070	1.090	.020	1.265	1.248	-.017	1.370	1.336	-.034	107

TABLE X-2

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (2): EXOGENOUS WAGES ("EXOG-WAGE")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	108	MISC FABRICATED WIRE PRODUCTS	1.106	1.100	-.007	1.587	1.296	-.291	1.604	1.381	-.223	108
MODEL	109	PIPES, VALVES, FITTINGS	1.073	1.086	.014	1.475	1.249	-.226	1.583	1.333	-.250	109
MODEL	110	OTH FABRICATED METAL PROD.	1.054	1.086	.032	1.337	1.246	-.091	1.436	1.321	-.115	110
MODEL	111	ENGINES AND TURBINES	1.045	1.120	.075	1.264	1.250	-.014	1.398	1.318	-.079	111
MODEL	112	FARM MACHINERY	1.060	1.102	.042	1.303	1.259	-.043	1.431	1.377	-.054	112
MODEL	113	CONSTR,MINE,OILFIELD MACH	1.071	1.130	.059	1.368	1.295	-.073	1.564	1.427	-.137	113
MODEL	114	MATERIALS HANDLING MACH.	1.053	1.129	.076	1.299	1.297	-.002	1.441	1.426	-.015	114
NO ACT	115	MACH. TOOLS, METAL CUTTING	1.067	1.140	.000	1.251	1.290	.000	1.349	1.384	.000	115
NO ACT	116	MACH TOOLS, METAL FORMING	1.116	1.139	.033	1.312	1.299	.000	1.413	1.390	.000	116
MODEL	117	OTHER METAL WORKING MACH	1.053	1.139	.086	1.336	1.285	-.051	1.422	1.366	-.056	117
MODEL	118	SPECIAL INDUSTRIAL MACH	1.088	1.115	.028	1.334	1.238	-.096	1.463	1.325	-.138	118
MODEL	119	PUMPS,COMPRESSORS,BLOWERS	1.061	1.113	.052	1.391	1.255	-.137	1.538	1.348	-.190	119
MODEL	120	BALL AND ROLLER BEARINGS	1.058	1.110	.053	1.346	1.255	-.091	1.447	1.337	-.110	120
MODEL	121	POWER TRANSMISSION EQUIP	1.107	1.113	.006	1.381	1.254	-.127	1.462	1.342	-.121	121
MODEL	122	INDUSTRIAL PATTERNS	1.058	1.111	.053	1.310	1.246	-.072	1.525	1.334	-.191	122
MODEL	123	COMPUTERS + RELATED MACH.	1.020	1.065	.045	1.047	1.137	.090	1.029	1.249	.220	123
MODEL	124	OTHER OFFICE MACHINERY	1.043	1.064	.021	1.196	1.135	-.060	1.241	1.240	-.002	124
MODEL	125	SERVICE INDUSTRY MACHINERY	1.003	1.106	.104	1.139	1.255	.116	1.185	1.343	.158	125
MODEL	126	MACHINE SHOP PRODUCTS	1.087	1.089	.002	1.380	1.233	-.147	1.505	1.363	-.142	126
EXOG	127	RAW SUGAR	1.122	1.122	.000	5.035	5.035	.000	1.549	1.549	.000	127
EXOG	128	GREEN COFFEE	1.462	1.462	.000	1.441	1.441	.000	.988	.988	.000	128
MODEL	129	ELECTRICAL MEASURING INSTRUME	1.000	1.052	.052	1.141	1.158	.018	1.258	1.308	.050	129
MODEL	130	TRANSFORMERS + SWITCHGEAR	1.048	1.072	.025	1.376	1.211	-.165	1.499	1.352	-.147	130
MODEL	131	MOTORS AND GENERATORS	1.090	1.115	.025	1.384	1.255	-.130	1.466	1.399	-.067	131
MODEL	132	INDUSTRIAL CONTROLS	1.001	1.117	.116	1.280	1.253	-.026	1.326	1.416	.089	132
MODEL	133	WELDING APP, GRAPHITE PROD	1.058	1.132	.074	1.479	1.295	-.184	1.579	1.440	-.139	133
MODEL	134	HOUSEHOLD APPLIANCES	1.018	1.107	.089	1.185	1.244	.359	1.261	1.343	.082	134
MODEL	135	ELEC LIGHTING + WIRING EQ.	1.054	1.076	.321	1.366	1.215	-.145	1.439	1.317	-.122	135
MODEL	136	RADIO AND TV RECEIVING	.982	1.063	.082	1.014	1.156	.142	.997	1.247	.250	136
MODEL	137	PHONOGRAPH RECORDS	1.019	1.064	.045	1.147	1.172	.026	1.173	1.270	.097	137
MODEL	138	COMMUNICATION EQUIPMENT	1.076	1.080	.004	1.191	1.179	-.012	1.309	1.313	.005	138
MODEL	139	ELECTRONIC COMPONENTS	1.019	1.017	-.003	1.125	1.106	-.019	1.108	1.213	.105	139
MODEL	140	BATTERIES	1.012	1.108	.096	1.185	1.277	.092	1.276	1.395	.119	140
MODEL	141	ENGINE ELECTRICAL EQUIP.	1.032	1.116	.084	1.182	1.263	.081	1.422	1.376	-.046	141
NO ACT	142	X-RAY, ELEC EQUIP,NEC	1.105	1.108	.030	1.269	1.229	.000	1.391	1.366	.000	142
NO ACT	143	AUTO STAMPINGS	1.000	1.000	.000	1.000	1.000	.000	1.000	1.000	.000	143
NO ACT	144	TRUCK, BUS, TRAILER BODIES	1.075	1.106	.000	1.212	1.190	.000	1.324	1.285	.000	144
MODEL	145	MOTOR VEHICLES	1.019	1.094	.075	1.180	1.146	-.034	1.275	1.252	-.024	145
NO ACT	147	AIRCRAFT	1.111	1.116	.003	1.250	1.239	.030	1.396	1.371	.000	147
NO ACT	148	AIRCRAFT ENGINES	1.115	1.122	.030	1.291	1.264	.000	1.431	1.389	.000	148

TABLE X-2 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (2): EXOGENOUS WAGES ("EXOG-WAGE")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
NO ACT	149	AIRCRAFT EQUIPMENT, NEC	1.114	1.122	.000	1.282	1.258	.000	1.418	1.385	.000	149
NO ACT	150	SHIP AND BOAT BUILDING	1.075	1.096	.000	1.261	1.238	.000	1.390	1.348	.000	150
NO ACT	153	TRAILER COACHES	1.122	1.139	.000	1.297	1.290	.000	1.391	1.380	.000	153
NO ACT	156	ENGR. + SCIENTIFIC INSTR.	1.126	1.139	.000	1.314	1.298	.000	1.433	1.416	.000	156
NO ACT	157	MECH. MEASURING DEVICES	1.090	1.102	.000	1.251	1.223	.000	1.309	1.288	.000	157
MODEL	158	OPTICAL + OPHTHALMIC GOODS	1.053	1.071	.017	1.197	1.183	-.014	1.288	1.249	-.039	158
MODEL	159	MEDICAL + SURGICAL INSTR.	1.099	1.106	.006	1.278	1.240	-.038	1.336	1.301	-.035	159
MODEL	160	PHOTOGRAPHIC EQUIPMENT	1.020	1.062	.042	1.154	1.185	.031	1.246	1.258	.012	160
MODEL	162	WATCHES AND CLOCKS	1.056	1.107	.051	1.166	1.260	.094	1.203	1.346	.143	162
MODEL	163	JEWELRY AND SILVERWARE	1.093	1.081	-.012	1.266	1.198	-.068	1.330	1.262	-.068	163
MODEL	164	TOYS,SPORT,MUSICAL INSTR.	1.058	1.083	.024	1.233	1.217	-.016	1.300	1.287	-.014	164
MODEL	165	OFFICE SUPPLIES	1.068	1.077	.009	1.214	1.202	-.012	1.292	1.273	-.020	165
MODEL	166	MISC MANUFACTURING, NEC	1.051	1.095	.044	1.261	1.242	-.019	1.317	1.320	.003	166
MODEL	167	RAILROADS	1.062	1.141	.079	1.257	1.305	.048	1.394	1.385	-.009	167
MODEL	168	BUSSES AND LOCAL TRANSIT	1.039	1.055	.016	1.094	1.144	.049	1.294	1.238	-.056	168
MODEL	169	TRUCKING	1.086	1.116	.030	1.180	1.230	.049	1.261	1.283	.022	169
MODEL	170	WATER TRANSPORTATION	1.097	1.111	.013	1.206	1.252	.045	1.300	1.402	.102	170
MODEL	171	AIRLINES	1.069	1.102	.034	1.160	1.188	.029	1.260	1.282	.022	171
NO ACT	172	PIPELINES	1.017	1.020	.000	1.156	1.149	.000	1.415	1.403	.000	172
NO ACT	173	FREIGHT FORWARDING	1.091	1.093	.000	1.166	1.171	.000	1.293	1.287	.000	173
MODEL	174	TELEPHONE AND TELEGRAPH	1.060	1.077	.017	1.092	1.146	.054	1.146	1.201	.056	174
NO ACT	175	RADIO AND TV BROADCASTING	1.044	1.060	.000	1.115	1.141	.000	1.129	1.145	.000	175
MODEL	176	ELECTRIC UTILITIES (AVL. PRIC	1.106	1.129	.023	1.453	1.378	-.075	1.589	1.490	-.099	176
MODEL	177	ELEC. UTILITIES (WHOLESALE PR	1.119	1.145	.026	1.500	1.397	-.103	1.662	1.511	-.151	177
MODEL	178	NATURAL GAS	1.077	1.126	.049	1.251	1.302	.051	1.497	1.497	.000	178
MODEL	179	WATER AND SEWER SERVICES	1.084	1.112	.028	1.159	1.196	.037	1.284	1.305	.021	179
MODEL	180	WHOLESALE TRADE	1.155	1.187	.032	1.282	1.274	-.008	1.354	1.333	-.021	180
MODEL	181	RETAIL TRADE	1.073	1.077	.004	1.157	1.177	.019	1.275	1.272	-.003	181
NO ACT	182	BANKS,CREDIT AGEN.,BROKERS	1.055	1.062	.000	1.132	1.128	.000	1.251	1.226	.000	182
MODEL	183	INSURANCE	.987	1.107	.120	.985	1.203	.217	1.115	1.277	.162	183
EXOG	184	OWNER-OCCUPIED DWELLINGS	1.079	1.079	.000	1.144	1.144	.000	1.206	1.206	.000	184
EXOG	185	REAL ESTATE	1.079	1.079	.000	1.144	1.144	.000	1.206	1.206	.000	185
MODEL	186	HOTEL AND LODGING PLACES	1.076	1.098	.022	1.152	1.211	.059	1.229	1.291	.062	186
MODEL	187	PERSONAL + REPAIR SERVICES	1.091	1.073	-.017	1.196	1.213	.018	1.265	1.284	.019	187
NO ACT	188	BUSINESS SERVICES	1.083	1.085	.000	1.189	1.172	.000	1.274	1.233	.000	188
NO ACT	189	ADVERTISING	1.071	1.092	.000	1.203	1.200	.000	1.305	1.283	.000	189
MODEL	190	AUTO REPAIR	1.089	1.091	.002	1.235	1.224	-.011	1.349	1.316	-.034	190
MODEL	191	MOVIES + AMUSEMENTS	1.064	1.157	.093	1.156	1.265	.109	1.216	1.303	.087	191
MODEL	192	MEDICAL SERVICES	1.071	1.094	.023	1.209	1.219	.010	1.341	1.317	-.024	192
NO ACT	193	PRIVATE SCHOOLS + NPO	1.118	1.123	.000	1.230	1.220	.000	1.327	1.298	.000	193

prices. However, there appear to be a number of sectors for which a variety of evidence shows this to be a likely case in 1974 and 1975. The fourth class is a residual: some significant errors occur in some sectors for which, as yet, no reasonable explanation exists. Our hope, of course, is that further work will be made on the model so that such mysteries can eventually be solved.

Before tackling the messy business of evaluating individual sector errors in terms of these classes, we should point to those sectors where the model appeared to work quite satisfactorily. We basically focus on the fourth quarter of 1975, since the control (and decontrol) periods probably distorts the comparison in many sectors for 1973:4 and 1974:4. In the food group we find that prices for Dairy products (25) and Grain mill products (26) follow quite closely their associated raw farm input costs and labor costs. This is especially the case for Grain mill products where the error is less than 3 percent given that the actual price rose 75 percent from 1972:1 to 1975:4.

The predictions for the largest of the textile sectors, Broad and narrow fabrics (36), are quite close to the actual for all but the 1973:4 observation. The 1975:4 comparisons for Miscellaneous textiles (39) is also very good (-.026), and the model appears to be homing in on the price of Yarn and thread (37). The remaining two textile sectors, Floor coverings (38) and Knitting (40), display large misses; we shall have more to say about Knitting below.

The prices for Household furniture (48) are quite accurately predicted for each quarter shown. The level of errors for both 1974:4 and 1975:4 are less than two percent. Other furniture (49), does not fare as well but the model error becomes smaller as we move from 1974:4 to 1975:4.

Given the exogenous price for Pulp mills (50) the model does a reasonable job in predicting the price for Paper and paperboard mills (51). The price for Paper products, nec(52) is apparently the one that reflects the paper shortage in 1974.

The model generally underpredicts in the metals and machinery sectors. However, for two important basic materials, Steel (91) and Aluminum (95) the model errors in 1975:4 are both less than 7 percent. The effort of control periods shows up clearly for both these sectors as the model overpredicts their prices as of 1973:4. The release of controls had an extraordinary impact on the steel price over 1974; the price rose 41 percent from 1973:4 to 1974:4. Large increases in iron ore prices, steel scrap prices, and labor costs are sufficient to allow the model to forecast a huge increase of 24.3 percent from 1973:4 to 1974:4, but still well below what actually occurred.

In addition to household furntiure the model tracks reasonably well two other important consumer durable prices: Household appliances (134) and Motor Vehicles (145). The model again overpredicts slightly in 1973:4 but by the end of 1975, the predicted level for Motor vehicles is within 2 percent of its actual value.

In the five transportation sectors (167-171) for which actual price data exist, the model does a creditable job in forecasting the levels for the 1975:4 observation. The quarterly changes in the actual prices for Trucking and Water transportation should not be taken too seriously. They are both derived from interpolating annual data with a polynomial.

The price for Telephone and telegraph (174) is predicted very closely. The high growth rate of labor productivity in this sector contributes to its falling relative price.

Reliable quarterly data exist for only a few other service sectors. Most of these are reasonably tracked by the model with the exception of Insurance (183), and Movies and amusements (191).

Deficiencies in the model that will require future work, however, lead to larger errors for other sectors. We find particularly large underpredictions of prices in nonferrous metals, chemicals, and paper (sector 52). The majority of sectors in these three groups fall into class one of our earlier taxonomy shortages. The model is too crude to capture adequately strong excess demand forces that were at work in these sectors during 1973 and 1974. For instance, we pay the price for two-digit aggregation for our markup equations in primary metals. World-wide demand, real and speculative, was very strong for nonferrous metals in 1973 and 1974. Our value-added price markup equation, running off Q/K for total primary metals, cannot hope to forecast movements of these competitively determined metals prices. We also find an aggregation problem in the model for the determination of input costs for these metals. An aggregate ores price for sector 14 (Other nonferrous ores) serves as the ores input prices for Lead (93), Zinc (94), Aluminum (95), and Other Primary nonferrous metals (96).

Demand measurement and aggregation problems infest the sectors in two-digit SIC group Chemicals. Most observers have stated that the shortage of a key input — petroleum feedstock — was responsible for the dramatic increase in many chemical product prices in 1974. What is puzzling is that the residual widens between 1974:4 and 1975:4 for

Industrial chemicals (64) and Pesticides and agricultural chemicals (66). For Industrial chemicals the conventional I/O table shows a .0253 input coefficient from the Petroleum refining sector. On the grounds that refined Petroleum prices understate the feedstock prices to Industrial chemicals, the model uses a weighted average price of the "effective" crude oil price (i.e. domestic plus imported, sector (75)) and the refined price from sector (76).[2] This helps the model predict, by historical standards, large increases in the industrial chemicals prices over the 1973:4 to 1975:4 period, but understate the actual price increases.

Conventional econometric treatment of chemical price behavior over this period fares no better. Joel Popkin, in a recent paper attempting to explain price behavior in primary manufacturing industries, constructs a quarterly aggregate price index for all of chemicals (SIC 28) and uses an equation estimated over 1958-73 to forecast prices over 1974 and 1975 (from 1973:4-1974:4 and 1974:4-1975:4).[3] This equation, to which we referred in the previous chapter concerning cost lags, uses petroleum prices (not precisely defined in his paper) in the construction of the input cost variable and a demand variable constructed from data on unfilled orders, new orders, finished goods inventories, and capacity utilization. (The reader should consult the Popkin article for an exact description and rationale for the demand variable.) The Popkin equation predicts a rise of 12.5 percent in 1974, whereas the SIC 28 price index

[2]The weights are .75 for crude petroleum (effective refiners price) and .25 for refined petroleum.

[3]Joel Popkin, "Price Behavior in Primary Manufacturing Industries," NBER Working Paper No. 136, July 1976.

rises 52.6 percent. In 1975, demand slackens and the equation predicts a fall of 1.3 percent in the price but the actual price rises 9.3 percent. Over the same two-year period the model here by comparison, forecasts a rise in an aggregate chemicals price of around 35 percent.

Not all of the chemical sector prices are overpredicted. One of the mysteries in the behavior of prices for Non-cellulosic fibers (sector 71). Basically, this is the price of nylon and BLS prices it as part of its product class pricing program as SIC 28241. In spite of a sizable (in 1972 dollars) input coefficient from Industrial chemicals of .299, the published price remained flat over the entire 1972-75 period. One conjectural hypothesis is that the expiration of the DuPont patents for nylon tended to hold the price down as other firms moved into this market.

For the three basic consumer goods sectors of chemicals: namely, Drugs (72), Cleaning and toilet products (73), and Paints (74), the model yields very satisfactory predictions.

Fabricated Metals

The model underpredicts the price levels for nearly all the sectors in the Fabricated metals groups, SIC 34 (sectors 100-110). We find particularly large errors for Other structural metal produces (104), Miscellaneous fabricated wire products (108), and Pipes, valves and fittings (109). For these three sectors the level of the actual index exceeds the model's by .20 or greater in 1975:4. We have some reason to believe that the WPI price for an indeterminable number of these sectors may have exceeded transactions prices, especially for 1975. As we will see in Section 10.3, the use of 1975 prices in our scheme to generate current dollar gross product originating (see Chapter III) yields an estimate of 28 billion dollars for SIC 34. The actual value was 24.1

billion. Although we delay a discussion until Section 10.3 of other possible sources of error for such a calculation, the magnitude of this error, as compared to other industries, was very large in 1975.

The input structures are straightforward enough in the fabricated metals sectors, that a check could be made with BEA's own calculation of material cost prices for their double-deflation work in preparation of GPO deflators. BEA computes material cost indexes at the 87-order level in the 1967 I/O tables; the weights are 1967-based and normalized, as the national accounts, to 1972. The major difference in their result is the extra precision that may be gained by use of five-digit SIC product class deflators in building their cost indexes.

BEA's 87 sectors included four in Fabricated Metals: Metal Containers; Heating, Plumbing, and Fabricated Structural Metal Products; Screw Machine Products, Nuts, etc.; and Metal Stampings, and Other Fabricated Metal Products.

Input and output prices for the 11 INFORUM sectors in Fabricated metals were aggregated into these four sectors using 1972 weights. For these calculations actual price data were used rather than those from the "exog-wage" simulation. The material cost indexes for the four sectors were all within two percent of the BEA price indexes for 1973, 1974, and 1975. The output price indexes also compared quite closely. The consistency with the BEA material cost indexes gives us more confidence that we are not omitting some important cost component in our price equations for the sectors.

With our basic price data appearing to be in order we can, of course, look to other cost components that may have been understated by the model. To aid in identifying other sources of error, a diagnostic display program was written that provides a capsule summary of the cost components for any selected industry. The program accesses several files created by the price-wage model to show annual I/O coefficients, material costs, labor costs, and "capital" costs. The table for Other structual metal products is shown on page 427. In this table actual prices are shown in the first four columns. In the row marked "Recomputed input prices indexes," the input prices indexes are computed on the basis of the annual average prices shown. The movement of this cost index will differ from that used in the model, since the model has a one quarter lag in passing through material costs. The model material price is shown in the lower left portion of the table.

The prices labeled "Model Prices (1972 = 1.0)" are those generated by the model when actual prices are used in the calculations of the input price indexes. Thus, the differences from the reported prices can be looked upon as essentially single equation type residuals.

The other components are generally self-explanatory. The absolute level of unit capital cost is the most unreliable figure in the table. It derives from the detailed value-added breakdown in the 1967 table, updated to 1972 (see Chapters II and III).

The basic message of this particular table is that there is no obvious understatement in costs that would yield an error of this magnitude which appears. Although the productivity figure has not been checked by reference to outside data, one has to concede that it is probably not overstated. The capital cost component rises by 75 percent from 1972-75.

ANALYSIS OF GROSS OUTPUT PRICE FOR INFORUM SECTOR 104 OTH STRUCTURAL METAL PRD.

	PRICES (1972 = 1.0)				INPUT-OUTPUT COEFFICIENTS			
	1972	1973	1974	1975	1972	1973	1974	1975
20 MAINTENANCE CONSTRUCTION	1.000	1.064	1.218	1.346	.004059	.004059	.004059	.004059
41 APPAREL	1.000	1.030	1.131	1.155	.001043	.000999	.000952	.000906
44 SAW AND PLANING MILLS	1.000	1.289	1.299	1.208	.001343	.001321	.001300	.001280
51 PAPER AND PAPERBOARD MILLS	1.000	1.055	1.317	1.517	.001317	.001322	.001328	.001334
52 PAPER PRODUCTS, NEC	1.000	1.032	1.206	1.609	.001113	.001132	.001150	.001169
53 WALL AND BUILDING PAPER	1.000	1.031	1.339	1.462	.000772	.000789	.000805	.000822
54 PAPERBOARD CONTAINERS	1.000	1.074	1.260	1.355	.005568	.005636	.005704	.005773
73 CLEANING + TOILET PROD.	1.000	1.013	1.123	1.252	.000977	.000899	.000920	.000941
74 PAINTS	1.000	1.026	1.235	1.415	.013687	.013598	.013510	.013425
75 PETROLEUM REFINING	1.000	1.154	1.736	2.085	.001872	.001977	.001881	.001096
78 PAVING AND ASPHALT	1.000	1.036	1.502	1.725	.001270	.001275	.001279	.001282
82 MISC PLASTIC PRODUCTS	1.000	1.019	1.155	1.429	.002956	.003094	.003227	.003353
86 GLASS	1.000	1.025	1.146	1.322	.013068	.012834	.012608	.012387
91 STEEL	1.000	1.035	1.315	1.550	.278413	.270176	.262414	.255092
92 COPPER	1.000	1.156	1.434	1.224	.010643	.010613	.010593	.010561
94 ZINC	1.000	1.259	2.139	2.103	.000529	.000529	.000529	.000529
95 ALUMINUM	1.000	1.019	1.417	1.502	.083236	.084152	.085067	.085992
96 OTH PRIM NON-FER METALS	1.000	1.259	1.963	1.929	.001569	.001578	.001567	.001555
105 SCREW MACHINE PRODUCTS	1.000	1.057	1.314	1.530	.020965	.020937	.021146	.021331
106 METAL STAMPINGS	1.000	1.050	1.248	1.459	.003936	.003863	.003830	.003778
107 CUTLERY,HAND TOOLS,HARDWR	1.000	1.033	1.154	1.327	.010022	.009981	.009943	.009839
108 MISC FABRICATED WIRE PRODUCTS	1.000	1.062	1.449	1.609	.006728	.006644	.006563	.006485
111 OTH FABRICATED METAL PROD.	1.000	1.032	1.201	1.390	.013015	.013101	.013175	.013237
117 OTHER METAL WORKING MACH	1.000	1.033	1.204	1.397	.003694	.003694	.003694	.003694
119 PUMPS,COMPRESSORS,BLOWERS	1.000	1.033	1.227	1.497	.001035	.001035	.001035	.001035
122 INDUSTRIAL PATTERNS	1.000	1.071	1.168	1.496	.001779	.001779	.001779	.001779
125 SERVICE INDUSTRY MACHINERY	1.000	.999	1.368	1.173	.001216	.001366	.001518	.001569
126 MACHINE SHOP PRODUCTS	1.000	1.049	1.213	1.442	.017719	.018373	.019020	.019657
130 TRANSFORMERS + SWITCHGEAR	1.000	1.031	1.232	1.453	.001243	.001308	.001365	.001420
131 MOTORS AND GENERATORS	1.000	1.049	1.222	1.407	.001693	.001709	.001726	.001744
133 WELDING APP, GRAPHITE PROD	1.000	1.034	1.257	1.579	.001414	.001414	.001414	.001414
167 RAILROADS	1.000	1.025	1.187	1.309	.010317	.010299	.010204	.010271
169 TRUCKING	1.000	1.043	1.126	1.214	.012917	.013166	.013517	.013871
170 WATER TRANSPORTATION	1.000	1.050	1.144	1.250	.000676	.000649	.000627	.000609
174 TELEPHONE AND TELEGRAPH	1.000	1.027	1.070	1.104	.008557	.008950	.009163	.009471
175 ELECTRIC UTILITIES	1.000	1.057	1.303	1.529	.005431	.005565	.005700	.005836
178 NATURAL GAS	1.000	1.046	1.177	1.411	.002739	.002713	.002688	.002663
180 WHOLESALE TRADE	1.000	1.033	1.099	1.130	.036302	.036984	.037467	.038353
181 RETAIL TRADE	1.000	1.046	1.113	1.187	.010099	.010099	.010099	.010099
182 BANKS,CREDIT AGEN.,BROKERS	1.000	1.055	1.113	1.221	.005507	.005507	.005507	.005507
183 INSURANCE	1.000	.950	.986	1.046	.003419	.003419	.003419	.003419
185 REAL ESTATE	1.000	1.051	1.111	1.174	.018944	.019126	.019408	.019591
188 BUSINESS SERVICES	1.000	1.052	1.122	1.196	.019432	.020301	.021149	.021973
189 ADVERTISING	1.000	1.043	1.135	1.261	.003975	.003859	.003747	.003640
190 AUTO REPAIR	1.000	1.014	1.128	1.260	.001438	.001492	.001545	.001597
193 PRIVATE SCHOOLS + NPO	1.000	1.066	1.157	1.230	.001211	.001211	.001211	.001211
194 POST OFFICE	1.000	1.030	1.163	1.196	.001250	.001250	.001250	.001250
197 BUSINESS TRAVEL(DUMMY)	1.000	1.063	1.152	1.270	.015728	.015728	.015728	.015728
198 OFFICE SUPPLIES(DUMMY)	1.000	1.030	1.205	1.436	.000854	.000854	.000854	.000854
RECOMPUTED INPUT PRICE INDEXES					1.000	1.034	1.257	1.410

1972 COLUMN SUM .670 SUM OF 50 LARGEST COEFFICIENTS .656 DIAGONAL .020

SECTOR 104 OUTPUT PRICE INDEXES	1972	1973	1974	1975
REPORTED PRICES (1972 = 1.0)	1.000	1.033	1.323	1.571
MODEL PRICES (1972 = 1.0)	1.000	1.049	1.189	1.364
MODEL PRICES (1972:1 = 1.0)	1.018	1.068	1.210	1.333
MODEL UNIT MATERIAL COST	.671	.689	.793	.938
PRODUC. INDEX - 3-YR MOVING AVE.	1.008	1.034	1.052	1.056
COMPENSATION PER MANHOUR INDEX	1.000	1.060	1.164	1.299
PERCENT CHANGE		6.0	9.8	11.6
EFFECTIVE UNIT LABOR COST	.279	.288	.309	.342
UNIT CAPITAL COST	.041	.063	.077	.073
MARKUP INDEX	1.015	1.078	1.105	1.074

The table here is representative of the other sectors in Fabricated metals with large errors. There seem to be two problems that are apparent here. The first is that the lack of data prevented estimation of our value-added markup equations beyond 1974. If large increases in durable goods prices resulted from the final elimination of controls in April 1974, we may expect to find an effect on profit incomes using annual data in both 1974 and 1975. As an extreme case, consider a hypothetical price history for years 1973-75"

Price of Widgets

	QTR 1	2	3	4	Annual
1973	1.00	1.00	1.00	1.00	1.00
1974	1.00	1.00	1.10	1.20	1.075
1975	1.20	1.20	1.20	1.20	1.20

The annual data give the illusion of large price increases in 1975, whereas the increase come only in the latter part of 19 4. If this price history is related to smoothly rising costs, profit data for 1975 as well as 1974 are required to quantify the impact of controls for our annual equations. For Fabricated metals, this phenomenon appears to be the case as profits rise in 19 5, even as output in the industry declines.

Thus, the first problem is just that another observation may be needed from our price equations to work satisfactorily over this period. The second problem is the one to which we referred at the beginning of our discussion on Fabricated metals. Given the observed prices, do the incomes implied by them correspond to reported incomes? And for Fabricated metals as a whole we shall see in the next section that the answer is No.

Machinery

Our inability to measure the impact of controls may also explain the trouble spots in the machinery sectors, although the problem is not as pervasive as in Fabricated metals. For at least one machinery sector — construction, Mine and oil field machinery (133) — we can point to the probability of strong demand peressure in 1975 leading to the model's underprediction. The strong demand is, of course, due to the rise in oil exploration activity that began in late 1974 and 1975. The model's underprediction increases from 1974:4 to 1975:4, whereas, in most of the machinery sectors the errors remain approximately the same or decline slightly. (This is not true for Industrial Patterns (122), where no explanation is apparent.)

The model overpredicts the actual price indexes by more than .10 for Computers (123) and Radio and TV receiving (136). Although the absolute errors are disappointing, the model does succeed in forecasting significant declines in the relative prices of these items from the 1972 base. For the latter sector, the Japanese competition in the color TV market probably plays a strong role in explaining the actual slight decline of this price.

Apparel

Apparel is one other important consumer goods sector where the effects of import competition may be a source of the model's overprediction. For this sector, the error in the model shows a disturbing tendency to widen across the three time periods. However, there appear to be, as yet, undetermined measurement errors for output and prices for this sector. The GPO deflator for Apparel in 1975 is 1.03 (1972 = 1.0), the lowest of any in manufacturing.

BEA's real gross product figures are, of course, obtained by dividing current dollar GPO by this deflator. If, for any reason, the deflator is biased downward the real gross product figure is biased upward and vice versa. The BEA real gross product index is 107.9 in 1975, again with a 1972 base. The Federal Reserve index of industrial production, on the other hand, shows a <u>decline</u> of 1.6 percent from 1972 using annual data.

A price equation using only BEA data can explain the modest price movements by the implied high rates of labor productivity growth. An index labor producting using BEA real gross product and hours worked by full-time and part-time employees rises to 1.221 in 1975 from a 1972 base. 1975 is a cyclical low; so, if anything, this figure understates the "trend" adjusted figure. The point here is that such an increase far outstrips the annual rate of productivity estimated in the INFORUM labor productivity equations of around 2.0 percent per year (and implied by FRB data over the recent period). The model shows the three-year moving average productivity level to be 1.092 in 1975 for Apparel on a 1972 base.

Apparel is a large, heterogenous sector and part of the problem may arise from product-mix changes. U.S. producers may be switching to higher-profit items as a substantial quantity of imported clothing has taken over the cheaper lines. Although the BEA output deflator for the construction of the GPO deflator is implicity weighted, the material cost index it uses is fixed with 1967 weights (as of 1975). Moving to a higher proportion of items in total apparel with higher value-added imputs means, pari passu, that material costs are overstated. An overstatement of material costs, of course, biases the GPO deflator downward. Without burdening the reader with further speculation, we will have to leave the unraveling of this mystery to future work.

Endogenous Wages

Table X-3 shows the comparison of actual to predicted prices in the model when the aggregate wage-change and industry relative wage are working freely in the system. The errors are almost uniformly greater than those in Table X-2; this is largely due to the interaction of prices and wages to produce a slightly lower "aggregate" wage level. This is reflected in the prediction of the personal consumption deflator for 1975:4 as 1.6 percent below it's value in simulation (2). On the whole, the dynamics of general wage-price interaction seem to be reasonably well captured by the model.

The largest difference in the errors between Table X-2 and X-3 occurs in Steel (91). In spite of the high price coefficient on the relative wage equation, the relative wage equation fails to capture the extraordinary size of the steel settlement in 1974. In terms of annual results, the model predicts a rise from 1.030 to 1.10 from 1972-1975 in the steel wage relative to the fixed-weight gross hourly earnings index for the entire private non-farm economy. The actual rise was from 1.03 to 1.188. The direct (and indirect) effects of this error give rise to an underprediction in the steel price for 1975:4 of .122 as compared to .046 in the exogenous wage version.

On the whole, however, the predictions from relative wage equations do not lead to significant deterioration in the explanation of relative price changes. Following the procedure of Nordhaus and Shoven, I have calculated the correlation between actual and predicted price changes across the set of industries labeled "MODEL." The matrix of correlation coefficients is as follows for two selected intervals:

	exogenous wages	endogenous wages
1973:4-1975:4	.657	.614
1972:1-1975:4	.694	.691

The deterioration in the correlation for the sub-period stems from the steel contract and simply that errors in tracking in the inflation rate (attributable, of course, to many other sources than steel wages) lead to full-model errors in the relative wage equations. These equations use recent inflation rates as an independent variable. Over the entire period, however, this problem is attenuated somewhat by reference to the correlation coefficients.

Errors in Industry Wages

In Table X-4 we display the errors in the industry wage indexes obtained from Simulation (3). We have shown here annual wage levels, rather than those for the fourth quarter since our primary source of actual wages was only on an annual basis.[4] The results in the table support the fact that the major errors in predicting prices over this historical period do not stem from errors in predicting wages. The vast majority of sectors have percentage errors for 1975 that are less than

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[4]The indexes under "STD" for the sub-aggregates are not actual values, but are generated from the equations. Thus, the small "errors" for lines 201-206 should be ignored.

TABLE X-3

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (3): EXOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, ENDOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	201	WHOLESALE PRICE INDEX	1.398	1.426	.028	1.695	1.619	-.075	1.775	1.689	-.086	201
MODEL	202	INDUSTRIAL COMPONENT	1.288	1.306	.019	1.616	1.526	-.090	1.728	1.631	-.098	202
MODEL	203	GROSS NATIONAL PRODUCT : DEFL	1.099	1.116	.017	1.247	1.237	-.011	1.340	1.312	-.028	203
MODEL	204	PERSONAL CONSUMPTION EXPEND	1.093	1.110	.017	1.218	1.222	.004	1.315	1.295	-.020	204
MODEL	205	DURABLES	1.032	1.051	.019	1.116	1.115	-.001	1.183	1.173	-.010	205
MODEL	206	NON-DURABLES	1.138	1.159	.021	1.304	1.293	-.011	1.400	1.360	-.040	206
MODEL	207	SERVICES	1.072	1.085	.013	1.174	1.194	.020	1.280	1.277	-.004	207
MODEL	208	GROSS PRIVATE FIXED INVESTM	1.088	1.097	.009	1.287	1.237	-.050	1.361	1.317	-.044	208
MODEL	209	BUSINESS STRUCTURES	1.096	1.097	.001	1.335	1.260	-.075	1.391	1.341	-.050	209
MODEL	210	PRODUCERS' DURABLE EQUIP	1.058	1.083	.025	1.240	1.194	-.046	1.334	1.283	-.052	210
MODEL	211	RESIDENTIAL CONSTRUCTION	1.114	1.108	-.006	1.297	1.265	-.032	1.358	1.332	-.026	211
MODEL	212	EXPORTS	1.209	1.234	.025	1.465	1.402	-.062	1.488	1.425	-.063	212
MODEL	213	GOVERNMENT EXPENDITURES	1.085	1.094	.009	1.259	1.231	-.028	1.361	1.325	-.037	213
MODEL	214	FEDERAL	1.091	1.097	.006	1.238	1.219	-.019	1.352	1.318	-.033	214
MODEL	215	STATE AND LOCAL	1.073	1.091	.018	1.251	1.227	-.023	1.350	1.315	-.035	215
EXOG	1	DAIRY FARM PRODUCTS	1.441	1.441	.000	1.416	1.416	.000	1.705	1.705	.000	1
EXOG	2	POULTRY AND EGGS	1.786	1.786	.000	1.719	1.719	.000	1.845	1.845	.000	2
EXOG	3	MEAT ANIMALS, OTH LIVESTK	1.335	1.335	.000	1.185	1.185	.000	1.457	1.457	.000	3
EXOG	4	COTTON	2.200	2.200	.000	1.261	1.261	.000	1.458	1.458	.000	4
EXOG	5	GRAINS	2.487	2.487	.000	3.030	3.030	.000	2.282	2.282	.000	5
EXOG	6	TOBACCO	1.189	1.189	.000	1.336	1.336	.000	1.342	1.342	.000	6
EXOG	7	FRUIT,VEGETABLES,OTH CROPS	1.525	1.525	.000	1.709	1.709	.000	1.550	1.550	.000	7
EXOG	8	FORESTRY PRODUCTS	2.058	2.058	.000	1.951	1.951	.000	1.704	1.704	.000	8
EXOG	9	FISHERY PRODUCTS	1.375	1.375	.000	1.293	1.293	.000	1.431	1.431	.000	9
NO ACT	10	AGR,FORESTRY+FISH SERVICES	1.154	1.128	.000	1.188	1.163	.000	1.275	1.249	.000	10
EXOG	11	IRON ORES	1.051	1.051	.000	1.374	1.374	.000	1.581	1.581	.000	11
EXOG	12	COPPER ORE	1.330	1.330	.000	1.542	1.542	.000	1.261	1.261	.000	12
EXOG	13	OTHER NON-FERROUS ORES	1.326	1.326	.000	1.872	1.872	.000	1.858	1.858	.000	13
EXOG	14	COAL MINING	1.218	1.218	.000	2.113	2.113	.000	1.916	1.916	.000	14
EXOG	15	NATURAL GAS	1.201	1.201	.000	1.551	1.551	.000	2.126	2.126	.000	15
EXOG	16	CRUDE PETROLEUM (DOMESTIC)	1.713	1.713	.000	2.000	2.000	.000	2.150	2.150	.000	16
EXOG	17	STONE AND CLAY MINING	1.038	1.038	.000	1.165	1.165	.000	1.317	1.329	.012	17
EXOG	18	CHEMICAL FERTILIZER MINING	1.283	1.283	.000	2.263	2.263	.000	2.840	2.840	.000	18
MODEL	19	NEW CONSTRUCTION	1.146	1.130	-.017	1.374	1.326	-.048	1.415	1.433	.018	19
NO ACT	20	MAINTENANCE CONSTRUCTION	1.116	1.120	.000	1.323	1.303	.000	1.405	1.406	.000	20
NO ACT	21	COMPLETE GUIDED MISSILES	1.168	1.159	.000	1.328	1.310	.000	1.504	1.458	.000	21
MODEL	22	AMMUNITION	1.015	1.134	.119	1.136	1.320	.184	1.231	1.441	.210	22
NO ACT	23	OTHER ORDNANCE	1.139	1.137	.000	1.331	1.297	.000	1.460	1.429	.000	23

TABLE X-3 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (3): EXOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, ENDOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	24	MEAT PRODUCTS	1.323	1.524	.201	1.303	1.309	.006	1.615	1.502	-.113	24
MODEL	25	DAIRY PRODUCTS	1.196	1.157	-.039	1.247	1.282	.035	1.431	1.381	-.050	25
MODEL	26	CANNED AND FROZEN FOODS	1.217	1.219	.002	1.406	1.325	-.081	1.467	1.404	-.063	26
MODEL	27	GRAIN MILL PRODUCTS	1.706	1.661	-.045	1.947	1.886	-.061	1.752	1.795	.043	27
MODEL	28	BAKERY PRODUCTS	1.231	1.187	-.044	1.482	1.372	-.113	1.526	1.407	-.119	28
EXOG	29	SUGAR	1.192	1.192	.000	4.665	4.665	.000	1.679	1.679	.000	29
MODEL	30	CONFECTIONERY PRODUCTS	1.178	1.316	.138	1.517	1.629	.112	1.659	1.532	-.127	30
MODEL	31	ALCOHOLIC BEVERAGES	1.054	1.135	.081	1.200	1.215	.015	1.270	1.240	-.030	31
MODEL	32	SOFT DRINKS AND FLAVORINGS	1.006	1.110	.104	1.498	1.385	-.113	1.479	1.363	-.116	32
MODEL	33	FATS AND OILS	1.787	1.935	.148	2.103	1.815	-.288	1.664	1.646	-.018	33
MODEL	34	MISC FOOD PRODUCTS	1.148	1.255	.107	1.470	1.341	-.128	1.602	1.417	-.185	34
MODEL	35	TOBACCO PRODUCTS	1.046	1.127	.081	1.212	1.277	.065	1.305	1.350	.045	35
MODEL	36	BROAD AND NARROW FABRICS	1.272	1.179	-.093	1.327	1.286	-.040	1.423	1.352	-.071	36
MODEL	37	YARN AND THREAD AND FINS	1.379	1.201	-.177	1.291	1.375	.083	1.479	1.513	.033	37
MODEL	38	FLOOR COVERINGS	1.069	1.131	.062	1.209	1.284	.074	1.200	1.396	.196	38
MODEL	39	MISC TEXTILLS	1.242	1.170	-.072	1.416	1.307	-.109	1.478	1.438	-.040	39
MODEL	40	KNITTING	.999	1.087	.088	1.150	1.236	.085	1.144	1.320	.176	40
MODEL	41	APPAREL.	1.071	1.062	-.009	1.175	1.196	.021	1.184	1.244	.060	41
MODEL	42	HOUSEHOLD TEXTILES	1.222	1.097	-.124	1.334	1.258	-.076	1.315	1.337	.022	42
MODEL	43	LOGGING CAMPS	1.424	1.472	.048	1.198	1.606	.408	1.310	1.465	.155	43
MODEL	44	SAW AND PLANING MILLS	1.424	1.243	-.181	1.198	1.442	.244	1.310	1.391	.080	44
MODEL	45	VENEER AND PLYWOOD	1.257	1.197	-.060	1.186	1.365	.179	1.315	1.315	.000	45
MODEL	46	MILLWORK AND WOOD PRODUCTS	1.206	1.140	-.065	1.234	1.304	.069	1.298	1.285	-.014	46
MODEL	47	WOODEN CONTAINERS	1.291	1.177	-.114	1.403	1.291	-.112	1.385	1.159	-.225	47
MODEL	48	HOUSEHOLD FURNITURE	1.084	1.073	-.011	1.236	1.210	-.026	1.276	1.239	-.036	48
MODEL	49	OTHER FURNITURE	1.130	1.061	-.069	1.421	1.193	-.228	1.415	1.241	-.174	49
EXOG	50	PULP MILLS	1.319	1.319	.000	2.331	2.331	.000	2.541	2.541	.000	50
MODEL	51	PAPER AND PAPERBOARD MILLS	1.095	1.159	.063	1.487	1.412	-.074	1.537	1.489	-.047	51
MODEL	52	PAPER PRODUCTS, NEC	1.062	1.120	.058	1.510	1.279	-.231	1.682	1.370	-.312	52
MODEL	53	WALL AND BUILDING PAPER	1.140	1.150	.010	1.517	1.340	-.177	1.509	1.392	-.116	53
MODEL	54	PAPERBOARD CONTAINERS	1.127	1.124	-.003	1.379	1.279	-.100	1.401	1.368	-.033	54
MODEL	55	NEWSPAPERS	1.049	1.088	.039	1.270	1.210	-.059	1.356	1.308	-.048	55
NO ACT	56	PERIODICALS	1.071	1.086	.000	1.196	1.188	.000	1.282	1.262	.000	56
NO ACT	57	BOOKS	1.078	1.061	.000	1.168	1.164	.000	1.237	1.229	.000	57
NO ACT	58	BUSINESS FORMS,BLANK BOOK	1.079	1.087	.000	1.231	1.203	.000	1.314	1.277	.000	58
NO ACT	59	COMMERCIAL PRINTING	1.071	1.090	.000	1.224	1.196	.000	1.314	1.277	.000	59
NO ACT	60	OTHER PRINTING, PUBLISHING	1.075	1.073	.000	1.180	1.160	.000	1.256	1.224	.000	60
EXOG	61	STEEL SCRAP	2.312	2.312	.000	3.098	3.098	.000	1.890	1.890	.000	61
EXOG	62	OILSEEDS	1.821	1.821	.000	2.373	2.373	.000	1.554	1.554	.000	62
EXOG	63	COCOA BEANS	2.837	2.837	.000	3.918	3.918	.000	2.683	2.683	.000	63

TABLE X-3 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (3): EXOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, ENDOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	64	INDUSTRIAL CHEMICALS	1.044	1.130	.086	1.560	1.390	-.169	1.941	1.537	-.404	64
MODEL	65	FERTILIZERS	1.224	1.111	-.113	2.076	1.329	-.747	1.836	1.453	-.383	65
MODEL	66	PESTICIDES + AGRIC. CHEM.	1.012	1.100	.088	1.356	1.222	-.134	2.230	1.250	-.979	66
MODEL	67	MISC CHEMICAL PRODUCTS	1.177	1.097	-.080	1.842	1.232	-.609	1.789	1.288	-.501	67
MODEL	68	PLASTIC MAT'LS. + RESINS	1.043	1.193	.150	2.000	1.628	-.372	2.057	1.823	-.234	68
MODEL	69	SYNTHETIC RUBBER	1.015	1.084	.069	1.451	1.243	-.208	1.462	1.323	-.139	69
MODEL	70	CELLULOSIC FIBERS	1.030	1.091	.062	1.181	1.389	.208	1.263	1.491	.228	70
MODEL	71	NON-CELLULOSIC FIBERS	.996	1.102	.106	1.030	1.259	.230	1.021	1.344	.322	71
MODEL	72	DRUGS	1.025	1.075	.050	1.179	1.178	-.001	1.260	1.233	-.027	72
MODEL	73	CLEANING + TOILET PROD.	1.021	1.100	.079	1.203	1.219	.016	1.269	1.297	.028	73
MODEL	74	PAINTS	1.090	1.141	.051	1.370	1.330	-.039	1.452	1.420	-.031	74
EXOG	75	EFFECTIVE CRUDE OIL PRICE	1.386	1.386	.000	2.373	2.373	.000	2.797	2.797	.000	75
MODEL	76	PETROLEUM REFINING	1.292	1.277	-.015	1.975	1.943	-.032	2.301	2.251	-.051	76
MODEL	77	FUEL OIL	1.426	1.288	-.138	2.451	1.960	-.491	2.779	2.271	-.508	77
MODEL	78	PAVING AND ASPHALT	1.064	1.088	.023	1.617	1.330	-.287	1.812	1.474	-.338	78
MODEL	80	TIRES AND INNER TUBES	1.063	1.097	.034	1.307	1.180	-.127	1.394	1.251	-.143	80
MODEL	81	RUBBER PRODUCTS	1.059	1.122	.063	1.249	1.210	-.039	1.316	1.270	-.046	81
NO ACT	82	MISC PLASTIC PRODUCTS	1.045	1.091	.000	1.351	1.292	.000	1.496	1.415	.000	82
MODEL	83	LEATHER + IND LTHR PROD	1.280	1.085	-.196	1.218	1.165	-.053	1.312	1.257	-.055	83
MODEL	84	FOOTWEAR(EXC. RUBBER)	1.145	1.088	-.057	1.239	1.146	-.092	1.289	1.176	-.113	84
MODEL	85	OTHER LEATHER PRODUCTS	1.029	1.104	.076	1.149	1.207	.058	1.163	1.267	.103	85
MODEL	86	GLASS	1.086	1.085	-.001	1.248	1.182	-.066	1.388	1.240	-.147	86
MODEL	87	STRUCTURAL CLAY PRODUCTS	1.060	1.078	.018	1.224	1.173	-.050	1.284	1.243	-.041	87
MODEL	88	POTTERY	1.082	1.063	-.019	1.280	1.116	-.164	1.394	1.169	-.225	88
MODEL	89	CEMENT, CONCRETE, GYPSUM	1.081	1.075	-.007	1.305	1.154	-.150	1.421	1.233	-.188	89
MODEL	90	OTHER STONE + CLAY PROD.	1.032	1.072	.040	1.317	1.142	-.175	1.456	1.199	-.257	90
MODEL	91	STEEL	1.053	1.142	.089	1.490	1.416	-.073	1.594	1.475	-.119	91
MODEL	92	COPPER	1.264	1.158	-.106	1.438	1.381	-.056	1.239	1.307	.069	92
MODEL	93	LEAD	1.228	1.146	-.082	1.981	1.469	-.512	1.606	1.538	-.068	93
MODEL	94	ZINC	1.604	1.133	-.471	2.300	1.418	-.882	2.214	1.484	-.729	94
MODEL	95	ALUMINUM	1.068	1.112	.045	1.549	1.309	-.240	1.519	1.391	-.128	95
MODEL	96	OTH PRIM NON-FER METALS	1.439	1.113	-.326	2.103	1.293	-.810	1.973	1.353	-.620	96
NO ACT	97	OTH NON-FER ROLL + DRAW	1.253	1.096	.000	1.738	1.265	.000	1.734	1.329	.000	97
MODEL	98	NON-FERROUS WIRE DRAWING	1.124	1.111	-.013	1.529	1.319	-.210	1.265	1.354	.089	98
MODEL	99	NON-FER CASTING + FORGING	1.225	1.102	-.123	1.621	1.283	-.338	1.662	1.361	-.301	99
MODEL	100	METAL CANS	1.075	1.113	.038	1.473	1.311	-.162	1.530	1.413	-.118	100
MODEL	101	METAL BARRELS AND DRUMS	1.034	1.090	.056	1.442	1.259	-.183	1.476	1.324	-.151	101
MODEL	102	PLUMBING + HEATING EQUIP.	1.064	1.084	.020	1.295	1.242	-.053	1.335	1.320	-.015	102
MODEL	103	BOILER SHOPS	1.093	1.096	.003	1.456	1.274	-.181	1.469	1.351	-.118	103
MODEL	104	OTH STRUCTURAL METAL PRD.	1.066	1.092	.025	1.509	1.263	-.245	1.589	1.339	-.250	104
MODEL	105	SCREW MACHINE PRODUCTS	1.094	1.067	-.027	1.528	1.228	-.300	1.540	1.298	-.242	105
MODEL	106	METAL STAMPINGS EXC. AUTO	1.113	1.078	-.035	1.405	1.251	-.154	1.512	1.319	-.192	106
MODEL	107	CUTLERY,HAND TOOLS,HARDWR	1.070	1.077	.007	1.265	1.234	-.031	1.370	1.317	-.053	107

TABLE X-3 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (3): EXOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, EXOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	108	MISC FABRICATED WIRE PRODUCTS	1.106	1.087	-.020	1.587	1.271	-.316	1.604	1.350	-.254	108
MODEL	109	PIPES, VALVES, FITTINGS	1.073	1.072	-.000	1.475	1.232	-.243	1.583	1.308	-.275	109
MODEL	110	OTH FABRICATED METAL PROD.	1.054	1.073	.019	1.337	1.231	-.105	1.436	1.298	-.138	110
MODEL	111	ENGINES AND TURBINES	1.045	1.104	.058	1.264	1.231	-.033	1.398	1.297	-.100	111
MODEL	112	FARM MACHINERY	1.060	1.100	.040	1.303	1.246	-.056	1.431	1.346	-.086	112
MODEL	113	CONSTR,MINE,OILFIELD MACH	1.071	1.116	.045	1.368	1.272	-.095	1.564	1.391	-.173	113
MODEL	114	MATERIALS HANDLING MACH.	1.053	1.115	.061	1.299	1.275	-.024	1.441	1.390	-.051	114
NO ACT	115	MACH. TOOLS, METAL CUTTING	1.067	1.132	.000	1.251	1.283	.000	1.349	1.373	.000	115
NO ACT	116	MACH TOOLS, METAL FORMING	1.116	1.131	.000	1.312	1.290	.000	1.413	1.376	.000	116
MODEL	117	OTHER METAL WORKING MACH	1.053	1.132	.079	1.336	1.280	-.056	1.422	1.357	-.065	117
MODEL	118	SPECIAL INDUSTRIAL MACH	1.088	1.099	.011	1.334	1.220	-.114	1.463	1.306	-.157	118
MODEL	119	PUMPS,COMPRESSORS,BLOWERS	1.061	1.097	.036	1.391	1.236	-.156	1.538	1.327	-.211	119
MODEL	120	BALL AND ROLLER BEARINGS	1.058	1.093	.036	1.346	1.234	-.112	1.447	1.315	-.132	120
MODEL	121	POWER TRANSMISSION EQUIP	1.107	1.096	-.011	1.381	1.234	-.147	1.462	1.320	-.142	121
MODEL	122	INDUSTRIAL PATTERNS	1.058	1.095	.037	1.318	1.228	-.090	1.525	1.314	-.211	122
MODEL	123	COMPUTERS + RELATED MACH.	1.020	1.059	.038	1.047	1.131	.083	1.029	1.238	.208	123
MODEL	124	OTHER OFFICE MACHINERY	1.043	1.061	.018	1.196	1.129	-.067	1.241	1.230	-.011	124
MODEL	125	SERVICE INDUSTRY MACHINERY	1.003	1.091	.088	1.139	1.238	.098	1.185	1.321	.136	125
MODEL	126	MACHINE SHOP PRODUCTS	1.087	1.072	-.015	1.380	1.214	-.165	1.505	1.343	-.162	126
EXOG	127	RAW SUGAR	1.122	1.122	.000	5.035	5.035	.000	1.549	1.549	.000	127
EXOG	128	GREEN COFFEE	1.462	1.462	.000	1.441	1.441	.000	.988	.988	.000	128
MODEL	129	ELECTRICAL MEASURING INSTRUME	1.000	1.040	.040	1.141	1.149	.008	1.258	1.293	.035	129
MODEL	130	TRANSFORMERS + SWITCHGEAR	1.048	1.059	.012	1.376	1.197	-.178	1.499	1.335	-.164	130
MODEL	131	MOTORS AND GENERATORS	1.090	1.101	.012	1.384	1.241	-.143	1.466	1.382	-.084	131
MODEL	132	INDUSTRIAL CONTROLS	1.001	1.101	.100	1.280	1.240	-.040	1.326	1.385	.059	132
MODEL	133	WELDING APP, GRAPHITE PROD	1.058	1.116	.058	1.479	1.280	-.199	1.579	1.412	-.168	133
MODEL	134	HOUSEHOLD APPLIANCES	1.018	1.086	.068	1.185	1.224	.039	1.261	1.322	.061	134
MODEL	135	ELEC LIGHTING + WIRING EQ.	1.054	1.054	-.001	1.360	1.195	-.165	1.439	1.296	-.143	135
MODEL	136	RADIO AND TV RECEIVING	.982	1.045	.063	1.014	1.142	.128	.997	1.228	.231	136
MODEL	137	PHONOGRAPH RECORDS	1.019	1.050	.031	1.147	1.161	.014	1.173	1.256	.083	137
MODEL	138	COMMUNICATION EQUIPMENT	1.076	1.060	-.016	1.191	1.168	-.023	1.309	1.287	-.022	138
MODEL	139	ELECTRONIC COMPONENTS	1.019	1.001	-.018	1.125	1.093	-.032	1.108	1.185	.078	139
MODEL	140	BATTERIES	1.012	1.094	.082	1.185	1.256	.072	1.276	1.378	.102	140
MODEL	141	ENGINE ELECTRICAL EQUIP.	1.032	1.101	.069	1.182	1.238	.056	1.422	1.354	-.068	141
NO ACT	142	X-RAY, ELEC EQUIP,NEC	1.105	1.091	.000	1.269	1.216	.000	1.391	1.339	.000	142
NO ACT	143	AUTO STAMPINGS	1.000	1.000	.000	1.030	1.000	.000	1.000	1.000	.000	143
NO ACT	144	TRUCK, BUS, TRAILER BODIES	1.075	1.092	.000	1.212	1.170	.000	1.324	1.261	.000	144
MODEL	145	MOTOR VEHICLES	1.019	1.078	.059	1.180	1.123	-.056	1.275	1.226	-.050	145
NO ACT	147	AIRCRAFT	1.111	1.104	.000	1.250	1.225	.000	1.396	1.341	.000	147
NO ACT	148	AIRCRAFT ENGINES	1.115	1.109	.000	1.291	1.247	.000	1.431	1.358	.000	148

TABLE X-3 (CONT.)

PREDICTED VS. ACTUAL PRICES FROM SIMULATION (3): EXOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ALL AVAILABLE PRICES
ALTERNATIVE RUN : EXOGENOUS PRICES, ENDOGENOUS WAGES

4TH QUARTER PRICE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
NO ACT	149	AIRCRAFT EQUIPMENT, NEC	1.114	1.109	.000	1.282	1.241	.000	1.418	1.353	.000	149
NO ACT	150	SHIP AND BOAT BUILDING	1.075	1.094	.000	1.261	1.222	.000	1.390	1.330	.000	150
NO ACT	153	TRAILER COACHES	1.122	1.117	.000	1.297	1.273	.000	1.391	1.365	.000	153
NO ACT	156	ENGR. + SCIENTIFIC INSTR.	1.126	1.129	.000	1.314	1.287	.000	1.433	1.405	.000	156
NO ACT	157	MECH. MEASURING DEVICES	1.090	1.093	.000	1.251	1.212	.000	1.309	1.275	.000	157
MODEL	158	OPTICAL + OPHTHALMIC GOODS	1.053	1.059	.006	1.197	1.170	-.027	1.288	1.234	-.054	158
MODEL	159	MEDICAL + SURGICAL INSTR.	1.099	1.094	-.006	1.278	1.224	-.054	1.336	1.283	-.053	159
MODEL	160	PHOTOGRAPHIC EQUIPMENT	1.020	1.059	.040	1.154	1.178	.024	1.246	1.260	.013	160
MODEL	162	WATCHES AND CLOCKS	1.056	1.095	.038	1.166	1.245	.079	1.203	1.331	.128	162
MODEL	163	JEWELRY AND SILVERWARE	1.093	1.062	-.031	1.266	1.183	-.084	1.330	1.252	-.078	163
MODEL	164	TOYS,SPORT,MUSICAL INSTR.	1.058	1.064	.006	1.233	1.200	-.033	1.300	1.272	-.029	164
MODEL	165	OFFICE SUPPLIES	1.068	1.056	-.012	1.214	1.186	-.028	1.292	1.260	-.032	165
MODEL	166	MISC MANUFACTURING, NEC	1.051	1.076	.025	1.261	1.225	-.036	1.317	1.306	-.011	166
MODEL	167	RAILROADS	1.062	1.083	.021	1.257	1.255	-.002	1.394	1.335	-.059	167
MODEL	168	BUSSES AND LOCAL TRANSIT	1.039	1.036	-.003	1.094	1.127	.032	1.294	1.206	-.088	168
MODEL	169	TRUCKING	1.086	1.083	-.002	1.180	1.213	.032	1.261	1.258	-.003	169
MODEL	170	WATER TRANSPORTATION	1.097	1.067	-.031	1.206	1.198	-.008	1.300	1.339	.039	170
MODEL	171	AIRLINES	1.069	1.101	.033	1.160	1.186	.026	1.260	1.278	.018	171
NO ACT	172	PIPELINES	1.017	1.075	.000	1.156	1.188	.000	1.415	1.395	.000	172
NO ACT	173	FREIGHT FORWARDING	1.091	1.055	.000	1.166	1.143	.000	1.293	1.297	.000	173
MODEL	174	TELEPHONE AND TELEGRAPH	1.060	1.072	.012	1.092	1.156	.064	1.146	1.163	.017	174
NO ACT	175	RADIO AND TV BROADCASTING	1.044	1.051	.000	1.115	1.138	.000	1.129	1.158	.000	175
MODEL	176	ELECTRIC UTILITIES (AVE. PRIC	1.106	1.117	.011	1.453	1.360	-.093	1.589	1.469	-.119	176
MODEL	177	ELEC. UTILITIES (WHOLESALE PR	1.119	1.132	.013	1.500	1.379	-.121	1.662	1.490	-.172	177
MODEL	178	NATURAL GAS	1.077	1.120	.043	1.251	1.297	.046	1.497	1.488	-.009	178
MODEL	179	WATER AND SEWER SERVICES	1.084	1.104	.020	1.159	1.188	.029	1.284	1.291	.007	179
MODEL	180	WHOLESALE TRADE	1.155	1.169	.014	1.282	1.274	-.009	1.354	1.309	-.045	180
MODEL	181	RETAIL TRADE	1.073	1.065	-.008	1.157	1.176	.019	1.275	1.251	-.024	181
NO ACT	182	BANKS,CREDIT AGEN.,BROKERS	1.055	1.058	.000	1.132	1.129	.000	1.251	1.218	.000	182
MODEL	183	INSURANCE	.987	1.116	.129	.985	1.202	.217	1.115	1.273	.158	183
EXOG	184	OWNER-OCCUPIED DWELLINGS	1.079	1.079	.000	1.144	1.144	.000	1.206	1.206	.000	184
EXOG	185	REAL ESTATE	1.079	1.079	.000	1.144	1.144	.000	1.206	1.206	.000	185
MODEL	186	HOTEL AND LODGING PLACES	1.076	1.095	.019	1.152	1.204	.052	1.229	1.293	.064	186
MODEL	187	PERSONAL + REPAIR SERVICES	1.091	1.063	-.027	1.196	1.203	.008	1.265	1.271	.007	187
NO ACT	188	BUSINESS SERVICES	1.083	1.073	.000	1.189	1.155	.000	1.274	1.215	.000	188
NO ACT	189	ADVERTISING	1.071	1.086	.000	1.203	1.194	.000	1.305	1.273	.000	189
MODEL	190	AUTO REPAIR	1.089	1.075	-.014	1.235	1.212	-.023	1.349	1.300	-.050	190
MODEL	191	MOVIES + AMUSEMENTS	1.064	1.153	.089	1.156	1.273	.117	1.216	1.332	.116	191
MODEL	192	MEDICAL SERVICES	1.071	1.100	.029	1.209	1.233	.023	1.341	1.330	-.011	192
NO ACT	193	PRIVATE SCHOOLS + NPO	1.118	1.118	.000	1.230	1.210	.000	1.327	1.286	.000	193

TABLE X-4

PREDICTED VS. ACTUAL WAGES FROM SIMULATION (3): ENDOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ACTUAL HOURLY EARNINGS INDEXES
ALTERNATIVE RUN : WAGE EQUATIONS, PRICES ENDOGENOUS

ANNUAL AVERAGE WAGE LEVELS 1972:1 = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	201	INDUSTRIAL	1.494	1.496	.002	1.629	1.635	.006	1.803	1.801	-.002	201
MODEL	202	CONSTR	1.569	1.569	.000	1.681	1.682	.001	1.795	1.800	.005	202
MODEL	203	TRD&FIN	1.452	1.455	.002	1.570	1.580	.010	1.700	1.703	.003	203
MODEL	204	SERVICES.	1.541	1.542	.001	1.671	1.674	.003	1.822	1.819	-.003	204
MODEL	205	WBAR(EQ.)	1.495	1.497	.002	1.623	1.627	.005	1.773	1.770	-.003	205
MODEL	206	WBAR(1-4)	1.497	1.499	.002	1.625	1.631	.006	1.777	1.777	-.000	206
MODEL	207	WBAR(RELW)	1.510	1.488	-.022	1.637	1.617	-.020	1.790	1.758	-.032	207
NO ACT	1	DAIRY FARM PRODUCTS	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	1
NO ACT	2	POULTRY AND EGGS	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	2
NO ACT	3	MEAT ANIMALS, OTH LIVESTK	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	3
NO ACT	4	COTTON	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	4
NO ACT	5	GRAINS	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	5
NO ACT	6	TOBACCO	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	6
NO ACT	7	FRUIT,VEGETABLES,OTH CROPS	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	7
NO ACT	8	FORESTRY PRODUCTS	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	8
NO ACT	9	FISHERY PRODUCTS	1.000	1.000	.000	1.000	1.000	.000	1.000	1.000	.000	9
NO ACT	10	AGR,FORESTRY+FISH SERVICES	1.097	1.073	.000	1.180	1.164	.000	1.286	1.265	.000	10
MODEL	11	IRON ORES	1.060	1.050	-.010	1.164	1.156	-.008	1.340	1.316	-.024	11
MODEL	12	COPPER ORE	1.104	1.070	-.034	1.201	1.183	-.018	1.366	1.327	-.040	12
MODEL	13	OTHER NON-FERROUS ORES	1.104	1.070	-.034	1.201	1.183	-.018	1.366	1.327	-.040	13
MODEL	14	COAL MINING	1.089	1.081	-.008	1.185	1.208	.023	1.371	1.332	-.039	14
MODEL	15	NATURAL GAS	1.077	1.047	-.029	1.215	1.186	-.029	1.351	1.338	-.013	15
MODEL	16	CRUDE PETROLEUM (DOMESTIC)	1.090	1.079	-.011	1.164	1.138	-.026	1.272	1.269	-.003	16
MODEL	17	STONE AND CLAY MINING	1.090	1.079	-.011	1.164	1.138	-.026	1.272	1.269	-.003	17
MODEL	18	CHEMICAL FERTILIZER MINING	1.090	1.079	-.011	1.164	1.138	-.026	1.272	1.269	-.003	18
MODEL	19	NEW CONSTRUCTION	1.078	1.064	-.014	1.165	1.140	-.025	1.245	1.220	-.025	19
MODEL	20	MAINTENANCE CONSTRUCTION	1.078	1.064	-.014	1.165	1.140	-.025	1.245	1.220	-.025	20
MODEL	21	COMPLETE GUIDED MISSILES	1.064	1.068	.003	1.159	1.160	.001	1.287	1.269	-.017	21
MODEL	22	AMMUNITION	1.056	1.056	-.001	1.151	1.144	-.007	1.236	1.259	.023	22
MODEL	23	OTHER ORDNANCE	1.056	1.056	-.001	1.151	1.144	-.007	1.236	1.259	.023	23
MODEL	24	MEAT PRODUCTS	1.061	1.063	.002	1.169	1.165	-.005	1.280	1.278	-.002	24
MODEL	25	DAIRY PRODUCTS	1.072	1.054	-.018	1.155	1.147	-.008	1.222	1.215	-.007	25
MODEL	26	CANNED AND FROZEN FOODS	1.089	1.068	-.020	1.195	1.184	-.011	1.339	1.317	-.022	26
MODEL	27	GRAIN MILL PRODUCTS	1.078	1.075	-.004	1.169	1.163	-.006	1.293	1.274	-.019	27
MODEL	28	BAKERY PRODUCTS	1.079	1.066	-.013	1.164	1.170	.006	1.281	1.263	-.018	28
MODEL	29	SUGAR	1.066	1.085	.019	1.156	1.156	-.000	1.310	1.253	-.057	29
MODEL	30	CONFECTIONERY PRODUCTS	1.077	1.069	-.009	1.160	1.153	-.007	1.282	1.267	-.016	30
MODEL	31	ALCOHOLIC BEVERAGES	1.094	1.085	-.009	1.187	1.178	-.009	1.294	1.296	.002	31
MODEL	32	SOFT DRINKS AND FLAVORINGS	1.092	1.084	-.008	1.193	1.183	-.010	1.335	1.311	-.024	32
MODEL	33	FATS AND OILS	1.081	1.072	-.009	1.170	1.161	-.009	1.268	1.261	-.007	33
MODEL	34	MISC FOOD PRODUCTS	1.081	1.072	-.009	1.170	1.161	-.009	1.268	1.261	-.007	34
MODEL	35	TOBACCO PRODUCTS	1.114	1.084	-.030	1.244	1.215	-.029	1.379	1.363	-.016	35
MODEL	36	BROAD AND NARROW FABRICS	1.088	1.074	-.014	1.183	1.176	-.007	1.274	1.254	-.020	36
MODEL	37	YARN AND THREAD AND FINS	1.088	1.074	-.014	1.183	1.176	-.007	1.274	1.254	-.020	37
MODEL	38	FLOOR COVERINGS	1.083	1.065	-.018	1.162	1.168	.006	1.241	1.246	.005	38
MODEL	39	MISC TEXTILES	1.083	1.065	-.018	1.162	1.168	.006	1.241	1.246	.005	39
MODEL	40	KNITTING	1.089	1.071	-.018	1.179	1.175	-.004	1.256	1.253	-.003	40
MODEL	41	APPAREL	1.072	1.057	-.015	1.153	1.142	-.011	1.230	1.215	-.015	41
MODEL	42	HOUSEHOLD TEXTILES	1.085	1.071	-.014	1.173	1.169	-.004	1.269	1.260	-.009	42
MODEL	43	LOGGING CAMPS	1.092	1.069	-.023	1.175	1.168	-.007	1.300	1.287	-.014	43
MODEL	44	SAW AND PLANING MILLS	1.098	1.070	-.028	1.195	1.196	.002	1.322	1.315	-.007	44
MODEL	45	VENEER AND PLYWOOD	1.080	1.066	-.014	1.179	1.173	-.007	1.300	1.291	-.009	45
MODEL	46	MILLWORK AND WOOD PRODUCTS	1.080	1.066	-.014	1.179	1.173	-.007	1.300	1.291	-.009	46
MODEL	47	WOODEN CONTAINERS	1.080	1.066	-.014	1.179	1.173	-.007	1.300	1.291	-.009	47
MODEL	48	HOUSEHOLD FURNITURE	1.075	1.060	-.014	1.149	1.153	.004	1.234	1.237	.003	48
MODEL	49	OTHER FURNITURE	1.075	1.060	-.014	1.149	1.153	.004	1.234	1.237	.003	49
MODEL	50	PULP MILLS	1.085	1.075	-.010	1.172	1.170	-.002	1.306	1.277	-.029	50
MODEL	51	PAPER AND PAPERBOARD MILLS	1.085	1.075	-.010	1.172	1.170	-.002	1.306	1.277	-.029	51
MODEL	52	PAPER PRODUCTS, NEC	1.082	1.071	-.012	1.173	1.157	-.016	1.297	1.269	-.029	52

TABLE X-4 (CONT.)

PREDICTED VS. ACTUAL WAGES FROM SIMULATION (3): ENDOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ACTUAL HOURLY EARNINGS INDEXES
ALTERNATIVE RUN : WAGE EQUATIONS, PRICES ENDOGENOUS

ANNUAL AVERAGE WAGE LEVELS 1972:I = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	53	WALL AND BUILDING PAPER	1.085	1.075	-.010	1.172	1.170	-.002	1.306	1.277	-.029	53
MODEL	54	PAPERBOARD CONTAINERS	1.082	1.071	-.012	1.173	1.157	-.016	1.297	1.269	-.029	54
MODEL	55	NEWSPAPERS	1.058	1.064	.005	1.128	1.143	.015	1.205	1.224	.019	55
MODEL	56	PERIODICALS	1.058	1.064	.005	1.128	1.143	.015	1.205	1.224	.019	56
MODEL	57	BOOKS	1.049	1.032	-.017	1.101	1.117	.017	1.180	1.223	.043	57
MODEL	58	BUSINESS FORMS,BLANK BOOK	1.064	1.060	-.004	1.140	1.139	-.002	1.237	1.225	-.012	58
MODEL	59	COMMERCIAL PRINTING	1.052	1.079	.027	1.127	1.139	.012	1.213	1.228	.015	59
MODEL	60	OTHER PRINTING, PUBLISHING	1.064	1.060	-.004	1.140	1.139	-.002	1.237	1.225	-.012	60
MODEL	64	INDUSTRIAL CHEMICALS	1.065	1.070	.005	1.175	1.165	-.010	1.294	1.269	-.024	64
MODEL	65	FERTILIZERS	1.070	1.074	.005	1.186	1.171	-.015	1.308	1.276	-.032	65
MODEL	66	PESTICIDES + AGRIC. CHEM.	1.070	1.074	.005	1.186	1.171	-.015	1.308	1.276	-.032	66
MODEL	67	MISC CHEMICAL PRODUCTS	1.070	1.074	.005	1.186	1.171	-.015	1.308	1.276	-.032	67
MODEL	68	PLASTIC MAT'LS. + RESINS	1.065	1.070	.005	1.175	1.165	-.010	1.294	1.269	-.024	68
MODEL	69	SYNTHETIC RUBBER	1.063	1.066	.003	1.170	1.163	-.008	1.309	1.288	-.020	69
MODEL	70	CELLULOSIC FIBERS	1.063	1.066	.003	1.170	1.163	-.008	1.309	1.288	-.020	70
MODEL	71	NON-CELLULOSIC FIBERS	1.063	1.066	.003	1.170	1.163	-.008	1.309	1.288	-.020	71
MODEL	72	DRUGS	1.073	1.058	-.005	1.183	1.166	-.017	1.293	1.281	-.012	72
MODEL	73	CLEANING + TOILET PROD.	1.073	1.068	-.005	1.183	1.166	-.017	1.293	1.281	-.012	73
MODEL	74	PAINTS	1.074	1.070	-.004	1.186	1.166	-.021	1.304	1.268	-.036	74
MODEL	75	EFFECTIVE CRUDE OIL PRICE	1.000	1.000	.000	1.000	1.000	.000	1.000	1.000	.000	75
MODEL	76	PETROLEUM REFINING	1.053	1.058	.005	1.211	1.171	-.040	1.396	1.335	-.060	76
MODEL	77	FUEL OIL	1.000	1.000	.000	1.000	1.000	.000	1.000	1.000	.000	77
MODEL	78	PAVING AND ASPHALT	1.060	1.049	-.012	1.207	1.148	-.059	1.319	1.280	-.039	78
MODEL	80	TIRES AND INNER TUBES	1.072	1.063	-.009	1.128	1.129	.001	1.220	1.207	-.014	80
MODEL	81	RUBBER PRODUCTS	1.072	1.063	-.009	1.128	1.129	.001	1.220	1.207	-.014	81
MODEL	82	MISC PLASTIC PRODUCTS	1.068	1.055	-.014	1.149	1.148	-.001	1.266	1.269	.003	82
MODEL	83	LEATHER + IND LTHR PROD	1.052	1.066	.014	1.125	1.123	-.002	1.206	1.205	-.001	83
MODEL	84	FOOTWEAR(EXC. RUBBER)	1.052	1.066	.014	1.125	1.123	-.002	1.206	1.205	-.001	84
MODEL	85	OTHER LEATHER PRODUCTS	1.052	1.066	.014	1.125	1.123	-.002	1.206	1.205	-.001	85
MODEL	86	GLASS	1.091	1.068	-.023	1.173	1.162	-.012	1.287	1.263	-.024	86
MODEL	87	STRUCTURAL CLAY PRODUCTS	1.083	1.068	-.015	1.165	1.156	-.009	1.233	1.246	.012	87
MODEL	88	POTTERY	1.083	1.068	-.015	1.165	1.156	-.009	1.233	1.246	.012	88
MODEL	89	CEMENT, CONCRETE, GYPSUM	1.075	1.073	-.002	1.166	1.165	-.001	1.267	1.287	.020	89
MODEL	90	OTHER STONE + CLAY PROD.	1.083	1.068	-.015	1.165	1.156	-.009	1.233	1.246	.012	90
MODEL	91	STEEL	1.098	1.080	-.019	1.292	1.222	-.070	1.474	1.397	-.077	91
MODEL	92	COPPER	1.110	1.093	-.017	1.236	1.201	-.035	1.363	1.299	-.064	92
MODEL	93	LEAD	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	93
MODEL	94	ZINC	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	94
MODEL	95	ALUMINUM	1.085	1.075	-.010	1.222	1.196	-.026	1.355	1.314	-.041	95
MODEL	96	OTH PRIM NON-FER METALS	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	96
MODEL	97	OTH NON-FER ROLL + DRAW	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	97
MODEL	98	NON-FERROUS WIRE DRAWING	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	98
MODEL	99	NON-FER CASTING + FORGING	1.093	1.077	-.015	1.191	1.188	-.003	1.279	1.294	.015	99
MODEL	100	METAL CANS	1.096	1.066	-.030	1.225	1.186	-.039	1.382	1.334	-.047	100
MODEL	101	METAL BARRELS AND DRUMS	1.066	1.063	-.002	1.150	1.153	.002	1.263	1.255	-.008	101
MODEL	102	PLUMBING + HEATING EQUIP.	1.072	1.063	-.009	1.170	1.161	-.009	1.282	1.274	-.008	102
MODEL	103	BOILER SHOPS	1.072	1.063	-.009	1.170	1.161	-.009	1.282	1.274	-.008	103
MODEL	104	OTH STRUCTURAL METAL PRD.	1.072	1.063	-.009	1.170	1.161	-.009	1.282	1.274	-.008	104
MODEL	105	SCREW MACHINE PRODUCTS	1.066	1.063	-.002	1.150	1.153	.002	1.263	1.255	-.008	105
MODEL	106	METAL STAMPINGS EXC. AUTO	1.072	1.070	-.002	1.159	1.166	.006	1.272	1.268	-.004	106
MODEL	107	CUTLERY,HAND TOOLS,HARDWR	1.072	1.070	-.002	1.159	1.166	.006	1.272	1.268	-.004	107
MODEL	108	MISC FABRICATED WIRE PRODUCTS	1.066	1.063	-.002	1.150	1.153	.002	1.263	1.255	-.008	108
MODEL	109	PIPES, VALVES, FITTINGS	1.066	1.063	-.002	1.150	1.153	.002	1.263	1.255	-.008	109
MODEL	110	OTH FABRICATED METAL PROD.	1.066	1.063	-.002	1.150	1.153	.002	1.263	1.255	-.008	110
MODEL	111	ENGINES AND TURBINES	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	111
MODEL	112	FARM MACHINERY	1.059	1.067	.008	1.167	1.162	-.005	1.308	1.266	-.042	112
MODEL	113	CONSTR,MINE,OILFIELD MACH	1.084	1.078	-.006	1.197	1.179	-.018	1.330	1.299	-.031	113
MODEL	114	MATERIALS HANDLING MACH.	1.084	1.078	-.006	1.197	1.179	-.018	1.330	1.299	-.031	114
MODEL	115	MACH. TOOLS, METAL CUTTING	1.064	1.065	.001	1.135	1.141	.007	1.222	1.221	-.001	115
MODEL	116	MACH TOOLS, METAL FORMING	1.064	1.065	.001	1.135	1.141	.007	1.222	1.221	-.001	116

TABLE X-4 (CONT.)

PREDICTED VS. ACTUAL WAGES FROM SIMULATION (3): ENDOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ACTUAL HOURLY EARNINGS INDEXES
ALTERNATIVE RUN : WAGE EQUATIONS, PRICES ENDOGENOUS

ANNUAL AVERAGE WAGE LEVELS 1972:1 = 1.0

			1973 STD	1973 ALT	1973 DIFF	1974 STD	1974 ALT	1974 DIFF	1975 STD	1975 ALT	1975 DIFF	
MODEL	117	OTHER METAL WORKING MACH	1.064	1.065	.001	1.135	1.141	.007	1.222	1.221	-.001	117
MODEL	118	SPECIAL INDUSTRIAL MACH	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	118
MODEL	119	PUMPS,COMPRESSORS,BLOWERS	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	119
MODEL	120	BALL AND ROLLER BEARINGS	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	120
MODEL	121	POWER TRANSMISSION EQUIP	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	121
MODEL	122	INDUSTRIAL PATTERNS	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	122
MODEL	123	COMPUTERS + RELATED MACH.	1.053	1.056	.002	1.115	1.114	-.001	1.218	1.207	-.011	123
MODEL	124	OTHER OFFICE MACHINERY	1.053	1.056	.002	1.115	1.114	-.001	1.218	1.207	-.011	124
MODEL	125	SERVICE INDUSTRY MACHINERY	1.074	1.064	-.009	1.149	1.145	-.003	1.239	1.225	-.014	125
MODEL	126	MACHINE SHOP PRODUCTS	1.077	1.066	-.011	1.158	1.151	-.007	1.264	1.251	-.013	126
MODEL	129	ELECTRICAL MEASURING INSTRUME	1.054	1.054	.001	1.121	1.124	.004	1.233	1.233	.000	129
MODEL	130	TRANSFORMERS + SWITCHGEAR	1.054	1.054	.001	1.121	1.124	.004	1.233	1.233	.000	130
MODEL	131	MOTORS AND GENERATORS	1.054	1.054	.001	1.121	1.124	.004	1.233	1.233	.000	131
MODEL	132	INDUSTRIAL CONTROLS	1.056	1.051	-.005	1.133	1.135	.002	1.265	1.249	-.016	132
MODEL	133	WELDING APP, GRAPHITE PROD	1.072	1.065	-.007	1.147	1.149	.002	1.260	1.237	-.023	133
MODEL	134	HOUSEHOLD APPLIANCES	1.070	1.058	-.012	1.138	1.138	-.001	1.246	1.246	.001	134
MODEL	135	ELEC LIGHTING + WIRING EQ.	1.070	1.058	-.012	1.138	1.138	-.001	1.246	1.246	.001	135
MODEL	136	RADIO AND TV RECEIVING	1.070	1.058	-.012	1.138	1.138	-.001	1.246	1.246	.001	136
MODEL	137	PHONOGRAPH RECORDS	1.070	1.058	-.012	1.138	1.138	-.001	1.246	1.246	.001	137
MODEL	138	COMMUNICATION EQUIPMENT	1.076	1.066	-.010	1.153	1.159	.006	1.279	1.268	-.011	138
MODEL	139	ELECTRONIC COMPONENTS	1.056	1.051	-.005	1.133	1.135	.002	1.265	1.249	-.016	139
MODEL	140	BATTERIES	1.077	1.071	-.005	1.152	1.142	-.010	1.265	1.248	-.017	140
MODEL	141	ENGINE ELECTRICAL EQUIP.	1.077	1.071	-.005	1.152	1.142	-.010	1.265	1.248	-.017	141
MODEL	142	X-RAY, ELEC EQUIP,NEC	1.072	1.065	-.007	1.147	1.149	.002	1.260	1.237	-.023	142
MODEL	143	AUTO STAMPINGS	1.082	1.080	-.001	1.185	1.168	-.017	1.342	1.322	-.020	143
MODEL	144	TRUCK, BUS, TRAILER BODIES	1.082	1.080	-.001	1.185	1.168	-.017	1.342	1.322	-.020	144
MODEL	145	MOTOR VEHICLES	1.082	1.050	-.001	1.185	1.168	-.017	1.342	1.322	-.020	145
MODEL	147	AIRCRAFT	1.064	1.068	.003	1.159	1.160	.001	1.287	1.269	-.017	147
MODEL	148	AIRCRAFT ENGINES	1.064	1.068	.003	1.159	1.160	.001	1.287	1.269	-.017	148
MODEL	149	AIRCRAFT EQUIPMENT, NEC	1.064	1.068	.003	1.159	1.160	.001	1.287	1.269	-.017	149
MODEL	150	SHIP AND BOAT BUILDING	1.054	1.059	.005	1.159	1.136	-.023	1.288	1.261	-.027	150
MODEL	153	TRAILER COACHES	1.054	1.034	-.021	1.115	1.108	-.007	1.209	1.232	.023	153
MODEL	156	ENGR. + SCIENTIFIC INSTR.	1.048	1.051	.004	1.115	1.118	.003	1.199	1.199	.000	156
MODEL	157	MECH. MEASURING DEVICES	1.048	1.051	.004	1.115	1.118	.003	1.199	1.199	.000	157
MODEL	158	OPTICAL + OPHTHALMIC GOODS	1.066	1.067	.000	1.157	1.154	-.003	1.240	1.231	-.009	158
MODEL	159	MEDICAL + SURGICAL INSTR.	1.066	1.067	.000	1.157	1.154	-.003	1.240	1.231	-.009	159
MODEL	160	PHOTOGRAPHIC EQUIPMENT	1.069	1.069	-.001	1.163	1.152	-.011	1.275	1.267	-.008	160
MODEL	162	WATCHES AND CLOCKS	1.068	1.051	-.017	1.172	1.129	-.043	1.278	1.253	-.025	162
MODEL	163	JEWELRY AND SILVERWARE	1.066	1.055	-.011	1.142	1.140	-.002	1.243	1.246	.002	163
MODEL	164	TOYS,SPORT,MUSICAL INSTR.	1.066	1.055	-.011	1.142	1.140	-.002	1.243	1.246	.002	164
MODEL	165	OFFICE SUPPLIES	1.066	1.055	-.011	1.142	1.140	-.002	1.243	1.246	.002	165
MODEL	166	MISC MANUFACTURING, NEC	1.066	1.055	-.011	1.142	1.140	-.002	1.243	1.246	.002	166
MODEL	167	RAILROADS	1.158	1.102	-.056	1.263	1.227	-.036	1.349	1.316	-.033	167
MODEL	168	BUSSES AND LOCAL TRANSIT	1.075	1.063	-.012	1.185	1.179	-.006	1.321	1.306	-.016	168
MODEL	169	TRUCKING	1.103	1.083	-.020	1.191	1.173	-.017	1.280	1.262	-.018	169
MODEL	170	WATER TRANSPORTATION	1.100	1.069	-.031	1.210	1.168	-.042	1.340	1.287	-.053	170
MODEL	171	AIRLINES	1.070	1.069	-.001	1.177	1.168	-.009	1.303	1.287	-.016	171
MODEL	172	PIPELINES	.995	1.069	.074	1.097	1.168	.071	1.260	1.287	.026	172
MODEL	173	FREIGHT FORWARDING	1.100	1.069	-.031	1.196	1.168	-.028	1.281	1.287	.005	173
MODEL	174	TELEPHONE AND TELEGRAPH	1.100	1.112	.012	1.178	1.227	.049	1.364	1.358	-.006	174
MODEL	175	RADIO AND TV BROADCASTING	1.066	1.074	.008	1.174	1.172	-.002	1.243	1.264	.021	175
MODEL	176	ELECTRIC UTILITIES (AVE. PRIC	1.074	1.075	.001	1.153	1.153	-.000	1.262	1.258	-.004	176
MODEL	177	ELEC. UTILITIES (WHOLESALE PR	1.074	1.075	.001	1.153	1.153	-.000	1.262	1.258	-.004	177
MODEL	178	NATURAL GAS	1.074	1.075	.001	1.153	1.153	-.000	1.262	1.258	-.004	178
MODEL	179	WATER AND SEWER SERVICES	1.074	1.075	.001	1.153	1.153	-.000	1.262	1.258	-.004	179
MODEL	180	WHOLESALE TRADE	1.075	1.063	-.012	1.158	1.166	.008	1.293	1.278	-.015	180
MODEL	181	RETAIL TRADE	1.072	1.069	-.002	1.156	1.172	.016	1.271	1.270	-.001	181
MODEL	182	BANKS,CREDIT AGEN.,BROKERS	1.044	1.059	.015	1.117	1.142	.025	1.195	1.201	.006	182
MODEL	183	INSURANCE	1.062	1.069	.008	1.138	1.131	-.007	1.211	1.190	-.021	183
MODEL	185	REAL ESTATE	1.085	1.069	-.016	1.156	1.126	-.031	1.248	1.220	-.028	185

TABLE X-4 (CONT.)

PREDICTED VS. ACTUAL WAGES FROM SIMULATION (3): ENDOGENOUS WAGES ("ALL-ON")

STANDARD RUN : ACTUAL HOURLY EARNINGS INDIXES
ALTERNATIVE RUN : WAGE EQUATIONS, PRICES ENDOGENOUS

ANNUAL AVERAGE WAGE LEVELS 1972:1 = 1.0

			1973			1974			1975			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	186	HOTEL AND LODGING PLACES	1.061	1.063	.002	1.159	1.152	-.007	1.248	1.267	.019	186
MODEL	187	PERSONAL + REPAIR SERVICES	1.084	1.072	-.012	1.174	1.163	-.010	1.250	1.236	-.013	187
MODEL	188	BUSINESS SERVICES	1.060	1.050	-.011	1.144	1.121	-.023	1.224	1.207	-.017	188
MODEL	189	ADVERTISING	1.060	1.050	-.011	1.144	1.121	-.023	1.224	1.207	-.017	189
MODEL	190	AUTO REPAIR	1.086	1.072	-.014	1.185	1.183	-.002	1.290	1.270	-.020	190
MODEL	191	MOVIES + AMUSEMENTS	1.074	1.073	-.002	1.143	1.164	.021	1.233	1.265	.032	191
MODEL	192	MEDICAL SERVICES	1.054	1.063	.009	1.169	1.200	.032	1.293	1.322	.029	192
MODEL	193	PRIVATE SCHOOLS + NPO	1.081	1.080	-.001	1.164	1.146	-.017	1.240	1.223	-.016	193

two percent. The correlation between actual and predicted wage changes across industries for selected intervals is shown below:

1972-73	.633	1973-74	.694
1972-74	.837	1973-75	.828
1972-75	.918	1974-75	.749

Our set of relative wage equations, especially as the 1974-75 inflationary period is added, performs very well in tracking the movement in the interindustry wage structure.

10.3 Incomes by Industry, 1973-75

In this section we compare our forecasts of income components by industry with those from BEA. In Table X-5, we use our available actual price data from the first simulation of the previous section ("Max-known") to compute current dollar GPO. The "product value-added" uses 1972 dollar 200-order predicted outputs from the standard INFORUM model.[5] Manhours at INFORUM's 88 sectoring level for the nonfarm economy are actual data for 1972 through 1975. Wages are based on actual 1972-75 hourly earnings at the 100-sector level of the industry equations.

The first three pages of Table X-5 show industry aggregation to the 16 industry division that are published by BEA. The remaining pages show detail by our 56 (generally two-digit SIC) income sectors.

When looking first at the top row of the table, the reader should bear in mind one important fact. The predicted aggregate GPO figures are

[5]This includes the adjustments of the manufacturing outputs by the FRB indexes.

TABLE X-5

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
1 ALL INDUSTRIES, TOTAL										
GROSS PRODUCT ORIGINATING	1169.4	1304.0	1308.2	4.2	1406.5	1414.8	8.3	1511.9	1514.4	2.5
LABOR COMPENSATION	715.1	799.1	803.2	4.1	875.8	885.1	9.4	928.7	936.1	7.4
INDIRECT BUSINESS TAXES	111.0	120.2	117.8	-2.4	128.4	126.8	-1.6	138.7	137.3	-1.4
CAP. CONSUMPTION ALLOW.	100.5	109.4	110.9	1.5	121.4	121.8	.4	132.8	130.2	-2.6
PROPRIETOR INCOME	75.6	92.8	97.4	4.6	87.9	87.7	-.2	92.7	89.6	-3.1
OTHER PROPERTY INCOME	167.1	182.4	178.8	-3.6	193.1	193.4	.3	219.0	221.3	2.2
2 PRIVATE ECONOMY (DOMESTIC)										
GROSS PRODUCT ORIGINATING	1007.5	1128.4	1130.6	2.2	1210.0	1217.8	7.8	1300.7	1297.9	-2.8
LABOR COMPENSATION	562.6	633.4	635.4	2.0	695.2	699.0	3.8	729.0	730.4	1.4
INDIRECT BUSINESS TAXES	110.9	120.1	117.8	-2.3	128.3	126.8	-1.4	138.6	137.3	-1.3
CAP. CONSUMPTION ALLOW.	100.5	109.4	110.9	1.5	121.4	121.8	.4	132.8	130.2	-2.6
PROPRIETOR INCOME	75.6	92.8	97.4	4.6	87.9	87.7	-.2	92.7	89.6	-3.1
OTHER PROPERTY INCOME	157.8	172.7	169.2	-3.5	177.2	182.5	5.3	207.6	210.5	2.8
3 AGRICULTURE,FORESTRY,&FISHERI										
GROSS PRODUCT ORIGINATING	35.4	53.8	60.1	6.3	52.6	59.5	6.8	54.8	54.7	-.1
LABOR COMPENSATION	6.3	7.4	8.4	1.1	8.4	10.3	1.9	9.1	11.8	2.7
INDIRECT BUSINESS TAXES	2.2	2.3	2.2	-.1	2.4	2.3	-.1	2.5	2.5	-.1
CAP. CONSUMPTION ALLOW.	5.9	6.6	6.2	-.5	7.9	7.1	-.8	8.5	8.0	-.5
PROPRIETOR INCOME	20.8	35.1	39.2	4.1	29.4	34.9	5.6	29.7	28.8	-.8
OTHER PROPERTY INCOME	.2	2.4	4.1	1.7	4.5	4.9	.3	5.0	3.6	-1.4
4 MINING										
GROSS PRODUCT ORIGINATING	18.9	21.4	23.5	2.5	31.8	35.5	3.8	37.6	39.9	2.3
LABOR COMPENSATION	7.8	8.7	8.7	.0	10.5	10.4	-.1	12.8	13.2	.4
INDIRECT BUSINESS TAXES	1.5	1.7	1.6	-.1	2.5	1.7	-.8	2.8	1.8	-.9
CAP. CONSUMPTION ALLOW.	4.7	4.8	4.8	-.0	5.4	5.0	-.3	5.8	5.3	-.5
PROPRIETOR INCOME	.0	-.1	.4	.5	1.5	.6	-.9	1.7	.6	-1.1
OTHER PROPERTY INCOME	4.9	6.2	8.4	2.2	11.9	17.8	5.9	14.5	18.9	4.4
5 CONTRACT CONSTRUCTION										
GROSS PRODUCT ORIGINATING	56.6	63.3	61.9	-1.4	66.7	63.3	-3.4	66.5	61.3	-5.2
LABOR COMPENSATION	43.0	48.4	49.6	1.2	51.5	53.4	1.9	50.2	50.2	-.1
INDIRECT BUSINESS TAXES	1.1	1.2	1.0	-.1	1.3	1.1	-.2	1.4	1.2	-.1
CAP. CONSUMPTION ALLOW.	3.0	3.5	4.0	.5	4.0	4.7	.7	4.5	4.6	.2
PROPRIETOR INCOME	7.0	7.8	6.5	-1.2	7.6	5.4	-2.1	7.0	5.7	-1.3
OTHER PROPERTY INCOME	2.5	2.4	.8	-1.7	2.4	-1.3	-3.7	3.4	-.5	-3.9
6 MANUFACTURING										
GROSS PRODUCT ORIGINATING	288.7	321.8	312.6	-9.2	334.1	340.3	6.1	346.0	361.9	15.8
LABOR COMPENSATION	203.3	229.9	229.3	-.6	249.4	250.6	1.2	251.4	252.6	1.2
INDIRECT BUSINESS TAXES	19.1	20.1	18.2	-2.0	20.2	19.1	-1.1	21.9	20.0	-.8
CAP. CONSUMPTION ALLOW.	24.8	26.6	27.5	.9	29.4	31.3	1.8	31.8	33.6	1.8
PROPRIETOR INCOME	1.9	2.1	2.4	.3	2.0	2.1	.1	2.3	2.4	.1
OTHER PROPERTY INCOME	39.6	43.2	35.4	-7.8	33.2	37.2	4.1	39.8	53.3	13.5

TABLE X-5

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
7 NONDURABLE GOODS										
GROSS PRODUCT ORIGINATING	116.8	127.5	122.4	-5.1	136.1	134.2	-1.9	142.4	152.2	9.8
LABOR COMPENSATION	76.5	83.3	83.2	-.1	90.1	89.9	-.3	93.2	92.0	-1.1
INDIRECT BUSINESS TAXES	14.6	15.3	14.3	-1.0	15.1	14.8	-.3	15.4	15.2	-.1
CAP. CONSUMPTION ALLOW.	10.1	11.3	11.0	-.3	12.0	12.3	.3	12.9	13.3	.4
PROPRIETOR INCOME	.6	.7	.0	-.7	.7	.0	-.7	.9	.0	-.9
OTHER PROPERTY INCOME	15.0	16.9	13.8	-3.1	18.1	17.2	-.9	20.1	31.6	11.5
8 DURABLE GOODS										
GROSS PRODUCT ORIGINATING	171.9	194.3	190.3	-4.1	198.2	206.1	7.9	203.7	203.7	6.0
LABOR COMPENSATION	126.8	146.6	146.0	-.5	159.2	160.7	1.5	158.3	160.6	2.3
INDIRECT BUSINESS TAXES	4.4	4.8	3.9	-.9	5.1	4.3	-.8	5.4	4.8	-.6
CAP. CONSUMPTION ALLOW.	14.7	15.3	16.5	1.2	17.5	18.9	1.5	18.9	20.2	1.4
PROPRIETOR INCOME	1.3	1.4	2.4	.9	1.3	2.1	.8	1.4	2.4	1.0
OTHER PROPERTY INCOME	24.6	26.2	21.5	-4.7	15.1	20.0	5.0	19.7	21.7	2.0
9 TRANSPORTATION										
GROSS PRODUCT ORIGINATING	46.2	51.3	51.2	-.1	56.3	53.3	-2.9	56.6	55.7	-.9
LABOR COMPENSATION	31.9	36.6	36.4	-.2	39.7	40.1	.4	40.5	41.0	.5
INDIRECT BUSINESS TAXES	2.9	3.1	3.1	.0	3.3	3.4	.1	3.6	3.7	.1
CAP. CONSUMPTION ALLOW.	6.3	6.4	6.6	.2	7.3	6.9	-.4	7.8	7.5	-.3
PROPRIETOR INCOME	1.5	1.7	1.8	.1	1.8	1.5	-.3	1.9	1.9	.0
OTHER PROPERTY INCOME	3.6	3.4	3.2	-.2	4.2	1.4	-2.8	2.9	1.7	-1.3
10 COMMUNICATION										
GROSS PRODUCT ORIGINATING	29.4	32.7	32.9	.1	35.3	35.0	-.4	38.4	36.4	-2.1
LABOR COMPENSATION	14.6	16.3	16.6	.3	17.8	18.4	.6	19.4	20.9	1.5
INDIRECT BUSINESS TAXES	4.0	4.2	3.9	-.3	4.4	4.0	-.5	4.7	4.1	-.6
CAP. CONSUMPTION ALLOW.	5.6	6.5	6.1	-.3	7.3	6.8	-.5	8.0	7.3	-.7
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	5.1	5.7	6.2	.5	5.8	5.8	-.0	6.4	4.1	-2.2
11 ELECTRIC,GAS & SANITARY										
GROSS PRODUCT ORIGINATING	28.0	30.5	30.4	-.1	31.2	33.8	2.7	37.2	39.8	2.7
LABOR COMPENSATION	9.3	10.3	10.3	.0	11.3	11.2	-.1	12.1	11.8	-.3
INDIRECT BUSINESS TAXES	4.2	4.6	3.9	-.8	5.0	4.2	-.8	5.5	4.6	-.8
CAP. CONSUMPTION ALLOW.	6.1	7.0	6.7	-.2	7.7	7.5	-.2	8.9	8.2	-.6
PROPRIETOR INCOME	.3	.4	.3	-.0	.2	.3	.1	.2	.4	.2
OTHER PROPERTY INCOME	8.0	8.2	9.1	1.0	7.0	10.6	3.6	10.6	14.8	4.2
12 WHOLESALE AND RETAIL TRADE										
GROSS PRODUCT ORIGINATING	201.2	223.8	227.4	3.6	242.9	248.2	5.2	272.4	269.5	-2.8
LABOR COMPENSATION	115.4	128.8	128.5	-.3	142.7	140.0	-2.8	153.5	152.3	-1.2
INDIRECT BUSINESS TAXES	40.1	44.3	46.1	1.7	48.0	49.5	1.5	53.1	53.5	.4
CAP. CONSUMPTION ALLOW.	11.2	11.6	12.3	.7	12.7	13.3	.7	14.0	13.9	-.0
PROPRIETOR INCOME	14.0	15.5	17.4	1.9	15.7	17.7	2.0	17.6	21.6	4.0
OTHER PROPERTY INCOME	20.5	23.5	23.0	-.5	23.9	27.7	3.8	34.2	28.4	-5.9

TABLE X-5

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
13 FINANCE, INSURANCE & REAL EST										
GROSS PRODUCT ORIGINATING	168.6	179.2	182.7	3.5	193.2	192.5	-.7	239.4	237.1	-2.3
LABOR COMPENSATION	38.1	42.3	42.5	.2	46.3	46.3	.0	50.0	48.5	-1.5
INDIRECT BUSINESS TAXES	32.0	34.3	34.1	-.2	36.6	37.4	.8	39.4	41.2	1.7
CAP. CONSUMPTION ALLOW.	24.9	27.2	27.5	.4	29.7	29.4	-.2	32.2	31.4	-.9
PROPRIETOR INCOME	4.6	3.1	3.4	.3	1.6	2.2	.6	2.4	2.1	-.3
OTHER PROPERTY INCOME	69.0	72.3	75.1	2.8	79.0	77.1	-1.8	85.3	83.9	-1.4
14 SERVICES										
GROSS PRODUCT ORIGINATING	134.5	150.5	147.5	-3.0	165.7	156.4	-9.3	181.8	171.6	-10.2
LABOR COMPENSATION	92.9	104.6	104.9	.3	117.6	118.4	.8	130.0	128.2	-1.8
INDIRECT BUSINESS TAXES	3.8	4.1	3.7	-.4	4.5	4.2	-.3	4.8	4.7	-.2
CAP. CONSUMPTION ALLOW.	8.0	9.2	9.1	-.1	10.1	9.7	-.5	11.5	10.4	-1.1
PROPRIETOR INCOME	25.4	27.3	25.9	-1.3	28.1	22.9	-5.2	30.0	26.0	-4.0
OTHER PROPERTY INCOME	4.4	5.4	3.9	-1.5	6.3	1.3	-4.0	5.5	2.3	-3.2
15 GOVERNMENT AND GOVERNMENT ENT										
GROSS PRODUCT ORIGINATING	154.9	166.5	168.5	2.0	182.1	187.5	5.5	230.6	236.5	5.9
LABOR COMPENSATION	152.5	165.8	167.9	2.1	180.6	186.1	5.5	199.7	235.7	6.0
INDIRECT BUSINESS TAXES	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.3	.6	.6	.0	1.4	1.4	.0	.9	.8	.0
16 REST OF THE WORLD										
GROSS PRODUCT ORIGINATING	.0	.0	9.1	9.1	.0	9.5	9.5	.0	10.0	10.0
LABOR COMPENSATION	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	9.1	9.1	.0	9.5	9.5	.0	10.0	10.0

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
1 FARMS										
GROSS PRODUCT ORIGINATING	32.0	50.1	54.8	4.8	48.4	54.5	6.0	50.3	50.9	.6
LABOR COMPENSATION	4.5	5.3	6.2	.9	6.1	8.2	2.1	6.5	9.8	3.2
INDIRECT BUSINESS TAXES	2.1	2.1	2.1	-.1	2.3	2.2	-.1	2.4	2.3	-.1
CAP. CONSUMPTION ALLOW.	5.4	6.2	5.7	-.5	7.4	6.6	-.8	7.9	7.5	-.4
PROPRIETOR INCOME	20.0	34.2	37.5	3.3	28.4	33.0	4.6	28.6	27.9	-.8
OTHER PROPERTY INCOME	-.0	2.2	3.3	1.1	4.3	4.5	.2	4.8	3.5	-1.3
2 AGRICULTURAL SERVICES, FOREST										
GROSS PRODUCT ORIGINATING	3.3	3.8	5.3	1.5	4.2	5.0	.8	4.5	3.8	-.7
LABOR COMPENSATION	1.7	2.1	2.2	.1	2.3	2.0	-.3	2.5	2.0	-.5
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.2	.1	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.5	.5	.5	.0	.5	.5	.0	.6	.5	-.1
PROPRIETOR INCOME	.8	.9	1.7	.8	.9	1.9	.9	1.0	.9	-.1
OTHER PROPERTY INCOME	.3	.2	.8	.6	.2	.4	.2	.2	.2	-.1
3 METAL MINING										
GROSS PRODUCT ORIGINATING	1.3	1.8	1.5	-.3	2.1	2.1	.0	2.2	1.7	-.4
LABOR COMPENSATION	1.1	1.3	1.2	-.0	1.4	1.4	-.1	1.5	1.6	.1
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.1	.3	.2	-.1
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.1	.2	.2	-.0	.2	.2	-.1
PROPRIETOR INCOME	-.0	-.0	.0	.0	-.1	.0	.1	-.1	.0	.1
OTHER PROPERTY INCOME	-.2	.3	-.1	-.4	.2	.3	.1	.2	-.2	-.4
4 COAL MINING										
GROSS PRODUCT ORIGINATING	3.1	3.6	3.6	.0	6.7	6.4	-.3	8.5	7.9	-.6
LABOR COMPENSATION	2.2	2.4	2.5	.0	3.0	2.9	-.1	4.2	4.0	-.2
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.2	.1	-.0
CAP. CONSUMPTION ALLOW.	.4	.6	.5	.0	.7	.6	-.1	.9	.7	-.1
PROPRIETOR INCOME	.0	.1	.0	-.1	.5	.0	-.5	.6	.0	-.6
OTHER PROPERTY INCOME	.3	.4	.5	.1	2.3	2.8	.4	2.9	3.0	.3
5 CRUDE PETROLEUM & NATURAL GAS										
GROSS PRODUCT ORIGINATING	12.3	13.2	16.4	3.2	20.0	23.9	3.9	23.7	26.7	3.0
LABOR COMPENSATION	3.2	3.6	3.5	-.1	4.5	4.5	.0	5.5	5.9	.4
INDIRECT BUSINESS TAXES	1.2	1.3	1.2	-.1	2.0	1.3	-.7	2.2	1.4	-.8
CAP. CONSUMPTION ALLOW.	3.6	3.6	3.6	-.0	3.8	3.7	-.1	4.0	3.9	-.1
PROPRIETOR INCOME	-.1	-.2	.0	.2	.9	.0	-.9	1.0	.0	-1.0
OTHER PROPERTY INCOME	4.4	4.9	8.0	3.1	8.7	14.4	5.7	13.9	15.5	4.6
6 MINING AND QUARRYING OF NONME										
GROSS PRODUCT ORIGINATING	2.3	2.8	2.4	-.4	3.1	3.2	.1	3.2	3.6	.4
LABOR COMPENSATION	1.2	1.4	1.5	.1	1.5	1.6	.1	1.6	1.7	.1
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.5	.6	.5	-.1	.6	.5	-.1	.7	.5	-.2
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.3	.6	.3	-.3	.7	1.0	.3	.7	1.2	.6

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
7 CONTRACT CONSTRUCTION										
GROSS PRODUCT ORIGINATING	56.6	63.3	61.9	-1.4	66.7	63.3	-3.4	66.5	61.3	-5.2
LABOR COMPENSATION	43.0	48.4	49.6	1.2	51.5	53.4	1.9	50.2	50.2	-.1
INDIRECT BUSINESS TAXES	1.1	1.2	1.0	-.1	1.3	1.1	-.2	1.4	1.2	-.1
CAP. CONSUMPTION ALLOW.	3.0	3.5	4.0	.5	4.0	4.7	.7	4.5	4.6	.2
PROPRIETOR INCOME	7.0	7.8	6.5	-1.2	7.6	5.4	-2.1	7.0	5.7	-1.3
OTHER PROPERTY INCOME	2.5	2.4	.8	-1.7	2.9	-1.3	-3.7	3.4	-.5	-3.9
8 FOOD AND KINDRED PRODUCTS										
GROSS PRODUCT ORIGINATING	27.6	28.3	28.1	-.2	30.5	34.7	4.2	35.8	42.7	7.0
LABOR COMPENSATION	16.8	17.9	17.9	.0	19.5	19.2	-.3	21.1	20.4	-.7
INDIRECT BUSINESS TAXES	5.6	5.6	5.5	-.1	5.6	5.9	.3	5.8	6.2	.5
CAP. CONSUMPTION ALLOW.	2.1	2.5	2.3	-.2	2.6	2.5	-.1	2.7	2.6	-.2
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	2.9	2.2	2.4	.1	2.7	7.1	4.4	6.0	13.5	7.4
9 TOBACCO MANUFACTURES										
GROSS PRODUCT ORIGINATING	4.2	4.4	4.3	-.2	4.9	4.5	-.4	5.5	5.2	-.3
LABOR COMPENSATION	.7	.8	.9	.1	.9	1.1	.2	1.0	1.2	.2
INDIRECT BUSINESS TAXES	2.3	2.5	2.4	-.1	2.4	2.4	-.1	2.4	2.4	-.1
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.0	.3	.3	-.0	.4	.3	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.0	.9	.8	-.2	1.3	.8	-.5	1.7	1.3	-.3
10 TEXTILE MILL PRODUCTS										
GROSS PRODUCT ORIGINATING	9.3	9.8	10.2	.5	11.2	11.6	.4	9.7	9.3	-.4
LABOR COMPENSATION	7.4	8.2	8.3	.0	8.3	8.5	.2	7.8	8.2	.5
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.8	.9	.9	-.0	.9	.9	.0	.9	.9	.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.9	.4	.9	.5	1.7	1.9	.2	.9	-.1	-.9
11 APPAREL										
GROSS PRODUCT ORIGINATING	9.9	10.6	10.5	-.1	10.8	10.4	-.3	11.1	10.3	-.8
LABOR COMPENSATION	8.5	9.3	9.2	-.1	9.5	9.7	.3	9.4	9.7	.3
INDIRECT BUSINESS TAXES	.1	.2	.1	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.3	.1	.2	.3	.1	.2	.3	.1
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	1.0	.8	.9	.0	.8	.2	-.6	1.2	.1	-1.1
12 LUMBER AND WOOD PRODUCTS										
GROSS PRODUCT ORIGINATING	8.9	11.2	10.5	-.6	11.6	9.7	-1.9	9.9	8.5	-1.4
LABOR COMPENSATION	5.2	5.9	5.9	.0	6.3	6.3	.1	5.8	5.9	.1
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.3	.3	-.0
CAP. CONSUMPTION ALLOW.	.9	1.1	1.0	-.1	1.4	1.2	-.1	1.5	1.3	-.2
PROPRIETOR INCOME	.6	.7	.6	-.1	.6	.6	.0	.5	.5	-.0
OTHER PROPERTY INCOME	1.9	3.3	2.8	-.5	3.1	1.3	-1.8	1.9	.5	-1.3

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
13 FURNITURE AND FIXTURES										
GROSS PRODUCT ORIGINATING	4.8	5.2	5.3	.1	5.3	5.8	.5	5.0	5.5	.5
LABOR COMPENSATION	4.0	4.6	4.5	-.0	4.7	4.9	.2	4.4	4.4	.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.0	.2	.2	.0	.2	.2	.0
PROPRIETOR INCOME	.1	.1	.0	-.1	.0	.0	-.0	.1	.0	-.1
OTHER PROPERTY INCOME	.5	.3	.5	.2	.3	.6	.3	.3	.8	.5
14 PAPER AND ALLIED PRODUCTS										
GROSS PRODUCT ORIGINATING	11.0	12.7	11.6	-1.2	13.9	14.5	.7	14.1	16.2	2.1
LABOR COMPENSATION	7.7	8.5	8.5	-.0	9.3	9.1	-.2	9.4	9.1	-.3
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.4	.3	-.0	.4	.4	-.0
CAP. CONSUMPTION ALLOW.	1.2	1.4	1.2	-.1	1.4	1.3	-.0	1.6	1.4	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.7	2.5	1.5	-1.0	2.8	3.8	.9	2.7	5.2	2.6
15 PRINTING AND PUBLISHING										
GROSS PRODUCT ORIGINATING	14.6	16.0	15.5	-.6	16.3	16.1	-.2	17.7	16.8	-.9
LABOR COMPENSATION	11.2	12.1	12.1	-.0	13.0	13.0	-.0	13.5	13.3	-.2
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.3	.3	-.0	.3	.3	-.0
CAP. CONSUMPTION ALLOW.	.8	1.0	1.0	.0	1.0	1.1	.1	1.1	1.1	.1
PROPRIETOR INCOME	.3	.3	.0	-.3	.3	.0	-.3	.4	.0	-.4
OTHER PROPERTY INCOME	2.0	2.4	2.1	-.2	1.7	1.8	.1	2.4	2.1	-.3
16 CHEMICALS AND ALLIED PRODUCTS										
GROSS PRODUCT ORIGINATING	21.5	23.5	21.5	-2.0	25.0	24.8	-.2	27.4	32.4	5.0
LABOR COMPENSATION	12.9	14.1	14.0	-.1	16.1	15.9	-.2	17.3	16.7	-.6
INDIRECT BUSINESS TAXES	.6	.6	.6	-.0	.6	.6	-.0	.7	.7	-.0
CAP. CONSUMPTION ALLOW.	2.9	3.0	3.0	.0	3.2	3.4	.2	3.4	3.8	.3
PROPRIETOR INCOME	.0	.1	.0	-.1	.2	.0	-.2	.1	.0	-.1
OTHER PROPERTY INCOME	5.2	5.8	4.0	-1.3	4.9	4.9	-.0	5.3	11.2	5.4
17 PETROLEUM REFINING										
GROSS PRODUCT ORIGINATING	7.6	9.6	9.5	-.1	11.2	5.7	-5.4	9.1	7.2	-1.9
LABOR COMPENSATION	2.9	3.1	3.0	-.1	3.7	3.6	-.1	4.2	4.1	-.1
INDIRECT BUSINESS TAXES	4.3	4.6	4.0	-.6	4.4	4.0	-.4	4.4	4.0	-.4
CAP. CONSUMPTION ALLOW.	1.1	1.4	1.3	-.0	1.5	1.6	.1	1.7	2.0	.3
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	-.8	.5	1.1	.6	1.5	-3.5	-5.0	-1.2	-2.9	-1.7
18 RUBBER AND MISC. PLASTICS										
GROSS PRODUCT ORIGINATING	9.0	10.2	9.1	-1.1	9.9	9.8	-.1	9.7	9.9	.2
LABOR COMPENSATION	6.3	7.2	7.3	.1	7.7	7.7	-.0	7.5	7.3	-.2
INDIRECT BUSINESS TAXES	.9	1.1	.9	-.2	1.0	.9	-.1	.9	.8	-.1
CAP. CONSUMPTION ALLOW.	.6	.7	.7	-.0	.8	.8	-.0	.9	.8	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.1	1.1	.2	-1.0	.4	.4	.0	.5	1.1	.6

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
19 LEATHER AND LEATHER PRODUCTS										
GROSS PRODUCT ORIGINATING	2.1	2.4	2.2	-.2	2.5	2.2	-.3	2.3	2.2	-.2
LABOR COMPENSATION	2.0	2.1	2.1	-.0	2.1	2.1	.0	2.0	2.1	.0
INDIRECT BUSINESS TAXES	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
CAP. CONSUMPTION ALLOW.	.1	.1	.1	-.0	.1	.1	.0	.1	.1	.0
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.0	.2	.0	-.2	.3	-.1	-.3	.2	-.0	-.2
20 STONE, CLAY, AND GLASS PRODUC										
GROSS PRODUCT ORIGINATING	9.9	10.9	11.1	.2	10.7	12.3	1.6	13.6	12.8	2.2
LABOR COMPENSATION	7.1	8.1	8.1	.0	8.6	8.6	.0	8.4	8.2	-.2
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.1	.3	.2	-.0
CAP. CONSUMPTION ALLOW.	1.0	1.1	1.1	.0	1.2	1.2	-.1	1.3	1.2	-.1
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	1.4	1.4	1.7	.3	.6	2.3	1.7	.6	3.2	2.6
21 PRIMARY METALS										
GROSS PRODUCT ORIGINATING	21.6	25.0	23.4	-1.6	32.0	31.1	-.9	29.4	30.4	1.0
LABOR COMPENSATION	16.1	19.1	19.0	-.1	22.2	22.2	.1	21.7	21.8	.1
INDIRECT BUSINESS TAXES	.6	.7	.6	-.1	.7	.7	-.0	.8	.7	-.0
CAP. CONSUMPTION ALLOW.	2.6	2.8	2.7	-.1	3.3	2.9	-.4	3.4	3.2	-.2
PROPRIETOR INCOME	.0	.0	.0	-.0	.1	.0	-.1	.0	.0	-.0
OTHER PROPERTY INCOME	2.2	2.4	1.1	-1.4	5.7	5.3	-.4	3.5	4.7	1.2
22 FABRICATED METAL PRODUCTS										
GROSS PRODUCT ORIGINATING	19.3	22.3	22.2	-.2	23.1	26.5	3.4	24.8	28.5	3.7
LABOR COMPENSATION	15.3	17.6	17.5	-.1	19.1	19.3	.2	19.0	19.0	-.0
INDIRECT BUSINESS TAXES	.5	.5	.4	-.0	.5	.5	-.0	.5	.5	-.0
CAP. CONSUMPTION ALLOW.	1.1	1.1	1.2	.1	1.2	1.3	.1	1.3	1.4	.1
PROPRIETOR INCOME	.2	.2	.0	-.2	.2	.0	-.2	.2	.0	-.2
OTHER PROPERTY INCOME	2.3	3.0	3.0	.1	2.0	5.3	3.3	3.7	7.6	3.8
23 MACHINERY, EXCEPT ELECTRICAL										
GROSS PRODUCT ORIGINATING	30.4	35.1	34.1	-1.0	36.7	38.3	1.5	43.8	41.1	.3
LABOR COMPENSATION	22.7	26.8	26.9	.1	30.6	31.4	.8	30.9	32.0	1.1
INDIRECT BUSINESS TAXES	.7	.7	.7	-.1	.8	.7	-.0	.8	.8	.0
CAP. CONSUMPTION ALLOW.	2.9	3.0	3.3	.3	3.4	4.0	.6	3.7	4.4	.6
PROPRIETOR INCOME	.2	.3	.5	.2	.3	.4	.1	.4	.5	.2
OTHER PROPERTY INCOME	3.8	4.3	2.7	-1.6	1.7	1.8	.0	4.9	3.4	-1.5
24 ELECTRICAL MACHINERY										
GROSS PRODUCT ORIGINATING	26.6	29.9	29.8	-.2	29.7	30.9	1.2	28.8	30.1	1.3
LABOR COMPENSATION	19.8	23.1	22.7	-.4	24.8	24.7	-.1	23.7	24.7	1.1
INDIRECT BUSINESS TAXES	.5	.6	.5	-.0	.6	.6	-.0	.6	.7	.0
CAP. CONSUMPTION ALLOW.	2.2	2.4	2.6	.2	2.7	3.1	.4	2.9	3.3	.5
PROPRIETOR INCOME	.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	4.0	3.8	4.0	.1	1.7	2.5	.9	1.7	1.4	-.2

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
25 TRANS. EQUIP. & ORDNANCE										
GROSS PRODUCT ORIGINATING	16.1	16.4	17.3	.9	16.1	18.5	2.4	18.4	20.6	2.2
LABOR COMPENSATION	14.0	15.1	15.1	.0	16.2	16.6	.4	17.5	17.7	.2
INDIRECT BUSINESS TAXES	.6	.5	.5	-.1	.6	.5	-.1	.6	.6	-.0
CAP. CONSUMPTION ALLOW.	1.1	.7	1.3	.6	.6	1.5	.8	.7	1.6	.9
PROPRIETOR INCOME	-.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	.3	-.0	.4	.5	-1.2	-.0	1.2	-.4	.7	1.1
26 MOTOR VEHICLES										
GROSS PRODUCT ORIGINATING	22.6	25.5	23.3	-2.2	20.0	18.8	-1.2	21.3	17.9	-3.4
LABOR COMPENSATION	13.7	16.4	16.4	-.0	16.0	15.6	-.4	15.7	15.8	.1
INDIRECT BUSINESS TAXES	.8	1.0	.5	-.6	1.1	.5	-.6	1.1	.6	-.5
CAP. CONSUMPTION ALLOW.	2.0	2.0	2.2	.2	2.4	2.6	.2	2.9	2.6	-.2
PROPRIETOR INCOME	-.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	6.1	6.0	4.2	-1.9	.4	.1	-.4	1.6	-1.2	-2.8
27 INSTRUMENTS										
GROSS PRODUCT ORIGINATING	6.8	7.6	8.1	.5	7.9	8.6	.7	9.1	8.5	-.6
LABOR COMPENSATION	5.1	5.3	5.9	.0	6.6	6.8	.2	7.0	6.8	-.2
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.2	.0
CAP. CONSUMPTION ALLOW.	.5	.6	.5	-.0	.6	.7	.3	.8	.7	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.1	1.0	1.6	.5	.6	1.0	.4	1.1	.9	-.2
28 MISC. MANUFACTURING INDUSTRIE										
GROSS PRODUCT ORIGINATING	4.9	5.2	5.3	.1	5.1	5.7	.6	6.5	5.8	.2
LABOR COMPENSATION	3.7	4.0	4.0	.0	4.3	4.4	.0	4.3	4.3	.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	-.0	.4	.3	-.1	.3	.3	-.0
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.8	.8	.9	.2	.2	.9	.7	.8	1.1	.3
29 RAILROADS										
GROSS PRODUCT ORIGINATING	10.3	11.5	11.4	-.2	12.3	12.3	-.0	11.5	12.7	1.3
LABOR COMPENSATION	7.8	9.4	9.1	-.3	10.2	9.9	-.3	10.2	9.8	-.3
INDIRECT BUSINESS TAXES	.5	.5	.5	-.1	.6	.5	-.1	.6	.5	-.1
CAP. CONSUMPTION ALLOW.	1.6	1.5	1.7	.2	1.6	1.8	.2	1.6	1.9	.3
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	.2	.1	-.0	-.1	.1	.2	-.9	.5	1.4
30 LOCAL, SUBURBAN, & HIGHWAY PA										
GROSS PRODUCT ORIGINATING	3.4	3.4	3.6	.2	3.7	3.6	-.1	3.9	3.9	.0
LABOR COMPENSATION	2.2	2.3	2.2	-.1	2.5	2.4	-.1	2.7	2.7	.0
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.3	.2	.3	.1	.2	.3	.1	.2	.3	.2
PROPRIETOR INCOME	.2	.2	.3	.1	.2	.2	.0	.2	.3	.1
OTHER PROPERTY INCOME	.5	.5	.6	.1	.6	.5	-.1	.6	.3	-.3

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
31 TRUCKING AND WAREHOUSING										
GROSS PRODUCT ORIGINATING	19.4	21.7	21.4	-.3	23.5	21.8	-1.8	23.7	22.6	-1.1
LABOR COMPENSATION	12.9	14.8	15.0	.2	15.9	16.4	.5	15.6	16.1	.5
INDIRECT BUSINESS TAXES	1.1	1.2	1.1	-.0	1.2	1.2	.0	1.3	1.3	.0
CAP. CONSUMPTION ALLOW.	2.1	2.3	2.3	.0	2.7	2.5	-.2	3.1	3.3	.2
PROPRIETOR INCOME	1.2	1.4	1.3	-.1	1.5	1.2	-.3	1.5	1.4	-.1
OTHER PROPERTY INCOME	2.1	2.1	1.7	-.4	2.2	.4	-1.9	2.2	.5	-1.7
32 WATER TRANSPORTATION										
GROSS PRODUCT ORIGINATING	2.7	3.0	3.0	-.0	3.6	3.0	-.6	3.9	3.0	-.9
LABOR COMPENSATION	2.3	2.6	2.6	.0	2.8	2.9	.1	3.0	3.0	-.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.4	.4	.4	-.0	.4	.4	-.0	.4	.4	-.1
PROPRIETOR INCOME	.0	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	-.1	-.1	-.1	.0	.2	-.4	-.6	.2	-.5	-.7
33 AIR TRANSPORTATION										
GROSS PRODUCT ORIGINATING	7.9	8.8	9.0	.2	9.6	9.7	.0	9.9	10.2	.3
LABOR COMPENSATION	5.3	6.0	6.0	-.0	6.5	6.8	.3	7.0	7.5	.5
INDIRECT BUSINESS TAXES	.9	1.0	1.1	.1	1.0	1.2	.2	1.1	1.3	.2
CAP. CONSUMPTION ALLOW.	1.4	1.5	1.5	-.1	1.7	1.4	-.3	1.9	1.1	-.6
PROPRIETOR INCOME	.0	-.0	.0	.0	-.0	.0	.0	-.0	.0	.0
OTHER PROPERTY INCOME	.3	.4	.5	.1	.5	.3	-.2	.0	.2	.2
34 PIPELINE TRANSPORTATION										
GROSS PRODUCT ORIGINATING	1.0	.9	1.0	.1	1.1	1.0	-.1	1.1	1.2	.1
LABOR COMPENSATION	.2	.2	.2	-.0	.3	.3	-.0	.3	.3	-.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.3	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	-.0	.2	.3	.0	.2	.3	.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.3	.0	.0	-.0
OTHER PROPERTY INCOME	.4	.4	.5	.1	.5	.4	-.1	.5	.5	.0
35 TRANSPORTATION SERVICES										
GROSS PRODUCT ORIGINATING	1.6	1.8	1.8	-.0	2.4	1.9	-.4	2.6	2.0	-.6
LABOR COMPENSATION	1.1	1.3	1.3	-.1	1.6	1.4	-.1	1.7	1.5	-.2
INDIRECT BUSINESS TAXES	.0	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.2	-.0	.4	.2	-.2	.6	.2	-.3
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.1	.1	.2	.2	.2	.2	-.0	.2	.2	-.0
36 TELEPHONE AND TELEGRAPH										
GROSS PRODUCT ORIGINATING	26.9	30.1	30.2	.1	32.6	32.2	-.4	35.2	33.7	-1.5
LABOR COMPENSATION	13.0	14.5	14.9	.4	15.9	16.5	.7	17.3	19.2	1.9
INDIRECT BUSINESS TAXES	3.9	4.1	3.8	-.3	4.4	3.9	-.4	4.6	4.0	-.6
CAP. CONSUMPTION ALLOW.	5.3	6.2	5.9	-.3	6.9	6.5	-.4	7.7	7.0	-.7
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	4.6	5.2	5.6	.4	5.4	5.3	-.2	5.6	3.5	-2.1

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
37 RADIO AND TELEVISION BROADCAS										
GROSS PRODUCT ORIGINATING	2.5	2.6	2.7	.0	2.7	2.8	.0	3.3	2.7	-.6
LABOR COMPENSATION	1.6	1.8	1.7	-.0	1.9	1.8	-.1	2.1	1.7	-.4
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	.0	.3	.3	-.0	.4	.3	-.0
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.5	.5	.6	.1	.4	.6	.1	.7	.6	-.1
38 ELECTRIC, GAS, AND SANITARY S										
GROSS PRODUCT ORIGINATING	28.0	30.5	30.4	-.1	31.2	33.8	2.7	37.2	39.8	2.7
LABOR COMPENSATION	9.3	10.3	10.3	.0	11.3	11.2	-.1	12.1	11.8	-.3
INDIRECT BUSINESS TAXES	4.2	4.6	3.9	-.8	5.0	4.2	-.8	5.5	4.6	-.8
CAP. CONSUMPTION ALLOW.	6.1	7.0	6.7	-.2	7.7	7.5	-.2	8.8	8.2	-.6
PROPRIETOR INCOME	.3	.4	.0	-.4	.2	.0	-.2	.2	.0	-.2
OTHER PROPERTY INCOME	8.0	8.2	9.4	1.3	7.0	11.0	3.9	13.6	15.2	4.7
39 WHOLESALE TRADE										
GROSS PRODUCT ORIGINATING	82.4	94.0	98.1	4.1	107.9	112.7	4.8	119.4	116.2	-3.2
LABOR COMPENSATION	43.3	49.1	49.2	.1	55.8	54.2	-1.5	59.7	58.0	-1.7
INDIRECT BUSINESS TAXES	19.9	21.7	22.7	1.0	22.6	24.2	1.6	25.5	25.7	.1
CAP. CONSUMPTION ALLOW.	4.3	4.6	5.0	.4	5.2	5.7	.4	6.0	5.6	-.4
PROPRIETOR INCOME	3.8	4.0	6.3	2.3	4.8	7.8	3.0	4.8	8.7	3.9
OTHER PROPERTY INCOME	11.2	14.7	15.0	.3	19.5	20.9	1.4	23.4	18.3	-5.1
40 RETAIL TRADE										
GROSS PRODUCT ORIGINATING	118.8	129.8	129.3	-.5	135.0	135.5	.4	153.0	153.4	.4
LABOR COMPENSATION	72.1	79.7	79.3	-.4	87.0	85.8	-1.2	93.9	94.3	.5
INDIRECT BUSINESS TAXES	20.1	22.6	23.4	.7	25.4	25.3	-.1	27.6	27.8	.2
CAP. CONSUMPTION ALLOW.	6.9	7.0	7.4	.3	7.4	7.7	.3	8.0	8.3	.3
PROPRIETOR INCOME	10.2	11.5	11.2	-.4	10.9	9.9	-1.0	12.8	12.9	.1
OTHER PROPERTY INCOME	9.4	8.8	8.1	-.8	4.4	6.8	2.4	10.9	10.1	-.7
41 BANKING AND CREDIT AGENCIES										
GROSS PRODUCT ORIGINATING	22.6	20.1	23.4	3.3	21.7	23.6	1.9	23.7	27.0	3.3
LABOR COMPENSATION	18.6	19.6	19.4	-.2	21.7	21.1	-.5	23.8	22.9	-.9
INDIRECT BUSINESS TAXES	1.7	1.8	1.6	-.2	1.8	1.7	-.0	1.8	1.9	.1
CAP. CONSUMPTION ALLOW.	2.1	2.6	2.2	-.4	3.1	2.3	-.8	3.7	2.6	-1.0
PROPRIETOR INCOME	.8	-.0	.4	.4	.0	.7	.6	.4	.4	-.1
OTHER PROPERTY INCOME	.0	-3.9	-.1	3.8	-4.9	-2.2	2.7	-6.0	-.8	5.3
42 INSURANCE AGENTS AND BROKERS										
GROSS PRODUCT ORIGINATING	21.1	22.0	21.2	-.8	21.8	20.0	-1.8	22.9	20.0	-2.9
LABOR COMPENSATION	13.5	15.0	15.3	.3	16.6	16.7	.1	18.0	16.8	-1.2
INDIRECT BUSINESS TAXES	2.4	2.4	2.2	-.2	2.6	2.4	-.1	2.7	2.7	-.0
CAP. CONSUMPTION ALLOW.	.8	1.0	.9	-.1	1.0	.9	-.2	1.1	.8	-.3
PROPRIETOR INCOME	2.1	2.2	2.1	-.1	2.0	2.0	-.0	2.2	2.0	-.2
OTHER PROPERTY INCOME	2.3	1.4	.7	-.6	-.4	-2.0	-1.6	-1.1	-2.4	-1.2

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
43 REAL ESTATE AND COMBINATION O										
GROSS PRODUCT ORIGINATING	124.9	137.1	138.0	.9	149.7	148.9	-.8	162.7	160.0	-2.7
LABOR COMPENSATION	6.6	7.7	7.8	.1	8.1	8.5	.4	8.1	8.7	.6
INDIRECT BUSINESS TAXES	27.9	30.1	30.4	.2	32.3	33.2	.9	34.9	36.6	1.7
CAP. CONSUMPTION ALLOW.	21.9	23.5	24.4	.9	25.5	26.3	.7	27.5	27.9	.5
PROPRIETOR INCOME	1.8	.9	.9	.0	-.4	-.4	.0	-.2	-.2	.0
OTHER PROPERTY INCOME	66.7	74.8	74.5	-.3	84.2	81.3	-2.9	92.4	87.0	-5.4
44 HOTELS AND OTHER LODGING PLAC										
GROSS PRODUCT ORIGINATING	7.2	7.9	7.8	-.1	8.5	7.8	-.7	9.1	7.9	-1.2
LABOR COMPENSATION	4.6	5.2	5.2	-.1	5.7	5.8	.1	6.2	6.5	.3
INDIRECT BUSINESS TAXES	.5	.6	.5	-.1	.6	.5	-.1	.7	.6	-.1
CAP. CONSUMPTION ALLOW.	1.1	1.2	1.2	-.0	1.3	1.2	-.1	1.4	1.2	-.2
PROPRIETOR INCOME	.1	.0	.4	.4	-.2	.0	.2	-.0	-.0	.0
OTHER PROPERTY INCOME	.9	.9	.7	-.3	1.0	.3	-.7	.9	-.3	-1.2
45 PERSONAL SERVICES										
GROSS PRODUCT ORIGINATING	11.5	12.1	12.2	.1	13.1	12.1	-1.0	13.6	12.3	-1.3
LABOR COMPENSATION	6.8	7.3	7.3	.0	7.8	7.8	.1	8.1	8.0	-.1
INDIRECT BUSINESS TAXES	.4	.5	.4	-.0	.5	.5	-.0	.5	.5	-.0
CAP. CONSUMPTION ALLOW.	.9	1.0	1.0	.1	1.1	1.0	-.0	1.1	1.0	-.1
PROPRIETOR INCOME	2.9	2.9	2.9	-.0	3.1	2.4	-.7	3.2	2.4	-.8
OTHER PROPERTY INCOME	.5	.5	.5	.1	.6	.3	-.3	.6	.3	-.3
46 MISC. BUSINESS SERVICES										
GROSS PRODUCT ORIGINATING	39.5	46.0	45.0	-1.0	50.5	47.6	-2.9	54.4	51.9	-2.5
LABOR COMPENSATION	24.3	28.2	28.6	.4	32.0	32.2	.2	34.4	33.6	-.9
INDIRECT BUSINESS TAXES	.5	.5	.5	-.0	.6	.6	-.0	.6	.6	.0
CAP. CONSUMPTION ALLOW.	2.5	3.1	2.9	-.2	3.4	3.2	-.2	3.9	3.4	-.5
PROPRIETOR INCOME	10.6	12.0	11.6	-.4	12.7	11.7	-1.0	13.5	13.0	-.5
OTHER PROPERTY INCOME	1.6	2.1	1.3	-.8	1.8	-.0	-1.8	1.9	1.3	-.6
47 AUTOMOBILE REPAIR AND GARAGES										
GROSS PRODUCT ORIGINATING	6.4	7.3	7.9	.5	7.8	8.5	.7	8.4	10.3	1.9
LABOR COMPENSATION	3.1	3.5	3.8	.2	3.8	4.5	.7	4.1	5.3	1.2
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.3	.3	.0
CAP. CONSUMPTION ALLOW.	1.7	1.9	2.1	.2	2.1	2.4	.3	2.3	2.8	.5
PROPRIETOR INCOME	1.0	1.1	1.1	-.0	1.0	.9	-.2	1.2	1.1	-.1
OTHER PROPERTY INCOME	.4	.5	.6	.1	.6	.5	-.0	.5	.8	.3
49 AMUSEMENT AND RECREATION SERV										
GROSS PRODUCT ORIGINATING	7.8	8.8	7.9	-1.0	9.4	7.9	-1.5	10.6	8.4	-2.2
LABOR COMPENSATION	4.8	5.2	5.1	.1	5.9	5.8	-.1	6.2	6.0	-.3
INDIRECT BUSINESS TAXES	1.5	1.7	1.5	-.1	1.8	1.7	-.2	2.0	1.9	-.1
CAP. CONSUMPTION ALLOW.	.9	1.1	1.0	-.1	1.3	1.0	-.3	1.5	1.1	-.5
PROPRIETOR INCOME	.3	.4	.2	-.2	.1	-.1	-.3	.2	.0	-.2
OTHER PROPERTY INCOME	.3	.4	-.1	-.6	.3	-.5	-.8	.6	-.6	-1.2

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
49 MEDICAL AND OTHER HEALTH SERV										
GROSS PRODUCT ORIGINATING	37.7	42.3	40.9	-1.3	48.0	45.1	-2.9	55.0	52.4	-2.6
LABOR COMPENSATION	25.5	29.5	29.3	-.2	34.5	34.9	.4	43.7	40.5	-.2
INDIRECT BUSINESS TAXES	.3	.4	.3	-.1	.4	.4	-.1	.4	.4	-.0
CAP. CONSUMPTION ALLOW.	.0	.8	.8	-.1	.9	.8	-.1	1.0	.8	-.2
PROPRIETOR INCOME	10.4	10.6	9.7	-1.0	11.1	8.3	-2.8	11.7	9.9	-1.8
OTHER PROPERTY INCOME	.8	.9	.8	-.1	1.0	.7	-.3	1.0	.8	-.2
50 EDUCATIONAL SERVICES										
GROSS PRODUCT ORIGINATING	19.1	20.8	20.5	-.3	22.8	22.0	-.8	24.9	22.8	-2.2
LABOR COMPENSATION	18.5	20.2	20.0	-.2	22.2	22.0	-.3	24.3	22.8	-1.6
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.3	.3	.0	.3	.4	.0
CAP. CONSUMPTION ALLOW.	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
PROPRIETOR INCOME	.2	.2	.1	-.1	.2	-.3	-.5	.2	-.4	-.6
OTHER PROPERTY INCOME	-.1	-.0	.0	.0	-.0	-.0	.0	-.0	-.0	-.0
51 PRIVATE HOUSEHOLDS										
GROSS PRODUCT ORIGINATING	5.3	5.4	5.4	.0	5.6	5.3	-.2	5.8	5.6	-.2
LABOR COMPENSATION	5.3	5.4	5.4	.0	5.6	5.3	-.2	5.8	5.6	-.2
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	-.0	.0	.0	-.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
52 FEDERAL - ENTERPRISES										
GROSS PRODUCT ORIGINATING	8.7	7.7	7.4	-.3	10.1	9.5	-.6	11.1	10.2	-.8
LABOR COMPENSATION	9.7	10.5	10.3	-.2	11.8	11.3	-.5	13.0	12.2	-.8
INDIRECT BUSINESS TAXES	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-1.0	-2.8	-2.8	.0	-1.9	-1.8	.0	-2.0	-2.0	.0
53 STATE AND LOCAL - ENTERPRIS										
GROSS PRODUCT ORIGINATING	8.8	9.7	9.5	-.2	10.3	10.2	-.2	11.0	10.9	-.1
LABOR COMPENSATION	5.5	6.2	6.1	-.2	7.2	7.0	-.2	8.2	8.1	-.1
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	3.3	3.4	3.4	.0	3.1	3.1	.0	2.8	2.8	.0
54 FEDERAL - GENERAL										
GROSS PRODUCT ORIGINATING	50.1	51.9	53.2	1.3	54.9	57.8	2.8	59.3	62.2	2.9
LABOR COMPENSATION	50.1	51.9	53.2	1.3	54.9	57.8	2.8	59.3	62.2	2.9
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TABLE X-5 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: AVAILABLE ACTUAL PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
55 STATE AND LOCAL - GENERAL										
GROSS PRODUCT ORIGINATING	87.3	97.1	98.3	1.2	106.7	110.0	3.3	119.2	123.2	4.0
LABOR COMPENSATION	87.3	97.1	98.3	1.2	106.7	110.0	3.3	119.2	123.2	4.0
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

built completely from data on prices and INFORUM predictions of real gross outputs that are disaggregated to the three and sometimes four-digit SIC level. Interindustry transactions are netted out via the predicted I/O matrices as well as the major imported intermediate input, crude petroleum. Our procedure for forecasting GPO seems to be working very well at this most aggregated level with the largest error at .6 percent in 1973.

The estimates for labor compensation at the most aggregate level do not fare as well with rather large overpredictions (of 9.4 million) for 1974 and 1975. Much of this error stems from Government and Government Enterprises and, in particular, State and local general government (sector 55). Although the employment for these sectors is exogenous, government wages are predicted by model. Our estimated equation relates state and local general government wages to private nonfarm wages and salaries per manhour with an elasticity of 1.10. State and local government relative wages, in fact, <u>fell</u> relative to the private sector from 1972-1975 leading to a 3.3 billion overestimate for sector 55 in 1975.

Labor Compensation for the private economy shown in the second panel of Table X-5 is not affected by this problem and had only a 3.8 billion discrepancy. One may ask, in view of the errors still apparent, why, if "wages" and manhours are exogenous, is there any error at all? Part of the answer is that employee manhours for the 50 income sectors and "compensation per manhour" are not the exogenous figures entered into the real and price-wage models. For the real model, for example, a single number covers a large amount of manhours in the Finance and Service Sector; the income model must divide these manhours among the ten included two-digit industry sectors and also split off the manhours for self-employed.

Because wages differ by two-digit sector, small errors may arise from either of these operations. In the price-wage model, the BLS hourly earnings indexes are read in, but the BLS-to-BEA wage bridge equations are at work and may err (see Chapter V, Section 4). The 3.8 billion dollar error that shows up for 1974 (panel 2, line 2) is probably slightly too high to be a result of these considerations, but tracking down the exact source has been postponed in view of more important problems in the table.

Looking again at the panel labeled "All Industries," we see that indirect business taxes and capital consumption allowances show no particular problem at the aggregate level. The CCA estimates show a slight negative bias by 1975; but alternative model runs extending beyond 1975 show the percentage error to remain nearly the same as for 1976.

For the private economy, most of the error in total GPO in each year is concentrated in the proprietor income and other property income components. The proprietor figures are "semi" residuals since our equations in Chapter VI use in their derivation both the non-wage income of the appropriate sector and the wage rate. The other property income figure is entirely a residual and it includes corporate profits, net interest, inventory valuation adjustment, and business transfers.

The row for Other property income for the private economy shows errors between 1.3 and 3.0 percent; a satisfactory performance considering that they are obtained as residuals. This fortuitous results, however, stems from offsetting errors as we see when we look at the predictions for the industry divisions. By and large, the major offsets are the large overprediction for Manufacturing (1974 and 1975) and underpredictions for Contract construction, Trade, and Services.

Since most of the other GPO components are reasonably close to their actual values, we can shift our attention to the errors in predicting total GPO in the various industries. As a general statement, the errors in, say, Trade and Manufacturing are not necessarily fatal flaws in a model explaining aggregate incomes, since some portions of these errors are interdependent. An understatement of wholesale trade margins causes an understatement of the cost of materials in manufacturing and leads to a corresponding overstatement of incomes, given actual manufacturing prices.

In Manufacturing, the model does quite well in predicting total GPO for Tobacco (9), Textile Mill Products (10), Apparel (11), Rubber and Miscellaneous Products (18), Leather and Leather Products (19), Machinery (24 and 25), and Miscellaneous Manufacturing. The most important problems occurred in three nondurable goods industries: Food (8), Paper (14), and Chemicals (16) and two durable goods industries: Fabricated Metals (22) and Motor Vehicles (6). In Food, the overprediction of GPO by 7.0 billion dollars in 1975 is consistent with the underprediction of prices for several manufactured food items which we saw in Table X-2.

The probable sources of much of this error (for 1975) are in Meat products (24) and Bakery products (28). The error for the latter is disconcerting given the fact that the price of Grain mill products (27) was predicted very closely by the model. The reported price of confectionery products is also high given that the input costs were calculated with actual prices for two important inputs: Sugar and Cocoa beans. I suspect there are definitional problems that make the output and input prices for this sector not well matched.

For Paper (16) what we are seeing in the 1975 GPO is probably the result of extraordinary prices for INFORUM sector 52, Paper products, nec. The reader may refer back to Table X-2 to find our substantial underprediction for this price, given exogenous prices for pulpwood and reasonable price predictions for paper and paperboard. The inputs and outputs for paper are homogenous enough that our input-output assumptions should work reasonable well for this industry. The error shown here strongly suggests the possibility that the BLS price indexes were not accurate measures of the transactions prices over this period.

We cannot come to the same conclusion in regard to the Chemicals industry (16). In spite of some special adjustment to enter crude (rather than refined) petroleum prices into the input costs of several of these sectors, the model is obviously not reflecting the prices of petroleum feedstocks. What biases in projected gross revenues that may result from improper weighting of the BLS collected price data on chemical outputs cannot be determined at this point.

For Fabricated metals (22) we show the large error in the GPO prediction to which we referred in the previous section. As stated then, the input cost indexes have been checked carefully against the BEA input cost compilations used for their double-deflation work. Again, for this sector, our conclusion is that the published prices indexes were not accurately reflecting transactions prices for a number of products in this sector.

No effort has been made to track down the source of the error for Motor Vehicles (26). The BEA value for GPO is subject to errors arising from the enterprise-establishment adjustment procedure and FRB-based real output (on the derived number of automobiles produced) figures may not have moved a "constant dollar" production index of the entire SIC 371 industry.

In summary, the job of improving the results for the industry income distributions would be made simpler if we could point to a single source of the error. Unfortunately, the errors that remain derive from aggregation problems in the table, our assumption that a single price in the appropriate input cost for all buyers in a single row, and what appears to be deviations of published prices from transactions prices for certain manufacturing sectors. This latter problem may not be as apparent when this procedure is tested against future data.

Endogenous Prices

In Table X-6 we insert the prices and wages from simulation (2) ("exog-wage") of previous section: prices are endogenous and wages are again fixed. The slightly greater errors (than in Table X-5) for indirect business taxes and CCA stem from the slightly lower aggregate price level that was generated for this run. The significant underprediction for Other property income in 1975 stems largely from Wholesale and Retail Trade. The problem in trade we will discuss briefly below.

A remarkable feature of the table is the dramatic improvement (relative to Table X-5) in the prediction of the GPO components for manufacturing, especially for nondurables. The underprediction of total GPO for durables probably reflects the weakness of the controls dummy variables

TABLE X-6

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
1 ALL INDUSTRIES, TOTAL										
GROSS PRODUCT ORIGINATING	1169.4	1304.0	1320.0	16.0	1406.5	1418.4	11.9	1511.9	1495.4	-16.5
LABOR COMPENSATION	715.1	799.1	803.2	4.1	875.8	885.4	9.6	928.7	935.9	7.1
INDIRECT BUSINESS TAXES	111.0	120.2	118.2	-2.0	128.4	126.7	-1.7	138.7	135.8	-2.9
CAP. CONSUMPTION ALLOW.	100.5	109.4	111.3	1.9	121.4	121.9	.4	132.8	129.4	-3.4
PROPRIETOR INCOME	75.6	92.8	98.9	6.1	87.9	89.9	2.0	92.7	92.3	-.3
OTHER PROPERTY INCOME	167.1	182.4	188.3	5.9	193.1	194.6	1.6	219.0	202.0	-17.0
2 PRIVATE ECONOMY (DOMESTIC)										
GROSS PRODUCT ORIGINATING	1007.5	1128.4	1142.4	14.0	1210.0	1221.3	11.3	1300.7	1278.9	-21.8
LABOR COMPENSATION	562.6	633.4	635.4	2.0	695.2	699.1	4.0	729.0	730.1	1.1
INDIRECT BUSINESS TAXES	110.9	120.1	118.2	-1.9	128.3	126.7	-1.6	138.6	135.8	-2.8
CAP. CONSUMPTION ALLOW.	100.5	109.4	111.3	1.9	121.4	121.9	.4	132.8	129.4	-3.4
PROPRIETOR INCOME	75.6	92.8	98.9	6.1	87.9	89.9	2.0	92.7	92.3	-.3
OTHER PROPERTY INCOME	157.8	172.7	178.6	5.9	177.2	183.8	6.6	207.6	191.2	-16.4
3 AGRICULTURE,FORESTRY,&FISHERI										
GROSS PRODUCT ORIGINATING	35.4	53.8	60.6	6.8	52.6	60.1	7.4	54.8	56.6	1.8
LABOR COMPENSATION	6.3	7.4	8.4	1.1	8.4	10.3	1.9	9.1	11.7	2.7
INDIRECT BUSINESS TAXES	2.2	2.3	2.2	-.1	2.4	2.3	-.1	2.5	2.4	-.1
CAP. CONSUMPTION ALLOW.	5.9	6.6	6.2	-.4	7.9	7.1	-.8	8.5	8.0	-.6
PROPRIETOR INCOME	20.8	35.1	39.6	4.5	29.4	35.4	6.0	29.7	30.6	.9
OTHER PROPERTY INCOME	.2	2.4	4.2	1.8	4.5	5.0	.4	5.0	3.9	-1.1
4 MINING										
GROSS PRODUCT ORIGINATING	18.9	21.4	23.8	2.3	31.8	35.7	3.9	37.6	40.6	3.0
LABOR COMPENSATION	7.8	8.7	8.7	.0	10.5	10.4	-.1	12.8	13.2	.4
INDIRECT BUSINESS TAXES	1.5	1.7	1.6	-.1	2.5	1.7	-.8	2.8	1.8	-1.0
CAP. CONSUMPTION ALLOW.	4.7	4.8	4.8	-.0	5.4	5.0	-.3	5.8	5.3	-.5
PROPRIETOR INCOME	.0	-.1	.4	.5	1.5	.6	-.9	1.7	.7	-1.0
OTHER PROPERTY INCOME	4.9	6.2	8.3	2.0	11.9	18.0	6.0	14.5	19.6	5.0
5 CONTRACT CONSTRUCTION										
GROSS PRODUCT ORIGINATING	56.6	63.3	61.9	-1.4	66.7	63.0	-3.7	66.5	63.2	-3.2
LABOR COMPENSATION	43.0	48.4	49.6	1.2	51.5	53.5	1.9	50.2	50.3	.1
INDIRECT BUSINESS TAXES	1.1	1.2	1.0	-.1	1.3	1.1	-.2	1.4	1.2	-.2
CAP. CONSUMPTION ALLOW.	3.0	3.5	4.0	.5	4.0	4.7	.8	4.5	4.6	.1
PROPRIETOR INCOME	7.0	7.8	6.5	-1.3	7.6	5.3	-2.3	7.0	6.5	-.5
OTHER PROPERTY INCOME	2.5	2.4	.7	-1.7	2.4	-1.5	-3.9	3.4	.6	-2.9
6 MANUFACTURING										
GROSS PRODUCT ORIGINATING	288.7	321.8	316.6	-5.2	334.3	336.9	2.7	346.0	339.1	-7.0
LABOR COMPENSATION	203.3	229.9	229.3	-.6	249.4	250.6	1.2	251.4	252.6	1.2
INDIRECT BUSINESS TAXES	19.1	20.1	18.2	-1.9	20.2	19.1	-1.1	20.8	20.0	-.8
CAP. CONSUMPTION ALLOW.	24.8	26.6	27.6	1.0	29.4	31.3	1.9	31.8	33.4	1.6
PROPRIETOR INCOME	1.9	2.1	2.3	.3	2.0	2.2	.1	2.3	2.4	.2
OTHER PROPERTY INCOME	39.6	43.2	39.3	-3.9	33.2	33.7	.5	39.8	30.7	-9.1

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
7 NONDURABLE GOODS										
GROSS PRODUCT ORIGINATING	116.8	127.5	121.7	-5.8	136.1	133.5	-2.5	142.4	138.7	-3.7
LABOR COMPENSATION	76.5	83.3	83.2	-.1	90.1	89.9	-.3	93.2	92.0	-1.1
INDIRECT BUSINESS TAXES	14.6	15.3	14.3	-1.0	15.1	14.8	-.3	15.4	15.2	-.1
CAP. CONSUMPTION ALLOW.	10.1	11.3	11.1	-.2	12.0	12.3	.4	12.9	13.2	.3
PROPRIETOR INCOME	.6	.7	.0	-.7	.7	.0	-.7	.9	.0	-.9
OTHER PROPERTY INCOME	15.0	16.9	13.1	-3.8	18.1	16.5	-1.6	20.1	18.2	-1.9
8 DURABLE GOODS										
GROSS PRODUCT ORIGINATING	171.9	194.3	194.9	.6	198.2	203.4	5.2	203.7	200.4	-3.3
LABOR COMPENSATION	126.8	146.6	146.0	-.5	159.2	160.7	1.5	158.3	160.5	2.3
INDIRECT BUSINESS TAXES	4.4	4.8	3.9	-.9	5.1	4.3	-.8	5.4	4.8	-.6
CAP. CONSUMPTION ALLOW.	14.7	15.3	16.5	1.2	17.5	19.0	1.5	18.9	20.1	1.2
PROPRIETOR INCOME	1.3	1.4	2.3	.9	1.3	2.2	.9	1.4	2.4	1.0
OTHER PROPERTY INCOME	24.6	26.2	26.1	-.1	15.1	17.2	2.1	19.7	12.5	-7.2
9 TRANSPORTATION										
GROSS PRODUCT ORIGINATING	46.2	51.3	53.1	1.9	56.3	55.7	-.6	56.6	57.5	.9
LABOR COMPENSATION	31.9	36.6	36.4	-.2	39.7	40.1	.5	40.5	40.9	.4
INDIRECT BUSINESS TAXES	2.9	3.1	3.1	.0	3.3	3.4	.1	3.6	3.7	.1
CAP. CONSUMPTION ALLOW.	6.3	6.4	6.7	.2	7.3	6.9	-.4	7.8	7.4	-.3
PROPRIETOR INCOME	1.5	1.7	2.0	.3	1.8	1.8	-.0	1.8	2.1	.3
OTHER PROPERTY INCOME	3.6	3.4	4.9	1.5	4.2	3.4	-.8	2.9	3.4	.5
10 COMMUNICATION										
GROSS PRODUCT ORIGINATING	29.4	32.7	33.2	.5	35.3	36.2	.9	38.4	37.7	-.7
LABOR COMPENSATION	14.6	16.3	16.6	.3	17.8	18.4	.6	19.4	20.9	1.5
INDIRECT BUSINESS TAXES	4.0	4.2	3.9	-.3	4.4	4.1	-.4	4.7	4.1	-.6
CAP. CONSUMPTION ALLOW.	5.6	6.5	6.2	-.3	7.3	6.8	-.4	8.0	7.2	-.8
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	5.1	5.7	6.5	.9	5.8	7.0	1.2	6.4	5.5	-.9
11 ELECTRIC,GAS & SANITARY										
GROSS PRODUCT ORIGINATING	28.0	30.5	31.2	.7	31.2	33.6	2.4	37.2	38.3	1.1
LABOR COMPENSATION	9.3	10.3	10.3	.0	11.3	11.2	-.1	12.1	11.8	-.3
INDIRECT BUSINESS TAXES	4.2	4.6	3.9	-.8	5.0	4.2	-.8	5.5	4.6	-.9
CAP. CONSUMPTION ALLOW.	6.1	7.0	6.8	-.2	7.7	7.5	-.2	8.8	8.2	-.6
PROPRIETOR INCOME	.3	.4	.3	-.0	.2	.4	.2	.2	.4	.2
OTHER PROPERTY INCOME	8.0	8.2	9.9	1.7	7.0	10.3	3.3	10.6	13.3	2.8
12 WHOLESALE AND RETAIL TRADE										
GROSS PRODUCT ORIGINATING	201.2	223.8	229.7	5.9	242.9	240.8	-2.2	272.4	253.6	-18.8
LABOR COMPENSATION	115.4	128.8	128.5	-.3	142.7	140.0	-2.8	153.5	152.3	-1.2
INDIRECT BUSINESS TAXES	40.1	44.3	46.3	2.0	48.0	49.2	1.2	53.1	52.2	-1.0
CAP. CONSUMPTION ALLOW.	11.2	11.6	12.4	.8	12.7	13.3	.7	14.0	13.8	-.1
PROPRIETOR INCOME	14.0	15.5	18.0	2.4	15.7	15.7	-.0	17.6	17.1	-.6
OTHER PROPERTY INCOME	20.5	23.5	24.5	1.0	23.9	22.6	-1.2	34.2	18.3	-15.9

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR COMPONENTS OF GROSS PRODUCT ORIGINATING 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
13 FINANCE, INSURANCE & REAL EST										
GROSS PRODUCT ORIGINATING	168.6	179.2	184.3	5.1	193.2	197.2	4.0	209.4	213.5	4.1
LABOR COMPENSATION	38.1	42.3	42.5	.2	46.3	46.3	.0	50.0	48.5	-1.6
INDIRECT BUSINESS TAXES	32.0	34.3	34.2	-.1	36.6	37.4	.8	39.4	41.1	1.6
CAP. CONSUMPTION ALLOW.	24.9	27.2	27.6	.5	29.7	29.4	-.3	32.2	31.2	-1.0
PROPRIETOR INCOME	4.6	3.1	3.5	.4	1.6	2.6	1.0	2.4	2.7	.3
OTHER PROPERTY INCOME	69.0	72.3	76.4	4.1	79.0	81.4	2.5	85.3	90.0	4.8
14 SERVICES										
GROSS PRODUCT ORIGINATING	134.5	150.5	148.0	-2.5	165.7	162.2	-3.5	181.8	178.7	-3.1
LABOR COMPENSATION	92.9	104.6	104.9	.3	117.6	118.5	.9	130.0	127.9	-2.1
INDIRECT BUSINESS TAXES	3.8	4.1	3.7	-.4	4.5	4.2	-.3	4.8	4.6	-.2
CAP. CONSUMPTION ALLOW.	8.0	9.2	9.1	-.1	10.1	9.7	-.5	11.5	10.3	-1.1
PROPRIETOR INCOME	25.4	27.3	26.2	-1.0	28.1	26.0	-2.1	30.0	29.9	-.1
OTHER PROPERTY INCOME	4.4	5.4	4.1	-1.3	5.3	3.9	-1.4	5.5	5.9	.4
15 GOVERNMENT AND GOVERNMENT ENT										
GROSS PRODUCT ORIGINATING	154.9	166.5	168.5	2.0	182.1	187.6	5.5	200.6	206.6	6.0
LABOR COMPENSATION	152.5	165.8	167.9	2.1	180.6	186.2	5.6	199.7	205.8	6.0
INDIRECT BUSINESS TAXES	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.3	.6	.6	.0	1.4	1.4	.0	.8	.8	.0
16 REST OF THE WORLD										
GROSS PRODUCT ORIGINATING	.0	.0	9.1	9.1	.0	9.5	9.5	.0	10.0	10.0
LABOR COMPENSATION	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	9.1	9.1	.0	9.5	9.5	.0	10.0	10.0

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
1 FARMS										
GROSS PRODUCT ORIGINATING	32.0	50.1	55.3	5.2	48.4	54.9	6.4	50.3	52.5	2.2
LABOR COMPENSATION	4.5	5.3	6.2	.9	6.1	8.2	2.2	6.5	9.7	3.2
INDIRECT BUSINESS TAXES	2.1	2.1	2.1	-.1	2.3	2.2	-.1	2.4	2.3	-.1
CAP. CONSUMPTION ALLOW.	5.4	6.2	5.7	-.5	7.4	6.6	-.8	7.9	7.4	-.5
PROPRIETOR INCOME	20.0	34.2	37.9	3.7	28.4	33.4	4.9	28.6	29.3	.7
OTHER PROPERTY INCOME	-.0	2.2	3.4	1.2	4.3	4.5	.2	4.8	3.7	-1.1
2 AGRICULTURAL SERVICES, FOREST										
GROSS PRODUCT ORIGINATING	3.3	3.8	5.3	1.6	4.2	5.2	1.0	4.5	4.2	-.3
LABOR COMPENSATION	1.7	2.1	2.2	.1	2.3	2.0	-.3	2.5	2.0	-.5
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.2	.1	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.5	.5	.5	.0	.5	.6	.0	.6	.5	-.0
PROPRIETOR INCOME	.8	.9	1.7	.8	.9	2.0	1.1	1.0	1.3	.2
OTHER PROPERTY INCOME	.3	.2	.8	.6	.2	.4	.2	.2	.2	-.0
3 METAL MINING										
GROSS PRODUCT ORIGINATING	1.3	1.8	1.5	-.3	2.1	2.1	.0	2.2	1.9	-.3
LABOR COMPENSATION	1.1	1.3	1.2	-.0	1.4	1.4	-.1	1.5	1.6	.1
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.1	.3	.2	-.1
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.1	.2	.2	-.0	.2	.2	-.1
PROPRIETOR INCOME	-.0	-.0	.0	.0	-.1	.0	.1	-.1	.0	.1
OTHER PROPERTY INCOME	-.2	.3	-.1	-.4	.2	.4	.1	.2	-.1	-.3
4 COAL MINING										
GROSS PRODUCT ORIGINATING	3.1	3.6	3.5	-.0	6.7	6.4	-.2	8.5	8.1	-.4
LABOR COMPENSATION	2.2	2.4	2.5	.0	3.0	2.9	-.1	4.2	4.0	-.2
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.2	.1	-.0
CAP. CONSUMPTION ALLOW.	.4	.5	.5	.0	.7	.6	-.1	.8	.7	-.1
PROPRIETOR INCOME	.0	.1	.0	-.1	.5	.0	-.5	.6	.0	-.6
OTHER PROPERTY INCOME	.3	.4	.5	.0	2.3	2.8	.5	2.8	3.2	.5
5 CRUDE PETROLEUM & NATURAL GAS										
GROSS PRODUCT ORIGINATING	12.3	13.2	16.3	3.1	20.0	24.0	4.0	23.7	27.0	3.3
LABOR COMPENSATION	3.2	3.6	3.5	-.1	4.5	4.5	.0	5.5	5.9	.4
INDIRECT BUSINESS TAXES	1.2	1.3	1.2	-.1	2.0	1.3	-.7	2.2	1.4	-.8
CAP. CONSUMPTION ALLOW.	3.6	3.6	3.6	-.0	3.8	3.7	-.1	4.0	3.9	-.2
PROPRIETOR INCOME	-.1	-.2	.0	.2	.9	.0	-.9	1.0	.0	-1.0
OTHER PROPERTY INCOME	4.4	4.9	8.0	3.1	8.7	14.4	5.8	10.9	15.8	4.9
6 MINING AND QUARRYING OF NONME										
GROSS PRODUCT ORIGINATING	2.3	2.8	2.4	-.4	3.1	3.2	.1	3.2	3.7	.4
LABOR COMPENSATION	1.2	1.4	1.5	.1	1.5	1.6	.1	1.6	1.7	.1
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.5	.6	.5	-.1	.6	.5	-.1	.7	.5	-.2
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.3	.6	.3	-.3	.7	1.0	.3	.7	1.3	.6

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
7 CONTRACT CONSTRUCTION										
GROSS PRODUCT ORIGINATING	56.6	63.3	61.9	-1.4	66.7	63.0	-3.7	66.5	63.2	-3.2
LABOR COMPENSATION	43.0	48.4	49.6	1.2	51.5	53.5	1.9	50.2	50.3	.1
INDIRECT BUSINESS TAXES	1.1	1.2	1.0	-.1	1.3	1.1	-.2	1.4	1.2	-.2
CAP. CONSUMPTION ALLOW.	3.0	3.5	4.0	.5	4.0	4.7	.8	4.5	4.6	.1
PROPRIETOR INCOME	7.0	7.8	6.5	-1.3	7.6	5.3	-2.3	7.0	6.5	-.5
OTHER PROPERTY INCOME	2.5	2.4	.7	-1.7	2.4	-1.5	-3.9	3.4	.6	-2.9
8 FOOD AND KINDRED PRODUCTS										
GROSS PRODUCT ORIGINATING	27.6	28.3	26.1	-2.2	30.5	32.3	1.8	35.8	37.1	1.3
LABOR COMPENSATION	16.8	17.9	17.9	.0	19.5	19.2	-.3	21.1	20.4	-.7
INDIRECT BUSINESS TAXES	5.6	5.6	5.5	-.1	5.6	5.9	.3	5.8	6.2	.5
CAP. CONSUMPTION ALLOW.	2.1	2.5	2.3	-.2	2.6	2.5	-.1	2.7	2.6	-.2
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	2.9	2.2	.4	-1.9	2.7	4.7	2.0	6.0	7.8	1.8
9 TOBACCO MANUFACTURES										
GROSS PRODUCT ORIGINATING	4.2	4.4	4.5	.1	4.9	5.1	.2	5.5	5.7	.2
LABOR COMPENSATION	.7	.8	.9	.1	.9	1.1	.2	1.0	1.2	.2
INDIRECT BUSINESS TAXES	2.3	2.5	2.4	-.1	2.4	2.4	-.1	2.4	2.4	-.1
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.0	.3	.3	-.0	.4	.3	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.0	.9	1.0	.1	1.3	1.4	.1	1.7	1.8	.1
10 TEXTILE MILL PRODUCTS										
GROSS PRODUCT ORIGINATING	9.3	9.8	9.8	.0	11.2	10.4	-.7	9.7	10.0	.3
LABOR COMPENSATION	7.4	8.2	8.3	.0	8.3	8.5	.2	7.8	8.2	.5
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.8	.9	.9	-.0	.9	.9	.0	.9	.9	.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.9	.4	.5	.0	1.7	.8	-.9	.9	.6	-.2
11 APPAREL										
GROSS PRODUCT ORIGINATING	9.9	10.6	10.6	.0	10.8	11.2	.5	11.1	11.4	.3
LABOR COMPENSATION	8.5	9.3	9.2	-.1	9.5	9.7	.3	9.4	9.7	.3
INDIRECT BUSINESS TAXES	.1	.2	.1	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.3	.1	.2	.3	.1	.2	.3	.1
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	1.0	.8	1.0	.2	.8	1.0	.2	1.2	1.2	-.0
12 LUMBER AND WOOD PRODUCTS										
GROSS PRODUCT ORIGINATING	8.9	11.2	9.5	-1.7	11.6	11.1	-.4	9.9	10.4	.4
LABOR COMPENSATION	5.2	5.9	5.9	.0	6.3	6.3	.1	5.8	5.9	.1
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.3	.3	-.0
CAP. CONSUMPTION ALLOW.	.9	1.1	1.0	-.1	1.4	1.2	-.1	1.5	1.3	-.2
PROPRIETOR INCOME	.6	.7	.5	-.1	.6	.7	.1	.5	.6	.1
OTHER PROPERTY INCOME	1.9	3.3	1.8	-1.5	3.1	2.6	-.5	1.8	2.2	.4

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
13 FURNITURE AND FIXTURES										
GROSS PRODUCT ORIGINATING	4.8	5.2	5.3	.1	5.3	5.3	.0	5.0	4.9	-.1
LABOR COMPENSATION	4.0	4.6	4.5	-.0	4.7	4.9	.2	4.4	4.4	.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.0	.2	.2	-.0	.2	.2	.0
PROPRIETOR INCOME	.1	.1	.0	-.1	.0	.0	-.0	.1	.0	-.1
OTHER PROPERTY INCOME	.5	.3	.4	.2	.3	.2	-.1	.3	.2	-.1
14 PAPER AND ALLIED PRODUCTS										
GROSS PRODUCT ORIGINATING	11.0	12.7	12.1	-.7	13.9	12.6	-1.3	14.1	12.5	-1.6
LABOR COMPENSATION	7.7	8.5	8.5	-.0	9.3	9.1	-.2	9.4	9.1	-.3
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.4	.3	-.0	.4	.4	-.0
CAP. CONSUMPTION ALLOW.	1.2	1.4	1.3	-.1	1.4	1.4	-.0	1.6	1.4	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.7	2.5	2.0	-.5	2.8	1.8	-1.0	2.7	1.5	-1.2
15 PRINTING AND PUBLISHING										
GROSS PRODUCT ORIGINATING	14.6	16.0	15.6	-.5	16.3	16.1	-.3	17.7	16.4	-1.3
LABOR COMPENSATION	11.2	12.1	12.1	-.0	13.0	13.0	-.0	13.5	13.3	-.2
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.3	.3	-.0	.3	.3	-.0
CAP. CONSUMPTION ALLOW.	.8	1.0	1.0	.0	1.0	1.1	.1	1.1	1.1	.1
PROPRIETOR INCOME	.3	.3	.0	-.3	.3	.0	-.3	.4	.0	-.4
OTHER PROPERTY INCOME	2.0	2.4	2.3	-.1	1.7	1.7	.0	2.4	1.7	-.7
16 CHEMICALS AND ALLIED PRODUCTS										
GROSS PRODUCT ORIGINATING	21.5	23.5	23.2	-.3	25.0	25.8	.9	27.4	25.5	-1.9
LABOR COMPENSATION	12.9	14.1	14.0	-.1	16.1	15.9	-.2	17.3	16.7	-.6
INDIRECT BUSINESS TAXES	.6	.6	.6	-.0	.6	.6	-.0	.7	.7	-.0
CAP. CONSUMPTION ALLOW.	2.9	3.0	3.0	.1	3.2	3.4	.2	3.4	3.7	.3
PROPRIETOR INCOME	.0	.1	.0	-.1	.2	.0	-.2	.1	.0	-.1
OTHER PROPERTY INCOME	5.2	5.8	5.7	-.2	4.9	6.0	1.0	5.9	4.5	-1.4
17 PETROLEUM REFINING										
GROSS PRODUCT ORIGINATING	7.6	9.6	8.0	-1.6	11.2	7.8	-3.4	9.1	8.5	-.6
LABOR COMPENSATION	2.9	3.1	3.0	-.1	3.7	3.6	-.1	4.2	4.1	-.1
INDIRECT BUSINESS TAXES	4.3	4.6	4.0	-.5	4.4	4.0	-.4	4.4	4.0	-.4
CAP. CONSUMPTION ALLOW.	1.1	1.4	1.3	-.0	1.5	1.6	.1	1.7	2.0	.3
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	-.8	.5	-.4	-.9	1.5	-1.4	-2.9	-1.2	-1.5	-.3
18 RUBBER AND MISC. PLASTICS										
GROSS PRODUCT ORIGINATING	9.0	10.2	9.6	-.6	9.9	10.1	.1	9.7	9.5	-.2
LABOR COMPENSATION	6.3	7.2	7.3	.1	7.7	7.7	-.0	7.5	7.3	-.2
INDIRECT BUSINESS TAXES	.9	1.1	.9	-.2	1.0	.9	-.1	.9	.8	-.1
CAP. CONSUMPTION ALLOW.	.6	.7	.7	-.0	.8	.8	-.0	.8	.8	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.1	1.1	.7	-.4	.4	.6	.3	.5	.7	.2

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
19 LEATHER AND LEATHER PRODUCTS										
GROSS PRODUCT ORIGINATING	2.1	2.4	2.1	-.3	2.5	2.1	-.4	2.3	2.1	-.2
LABOR COMPENSATION	2.0	2.1	2.1	-.0	2.1	2.1	.0	2.0	2.1	.0
INDIRECT BUSINESS TAXES	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
CAP. CONSUMPTION ALLOW.	.1	.1	.1	-.0	.1	.1	.0	.1	.1	.0
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.0	.2	-.0	-.2	.3	-.1	-.4	.2	-.0	-.2
20 STONE, CLAY, AND GLASS PRODUC										
GROSS PRODUCT ORIGINATING	9.9	10.9	11.3	.4	10.7	11.4	.7	10.6	10.5	-.1
LABOR COMPENSATION	7.1	8.1	8.1	.0	8.6	8.6	.0	8.4	8.2	-.2
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.3	.2	-.0
CAP. CONSUMPTION ALLOW.	1.0	1.1	1.1	.0	1.2	1.2	-.0	1.3	1.2	-.1
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	1.4	1.4	1.9	.5	.6	1.4	.8	.6	.9	.3
21 PRIMARY METALS										
GROSS PRODUCT ORIGINATING	21.6	25.0	24.3	-.7	32.0	28.2	-3.8	29.4	27.9	-1.5
LABOR COMPENSATION	16.1	19.1	19.0	-.1	22.2	22.2	.1	21.7	21.8	.1
INDIRECT BUSINESS TAXES	.6	.7	.6	-.1	.7	.7	-.0	.8	.7	-.0
CAP. CONSUMPTION ALLOW.	2.6	2.8	2.7	-.1	3.3	2.9	-.4	3.4	3.2	-.2
PROPRIETOR INCOME	.0	.0	.0	-.0	.1	.0	-.1	.0	.0	-.0
OTHER PROPERTY INCOME	2.2	2.4	2.0	-.4	5.7	2.4	-3.3	3.5	2.2	-1.3
22 FABRICATED METAL PRODUCTS										
GROSS PRODUCT ORIGINATING	19.3	22.3	21.9	-.4	23.1	23.1	.0	24.8	23.1	-1.7
LABOR COMPENSATION	15.3	17.6	17.5	-.1	19.1	19.3	.2	19.0	19.0	-.0
INDIRECT BUSINESS TAXES	.5	.5	.4	-.0	.5	.5	-.0	.5	.5	-.0
CAP. CONSUMPTION ALLOW.	1.1	1.1	1.2	.1	1.2	1.3	.1	1.3	1.4	.1
PROPRIETOR INCOME	.2	.2	.0	-.2	.2	.0	-.2	.2	.0	-.2
OTHER PROPERTY INCOME	2.3	3.0	2.8	-.2	2.0	1.9	-.1	3.7	2.2	-1.5
23 MACHINERY, EXCEPT ELECTRICAL										
GROSS PRODUCT ORIGINATING	30.4	35.1	35.3	.2	36.7	39.5	2.7	40.8	39.6	-1.2
LABOR COMPENSATION	22.7	26.8	26.9	.1	30.6	31.4	.8	30.9	32.0	1.1
INDIRECT BUSINESS TAXES	.7	.7	.7	-.1	.8	.7	-.0	.8	.8	.0
CAP. CONSUMPTION ALLOW.	2.9	3.0	3.3	.3	3.4	4.0	.6	3.7	4.4	.6
PROPRIETOR INCOME	.2	.3	.6	.3	.3	.4	.1	.4	.5	.1
OTHER PROPERTY INCOME	3.8	4.3	3.9	-.4	1.7	2.9	1.2	4.9	2.0	-2.9
24 ELECTRICAL MACHINERY										
GROSS PRODUCT ORIGINATING	26.6	29.9	30.6	.7	29.7	32.0	2.3	28.8	31.4	2.6
LABOR COMPENSATION	19.8	23.1	22.7	-.4	24.8	24.7	-.1	23.7	24.7	1.1
INDIRECT BUSINESS TAXES	.5	.6	.5	-.0	.6	.6	-.0	.6	.7	.0
CAP. CONSUMPTION ALLOW.	2.2	2.4	2.6	.2	2.7	3.1	.4	2.8	3.3	.5
PROPRIETOR INCOME	.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	4.0	3.8	4.7	.9	1.7	3.6	2.0	1.7	2.7	1.0

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
25 TRANS. EQUIP. & ORDNANCE										
GROSS PRODUCT ORIGINATING	16.1	16.4	17.4	1.0	16.1	18.7	2.6	18.4	20.1	1.7
LABOR COMPENSATION	14.0	15.1	15.1	.0	16.2	16.6	.4	17.5	17.7	.2
INDIRECT BUSINESS TAXES	.6	.5	.5	-.1	.6	.5	-.0	.6	.6	-.0
CAP. CONSUMPTION ALLOW.	1.1	.7	1.3	.6	.6	1.5	.8	.7	1.6	.9
PROPRIETOR INCOME	-.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	.3	-.0	.5	.5	-1.2	.1	1.3	-.4	.2	.6
26 MOTOR VEHICLES										
GROSS PRODUCT ORIGINATING	22.6	25.5	25.6	.2	20.0	19.2	-.8	21.3	17.9	-3.4
LABOR COMPENSATION	13.7	16.4	16.4	-.0	16.0	15.6	-.4	15.7	15.8	.1
INDIRECT BUSINESS TAXES	.8	1.0	.5	-.6	1.1	.5	-.6	1.1	.6	-.5
CAP. CONSUMPTION ALLOW.	2.0	2.0	2.2	.2	2.4	2.6	.2	2.9	2.6	-.2
PROPRIETOR INCOME	-.0	.0	.0	-.0	-.0	.0	.0	.0	.0	-.0
OTHER PROPERTY INCOME	6.1	6.0	6.5	.5	.4	.5	.1	1.6	-1.1	-2.7
27 INSTRUMENTS										
GROSS PRODUCT ORIGINATING	6.8	7.6	8.3	.7	7.9	9.1	1.3	9.1	8.8	-.2
LABOR COMPENSATION	5.1	5.9	5.9	.0	6.6	6.8	.2	7.0	6.8	-.2
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.2	.0
CAP. CONSUMPTION ALLOW.	.5	.6	.6	-.0	.6	.7	.0	.8	.7	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	1.1	1.0	1.7	.7	.6	1.6	1.0	1.1	1.2	.1
28 MISC. MANUFACTURING INDUSTRIE										
GROSS PRODUCT ORIGINATING	4.9	5.2	5.4	.2	5.1	5.7	.6	5.5	5.8	.2
LABOR COMPENSATION	3.7	4.0	4.0	.0	4.3	4.4	.0	4.3	4.3	.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	-.0	.4	.3	-.1	.3	.3	-.0
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.8	.8	1.0	.3	.2	1.0	.7	.8	1.1	.3
29 RAILROADS										
GROSS PRODUCT ORIGINATING	10.3	11.5	12.3	.8	12.3	13.0	.7	11.5	13.4	2.0
LABOR COMPENSATION	7.8	9.4	9.1	-.3	10.2	9.9	-.3	10.2	9.8	-.3
INDIRECT BUSINESS TAXES	.5	.5	.5	-.1	.6	.5	-.1	.6	.5	-.1
CAP. CONSUMPTION ALLOW.	1.6	1.5	1.7	.2	1.6	1.8	.2	1.6	1.9	.3
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	.2	1.1	.9	-.1	.8	.9	-.9	1.2	2.1
30 LOCAL, SUBURBAN, & HIGHWAY PA										
GROSS PRODUCT ORIGINATING	3.4	3.4	3.6	.2	3.7	3.7	.0	3.9	3.8	-.0
LABOR COMPENSATION	2.2	2.3	2.2	-.1	2.5	2.4	-.1	2.7	2.7	.0
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.2	.2	-.0
CAP. CONSUMPTION ALLOW.	.3	.2	.3	.1	.2	.3	.1	.2	.3	.2
PROPRIETOR INCOME	.2	.2	.3	.1	.2	.2	.0	.2	.3	.1
OTHER PROPERTY INCOME	.5	.5	.6	.1	.6	.5	-.0	.6	.3	-.3

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
31 TRUCKING AND WAREHOUSING										
GROSS PRODUCT ORIGINATING	19.4	21.7	22.1	.4	23.5	23.1	-.4	23.7	23.6	-.1
LABOR COMPENSATION	12.9	14.8	15.0	.2	15.9	16.4	.5	15.6	16.1	.5
INDIRECT BUSINESS TAXES	1.1	1.2	1.2	-.0	1.2	1.2	.0	1.3	1.3	.0
CAP. CONSUMPTION ALLOW.	2.1	2.3	2.3	.0	2.7	2.5	-.2	3.1	3.2	.1
PROPRIETOR INCOME	1.2	1.4	1.4	.1	1.5	1.4	-.0	1.5	1.6	.1
OTHER PROPERTY INCOME	2.1	2.1	2.2	.2	2.2	1.5	-.7	2.2	1.4	-.8
32 WATER TRANSPORTATION										
GROSS PRODUCT ORIGINATING	2.7	3.0	3.0	-.0	3.6	3.2	-.5	3.9	3.4	-.5
LABOR COMPENSATION	2.3	2.6	2.6	.0	2.8	2.9	.1	3.0	3.0	-.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.4	.4	.4	-.0	.4	.4	-.0	.4	.4	-.0
PROPRIETOR INCOME	.0	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	-.1	-.1	-.1	.0	.2	-.2	-.5	.2	-.1	-.3
33 AIR TRANSPORTATION										
GROSS PRODUCT ORIGINATING	7.9	8.8	9.2	.4	9.6	9.7	.1	9.9	10.0	.1
LABOR COMPENSATION	5.3	6.0	6.0	-.0	6.5	6.8	.3	7.0	7.5	.4
INDIRECT BUSINESS TAXES	.9	1.0	1.1	.1	1.0	1.2	.2	1.1	1.3	.2
CAP. CONSUMPTION ALLOW.	1.4	1.5	1.5	-.0	1.7	1.4	-.3	1.8	1.1	-.6
PROPRIETOR INCOME	.0	-.0	.0	.0	-.0	.0	.0	-.0	.0	.0
OTHER PROPERTY INCOME	.3	.4	.6	.3	.5	.3	-.2	.0	.1	.0
34 PIPELINE TRANSPORTATION										
GROSS PRODUCT ORIGINATING	1.0	.9	1.0	.1	1.1	1.0	-.0	1.1	1.2	.1
LABOR COMPENSATION	.2	.2	.2	-.0	.3	.3	-.0	.3	.3	-.0
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	-.0	.2	.3	.0	.2	.3	.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.4	.4	.5	.1	.5	.4	-.1	.5	.5	.0
35 TRANSPORTATION SERVICES										
GROSS PRODUCT ORIGINATING	1.6	1.8	1.8	.0	2.4	1.9	-.4	2.6	2.0	-.6
LABOR COMPENSATION	1.1	1.3	1.3	-.1	1.6	1.4	-.1	1.7	1.5	-.2
INDIRECT BUSINESS TAXES	.0	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.2	.2	.2	-.0	.4	.2	-.2	.6	.2	-.4
PROPRIETOR INCOME	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
OTHER PROPERTY INCOME	.1	.1	.3	.2	.2	.2	-.0	.2	.2	-.0
36 TELEPHONE AND TELEGRAPH										
GROSS PRODUCT ORIGINATING	26.9	30.1	30.6	.5	32.6	33.5	.9	35.2	35.0	-.1
LABOR COMPENSATION	13.0	14.5	14.9	.4	15.9	16.5	.7	17.3	19.2	1.9
INDIRECT BUSINESS TAXES	3.9	4.1	3.9	-.3	4.4	4.0	-.4	4.6	4.0	-.5
CAP. CONSUMPTION ALLOW.	5.3	6.2	5.9	-.3	6.9	6.5	-.4	7.7	7.0	-.7
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	4.6	5.2	6.0	.8	5.4	6.5	1.0	5.6	4.9	-.8

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
37 RADIO AND TELEVISION BROADCAS										
GROSS PRODUCT ORIGINATING	2.5	2.6	2.7	.0	2.7	2.8	.0	3.3	2.7	-.6
LABOR COMPENSATION	1.6	1.8	1.7	-.0	1.9	1.8	-.1	2.1	1.7	-.4
INDIRECT BUSINESS TAXES	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
CAP. CONSUMPTION ALLOW.	.3	.3	.3	-.0	.3	.3	-.0	.4	.3	-.1
PROPRIETOR INCOME	.0	.0	.0	-.0	.0	.0	-.0	.0	.0	-.0
OTHER PROPERTY INCOME	.5	.5	.6	.1	.4	.6	.2	.7	.6	-.1
38 ELECTRIC, GAS, AND SANITARY S										
GROSS PRODUCT ORIGINATING	28.0	30.5	31.2	.7	31.2	33.6	2.4	37.2	38.3	1.1
LABOR COMPENSATION	9.3	10.3	10.3	.0	11.3	11.2	-.1	12.1	11.8	-.3
INDIRECT BUSINESS TAXES	4.2	4.6	3.9	-.8	5.0	4.2	-.8	5.5	4.6	-.9
CAP. CONSUMPTION ALLOW.	6.1	7.0	6.8	-.2	7.7	7.5	-.2	8.8	8.2	-.6
PROPRIETOR INCOME	.3	.4	.0	-.4	.2	.0	-.2	.2	.0	-.2
OTHER PROPERTY INCOME	8.0	8.2	10.2	2.0	7.0	10.7	3.7	10.6	13.7	3.2
39 WHOLESALE TRADE										
GROSS PRODUCT ORIGINATING	82.4	94.0	100.3	6.3	107.9	109.5	1.6	119.4	110.5	-8.9
LABOR COMPENSATION	43.3	49.1	49.2	.1	55.8	54.2	-1.6	59.7	58.0	-1.7
INDIRECT BUSINESS TAXES	19.9	21.7	22.8	1.1	22.6	24.0	1.4	25.5	25.1	-.5
CAP. CONSUMPTION ALLOW.	4.3	4.6	5.0	.5	5.2	5.7	.4	6.0	5.6	-.4
PROPRIETOR INCOME	3.8	4.0	6.8	2.8	4.8	7.0	2.2	4.8	7.0	2.2
OTHER PROPERTY INCOME	11.2	14.7	16.5	1.8	19.5	18.6	-.9	23.4	14.8	-8.6
40 RETAIL TRADE										
GROSS PRODUCT ORIGINATING	118.8	129.8	129.3	-.4	135.0	131.2	-3.8	153.0	143.2	-9.9
LABOR COMPENSATION	72.1	79.7	79.3	-.4	87.0	85.8	-1.2	93.8	94.3	.5
INDIRECT BUSINESS TAXES	20.1	22.6	23.5	.9	25.4	25.1	-.2	27.6	27.1	-.5
CAP. CONSUMPTION ALLOW.	6.9	7.0	7.3	.3	7.4	7.7	.3	8.0	8.2	.2
PROPRIETOR INCOME	10.2	11.5	11.1	-.4	10.9	8.6	-2.3	12.8	10.0	-2.8
OTHER PROPERTY INCOME	9.4	8.8	8.0	-.8	4.4	4.0	-.4	10.8	3.6	-7.3
41 BANKING AND CREDIT AGENCIES										
GROSS PRODUCT ORIGINATING	22.6	20.1	23.5	3.3	21.7	23.8	2.1	23.7	27.2	3.5
LABOR COMPENSATION	18.0	19.6	19.4	-.2	21.7	21.1	-.5	23.8	22.9	-.9
INDIRECT BUSINESS TAXES	1.7	1.8	1.6	-.2	1.8	1.7	-.0	1.8	1.9	.1
CAP. CONSUMPTION ALLOW.	2.1	2.6	2.3	-.4	3.1	2.2	-.9	3.7	2.4	-1.2
PROPRIETOR INCOME	.8	-.0	.4	.4	.0	.7	.6	.4	.4	-.1
OTHER PROPERTY INCOME	.0	-3.9	-.1	3.8	-4.9	-1.9	2.9	-6.0	-.4	5.6
42 INSURANCE AGENTS AND BROKERS										
GROSS PRODUCT ORIGINATING	21.1	22.0	23.2	1.2	21.8	24.9	3.1	22.9	26.1	3.2
LABOR COMPENSATION	13.5	15.0	15.3	.3	16.6	16.7	.1	18.0	16.8	-1.2
INDIRECT BUSINESS TAXES	2.4	2.4	2.2	-.2	2.6	2.4	-.1	2.7	2.7	-.0
CAP. CONSUMPTION ALLOW.	.8	1.0	1.0	-.0	1.0	1.0	-.0	1.1	1.0	-.1
PROPRIETOR INCOME	2.1	2.2	2.2	.1	2.0	2.3	.4	2.2	2.5	.3
OTHER PROPERTY INCOME	2.3	1.4	2.5	1.1	-.4	2.4	2.8	-1.1	3.1	4.3

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
43 REAL ESTATE AND COMBINATION O										
GROSS PRODUCT ORIGINATING	124.9	137.1	137.6	.5	149.7	148.6	-1.2	162.7	160.2	-2.5
LABOR COMPENSATION	6.6	7.7	7.8	.1	8.1	8.5	.5	8.1	8.8	.6
INDIRECT BUSINESS TAXES	27.9	30.1	30.4	.3	32.3	33.3	1.0	34.9	36.5	1.6
CAP. CONSUMPTION ALLOW.	21.9	23.5	24.4	.9	25.5	26.2	.7	27.5	27.8	.3
PROPRIETOR INCOME	1.8	.9	.9	.0	-.4	-.4	.0	-.2	-.2	.0
OTHER PROPERTY INCOME	66.7	74.8	74.0	-.8	84.2	81.0	-3.3	92.4	87.4	-5.1
44 HOTELS AND OTHER LODGING PLAC										
GROSS PRODUCT ORIGINATING	7.2	7.9	8.0	.1	8.5	8.6	.2	9.1	9.5	.3
LABOR COMPENSATION	4.6	5.2	5.2	-.1	5.7	5.8	.1	6.2	6.2	.0
INDIRECT BUSINESS TAXES	.5	.6	.5	-.1	.6	.5	-.1	.7	.6	-.1
CAP. CONSUMPTION ALLOW.	1.1	1.2	1.2	-.0	1.3	1.2	-.1	1.4	1.2	-.2
PROPRIETOR INCOME	.1	.0	.4	.4	-.2	.3	.4	-.0	.5	.5
OTHER PROPERTY INCOME	.9	.9	.8	-.2	1.0	.9	-.1	.9	1.0	.1
45 PERSONAL SERVICES										
GROSS PRODUCT ORIGINATING	11.5	12.1	12.0	-.1	13.1	12.6	-.5	13.6	13.6	.0
LABOR COMPENSATION	6.8	7.3	7.3	.0	7.8	7.8	.1	8.1	8.0	-.2
INDIRECT BUSINESS TAXES	.4	.5	.4	-.0	.5	.5	-.0	.5	.5	-.0
CAP. CONSUMPTION ALLOW.	.9	1.0	1.0	.0	1.1	1.0	-.0	1.1	1.1	-.1
PROPRIETOR INCOME	2.9	2.9	2.8	-.2	3.1	2.9	-.3	3.2	3.4	.2
OTHER PROPERTY INCOME	.5	.5	.5	.0	.6	.4	-.2	.6	.6	.1
46 MISC. BUSINESS SERVICES										
GROSS PRODUCT ORIGINATING	39.5	46.0	44.8	-1.1	50.5	48.3	-2.3	54.4	52.5	-1.9
LABOR COMPENSATION	24.3	28.2	28.6	.4	32.0	32.2	.2	34.4	33.7	-.7
INDIRECT BUSINESS TAXES	.5	.5	.5	-.0	.6	.6	-.0	.6	.6	.0
CAP. CONSUMPTION ALLOW.	2.5	3.1	2.9	-.2	3.4	3.0	-.4	3.9	3.2	-.8
PROPRIETOR INCOME	10.6	12.0	11.5	-.5	12.7	12.0	-.7	13.5	13.3	-.2
OTHER PROPERTY INCOME	1.6	2.1	1.3	-.9	1.8	.4	-1.4	1.9	1.7	-.2
47 AUTOMOBILE REPAIR AND GARAGES										
GROSS PRODUCT ORIGINATING	6.4	7.3	7.5	.1	7.8	9.6	1.8	8.4	11.7	3.3
LABOR COMPENSATION	3.1	3.5	3.8	.2	3.8	4.5	.7	4.1	5.2	1.1
INDIRECT BUSINESS TAXES	.2	.2	.2	-.0	.2	.2	-.0	.3	.3	.0
CAP. CONSUMPTION ALLOW.	1.7	1.9	2.0	.1	2.1	2.5	.4	2.3	2.9	.6
PROPRIETOR INCOME	1.0	1.1	.9	-.2	1.0	1.4	.4	1.2	1.8	.7
OTHER PROPERTY INCOME	.4	.5	.5	-.0	.6	1.0	.4	.5	1.4	.9
48 AMUSEMENT AND RECREATION SERV										
GROSS PRODUCT ORIGINATING	7.8	8.8	8.4	-.4	9.4	9.2	-.2	10.6	9.7	-.9
LABOR COMPENSATION	4.8	5.2	5.3	.1	5.9	5.8	-.1	6.2	6.0	-.3
INDIRECT BUSINESS TAXES	1.5	1.7	1.5	-.1	1.8	1.7	-.2	2.0	1.9	-.1
CAP. CONSUMPTION ALLOW.	.9	1.1	1.1	-.1	1.3	1.1	-.2	1.5	1.1	-.4
PROPRIETOR INCOME	.3	.4	.4	-.0	.1	.3	.2	.2	.4	.2
OTHER PROPERTY INCOME	.3	.4	.2	-.3	.3	.3	.1	.6	.3	-.4

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
49 MEDICAL AND OTHER HEALTH SERV										
GROSS PRODUCT ORIGINATING	37.7	42.3	41.4	-.9	48.0	46.3	-1.7	55.0	53.2	-1.7
LABOR COMPENSATION	25.5	29.5	29.3	-.2	34.5	35.0	.4	40.7	40.3	-.4
INDIRECT BUSINESS TAXES	.3	.4	.3	-.1	.4	.4	-.1	.4	.4	-.0
CAP. CONSUMPTION ALLOW.	.8	.8	.8	-.1	.9	.8	-.1	1.0	.8	-.2
PROPRIETOR INCOME	10.4	10.6	10.1	-.5	11.1	9.4	-1.7	11.7	10.8	-.9
OTHER PROPERTY INCOME	.8	.9	.9	-.0	1.0	.8	-.2	1.0	.9	-.1
50 EDUCATIONAL SERVICES										
GROSS PRODUCT ORIGINATING	19.1	20.8	20.5	-.3	22.8	22.2	-.6	24.9	22.9	-2.0
LABOR COMPENSATION	18.5	20.2	20.0	-.2	22.2	22.0	-.2	24.3	22.9	-1.5
INDIRECT BUSINESS TAXES	.3	.3	.3	-.0	.3	.3	.0	.3	.4	.0
CAP. CONSUMPTION ALLOW.	.1	.1	.1	-.0	.1	.1	-.0	.1	.1	-.0
PROPRIETOR INCOME	.2	.2	.1	-.1	.2	-.2	-.4	.2	-.3	-.5
OTHER PROPERTY INCOME	-.1	-.0	.0	.0	-.0	-.0	.0	-.0	-.0	.0
51 PRIVATE HOUSEHOLDS										
GROSS PRODUCT ORIGINATING	5.3	5.4	5.4	.0	5.6	5.3	-.2	5.8	5.6	-.2
LABOR COMPENSATION	5.3	5.4	5.4	.0	5.6	5.3	-.2	5.8	5.6	-.2
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	-.0	.0	.0	-.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
52 FEDERAL - ENTERPRISES										
GROSS PRODUCT ORIGINATING	8.7	7.7	7.4	-.3	10.1	9.6	-.6	11.1	10.2	-.8
LABOR COMPENSATION	9.7	10.5	10.3	-.2	11.8	11.3	-.5	13.0	12.2	-.8
INDIRECT BUSINESS TAXES	.1	.1	.0	-.1	.1	.0	-.1	.1	.0	-.1
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-1.0	-2.8	-2.8	.0	-1.8	-1.8	.0	-2.0	-2.0	.0
53 STATE AND LOCAL - ENTERPRIS										
GROSS PRODUCT ORIGINATING	8.8	9.7	9.5	-.2	10.3	10.2	-.1	11.0	10.9	-.1
LABOR COMPENSATION	5.5	6.2	6.1	-.2	7.2	7.1	-.1	8.2	8.1	-.1
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	3.3	3.4	3.4	.0	3.1	3.1	.0	2.8	2.8	.0
54 FEDERAL - GENERAL										
GROSS PRODUCT ORIGINATING	50.1	51.9	53.2	1.3	54.9	57.8	2.8	59.3	62.2	2.9
LABOR COMPENSATION	50.1	51.9	53.2	1.3	54.9	57.8	2.8	59.3	62.2	2.9
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

TABLE X-6 (CONT.)

PREDICTION ERRORS FOR GPO COMPONENTS BY INCOME SECTOR 1973-75

INCOMES CALCULATED WITH: PREDICTED PRICES, ACTUAL WAGES

	1972	1973			1974			1975		
	ACTUAL	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF	ACTUAL	PRED	DIFF
55 STATE AND LOCAL - GENERAL										
GROSS PRODUCT ORIGINATING	87.3	97.1	98.3	1.2	106.7	110.1	3.4	119.2	123.2	4.0
LABOR COMPENSATION	87.3	97.1	98.3	1.2	106.7	110.1	3.4	119.2	123.2	4.0
INDIRECT BUSINESS TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

estimated in the markup equations: correcting this problem probably requires the use of 1975 data. Given the magnitude of the 1975 recession, the predicted fall of Other property income from 17.2 to 12.5 billion in the durable goods sector is not unreasonable. The reported Other property income, in fact, rose from 15.1 to 19.7 billion.

When we turn to the individual sector results, we find the greatest improvement in the Food sector (8). The error in predicting GPO is reduced from 7.0 to 1.3 billion dollars. In Chemicals, the 5.0 billion overestimate of GPO has now been reduced to 1.1 billion. Obviously the estimation of non-wage income is substantially improved by reference to the labor costs only rather than trying to rely on our I/O structure and input and output price indexes for these sectors.

The 3.7 billion overprediction of GPO in 1975 for Fabricated Metals is turned into an underestimate of 1.1 billion when the prices themselves are predicted by the models. This result suggests that our "under predictions" of the 1975 prices at the I/O sectors within this two-digit SIC industry are due both to errors in the reported prices <u>and</u> in our price equations.

The largest errors on an absolute basis occur in the trade sectors (39 and 40). An intensive effort was made to determine the precise source(s) of the underpredictions of GPO. My final conclusion was that errors were attributable almost entirely to the price equation. These equations, running off the unemployment rate for men 20 and older, significantly underpredicted the markup ratio for 1975. The probable explanation for this error is that the tax rebate in mid-1975 stimulated consumer spending beyond what normally would have occurred given the extraordinarily high unemployment rates that prevailed. The price markup equations estimated through 1975 will be able to test this hypothesis.

10.4 Aggregate Income Predictions, 1973-1975

In the final stage of the income model, we use our aggregate functions estimated in Chapter VII to derive corporate profits and real disposable personal income. A test of these equations is given in Table X-7. As in the previous section, we are taking the output predictions of the standard INFORUM model as exogenous for 1973-75, and again, manhours are actual observations at the INFORUM 90-sector level of the aggregation. This procedure is necessary to isolate errors steming from our industry income distributions and our aggregate income equations. Thus, the reader should bear in mind that errors shown are not full model errors (regretfully).

Given the author's resources, the equations at this point have been estimated over only one sample period: the regressions end uniformly in 1973. Thus, the 1973 errors are, in fact, within-sample errors. Autocorreclation adjustments to most equations have been made in forecasting from the 1972 base period. The 1974 and 1975 actual data are preliminary, taken from the July 1976 SCB. Although revised data, at this writing, are available for some components, others are missing and I wish to maintain consistency with the industry GPO components.

The top panel of the table shows the derivation of corporate profits plus IVA. The first row is taken from the "Other property income" aggregates shown in Tables X-5 and X-6. From this figure we subtract net interest, rental income, business transfers, current surplus of government enterprises and add subsidies to obtain corporate profits. With

TABLE X-7

Predicted vs. Actual for Major Income Aggregates

	1973				1974				1975			
	Actual	Max Known	Exog Wage	All-on	Actual	Max Known	Exog Wage	All-on	Actual	Max Known	Exog Wage	All-on
					Corporate Profits							
Other property income (from industry detail)	182.4	178.9	188.6	186.9	193.1	193.4	194.6	192.5	219.0	221.3	201.9	200.9
- Net interest*	52.3	52.3	52.3	52.3	67.1	67.1	67.1	67.1	74.6	74.6	74.6	74.6
- Rental income*	31.3	31.3	31.3	31.3	33.3	33.3	33.3	33.3	37.0	37.0	37.0	37.0
- Business transfers - current surplus +	1.6	1.7	2.0	1.9	4.9	5.5	5.5	5.4	4.3	5.2	4.9	4.7
Equals: Corporate profits + IVA	97.2	93.6	103.0	101.4	87.8	87.5	88.7	86.7	103.1	104.5	85.4	84.6

* Exogenous

TABLE X-7 (Continued)

	1973				1974				1975			
	Actual	Max Known	Exog Wage	All-on	Actual	Max Known	Exog Wage	All-on	Actual	Max Known	Exog Wage	All-on
					Personal Income							
Wage and Salary income	701.3	707.5	707.5	703.4	765.0	777.3	777.4	775.1	806.7	820.7	820.5	812.9
Other labor income	48.7	46.8	46.8	46.4	55.5	51.6	51.5	51.3	62.5	55.1	54.9	54.1
Proprietors' income + CCA adjustment	92.4	97.4	98.9	98.6	86.9	87.7	89.9	89.5	90.2	89.6	92.3	92.4
Rental Income* (includes CCA adjustment)	21.6	21.6	21.6	21.6	21.0	21.0	21.0	21.0	22.4	22.4	22.4	22.4
Dividends	27.9	26.2	26.9	26.7	30.8	29.1	29.2	28.8	32.1	31.8	30.3	29.9
Personal interest income	84.0	83.1	83.6	83.5	101.4	99.4	99.7	99.6	110.7	107.0	107.0	106.8
Transfer payments	118.9	120.7	121.8	121.2	140.3	140.8	141.3	141.1	175.2	175.1	173.1	172.2
Less personal contribution for social insurance	42.3	43.7	43.7	43.5	47.6	50.7	50.7	50.6	50.0	54.3	54.3	54.0
Equals personal income	1052.4	1059.4	1063.3	1057.8	1153.3	1156.0	1159.3	1155.8	1249.7	1247.3	1246.2	1236.7
Less: personal taxes and nontaxes	150.8	154.6	155.2	154.1	170.4	180.1	180.9	179.9	168.8	177.1	177.3	175.3
Equals: Disposable personal income	901.7	904.8	908.1	903.7	982.9	975.9	978.4	976.0	1080.8	1070.2	1068.9	1061.5
Disposable personal income per capita (1972:)	4068	4052	4028	4026	3981	3957	3951	3947	4007	3965	4010	4003

* Exogenous

the exception of business transfers, these items have been taken at their observed values for this table. On the whole, the predictions using actual prices perform more accurately than those using the simulated prices. Our dummy variables in the price markup equations are unable to represent adequately the precise timing and strength of the price-wage controls. Using the markup equations with known wages, we overestimate the corporate profits total in 1973 and underestimate it in 1975.

The second panel of the table shows the major components of personal income. Our predictions of nominal personal income are all within two percent of the actual. The errors in 1973 stem mainly from overestimation of properietors' income, mainly farm income, as we discussed in the previous section. The underprediction of 13 billion dollars in 1975 for simulation (3) is caused by the generally lower prices and wages generated by the interactions of both sets of equations within the price model.

The effects of the overall price level are cancelled out when we compare estimates of real disposable personal income in the last line of the table. In this line, the disposable personal income estimates have been divided by mid-year U.S. population and the estimate of the implicit personal consumption deflator generated in the price model. (Adjustment factors to link the model-generated fixed-weighted and implicit deflators have been taken as exogenous.) The percentage errors for these items are generally one-half percent or less. As a system for closing the complete INFORUM model with respect to real personal consumption expenditure, the income model appears to be working very well.

Several areas of the aggregate income functions show signs of post-sample instability which will require closer attention for future work. The sources of the overestimates for wage and salary payments in the "max-known" and "exog-wage" runs are basically two. The first is the abnormal behavior of the state and local wage rate with respect to the aggregate private wage index (especially in 1975 which we mentioned in section 10.3). The second source is apparently a structural shift beginning about 1973 of the relationship of wage supplements (in the private economy) with respect to total labor compensation. The growth of the "Other labor income" (i.e. fringe benefits consisting mainly of private pension plans) was extraordinarily high over the 1973-1975 period and equations linking wages and salaries to labor compensation (which fit extremely well over the 1947-73 period) fail to capture this growth. One explanation is that as rising nominal incomes pushed up effective tax rates at faster rates, wage negotiators preferred settlements with higher proportions of (less or non-taxable) fringe benefits. Another contributing cause may have been differential treatment that was given to supplements in the price-wage controls period.

The other are for which some problem shows up is the equations linking personal income tax payments (NIA basis) with total liability data from the IRS. The equation shows a payments overprediction of about four billion dollars in 1974, <u>given actual liabilities</u> for 1974. For 1975 we cannot explicitly test the income tax equations since both tax rebates and a temporary tax cut were in effect. For these simulations I have modeled these provisions as an 8.0 billion decline in payments for 1975 and an 8.2 decline in liabilities. These estimates were obtained from the April, 1975 <u>Survey of Current Business</u>.

CHAPTER XI

SIMULATION AND FORECAST

In this chapter we present a simulation of the complete model and an annual forecast through 1982. Both of these exercises show the present model to yield plausible behavior, but as with any econometric model in its initial stages, areas for future work are apparent. An important result at this stage of the research is simply that the full model, consisting of the real, price-wage, and income submodels can be solved for a unique, realistic solution for all variables.

11.1 Simulation of Full Model

The simulation performed with the full model was actually a conventional multiplier analysis. A textbook case was considered: federal government expenditures were increased by 10 billion dollars (in constant 1972 prices) and the new level of spending was maintained for four years. The results of this solution were then compared to a control solution in which government expenditures were pegged at their initial values. To save computing time the runs were performed over only the period 1972-75.[1]

Portions of the "full" model are as yet incomplete and so certain variables are entered exogenously, in contrast to standard macroeconomic models. The most important of these exogenous variables are interest

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[1]The reader may reasonably wonder why we chose four years, rather than a more customary five, to perform the analysis. When the study was undertaken, there was a bug in the reprogramming of the real model into a full-fledged, 1972-base simulation model (as contrasted to its usual forecasting application). This error prevented a model solution for the fifth year.

rates: actual values were used for both the control and perturbed solutions. Thus, the full model is incapable, as yet, of showing a negative feedback via financial markets of changes in fiscal policy variables. Thus, the analysis conducted here assumed implicitly that the Federal Reserve was pursuing an accommodating monetary policy with respect to the change in government expenditures.

Model Linkage and Solution Procedure

The price-wage model was designed from the beginning to run independently from the real model. However, as we mentioned in Chapter I, the block of equations making up the income model was programmed in two separate versions. The first version is akin to the price-wage model; the income model reads as inputs from both the real model and the price-wage model variables generated in previous solutions of these models. In the second version, the computer code of the income model is integrated directly with real model. Thus, a consistent solution, iterating on real disposable income, can be achieved on a year-by-year basis. This method of solution saves start-up costs (i.e., reading in the parameters of the model for the first year), and allows us to see more clearly the behavior of the real model for a given year when it is fully closed on the income side.

Upon the experience thus far, the following solution procedure was found satisfactory for "relevant range" types of shocks to the complete model. First, the real-income model was run for the specified number of years using the latest set of price and wage vectors. With reasonable guesses as to levels of disposable income, the model usually required three iterations of the real-income loop to converge to a stable value of real disposable per capita income (defined to be $\pm$ 5 dollars relative to that in the previous iteration). The speed of convergence is, of course, a function of the aggregate marginal propensity to consume (around .7 for the 1977 version of the disaggregated consumption equations, taken as a whole), and other leakages through imports and the tax system.

Next, the price-wage model is run over the same set of years using the outputs, employment, productivity, and unemployment rates of the real-income model solution. The new set of price and wage vectors as well as the previous solution values of disposable income are then used in a second solution of the real-income model. For modest changes in the aggregate "real" wage, the real-income model may require fewer than three iterations to converge to a solution. Of course, changes in relative prices will change the vector of final demands for this solution.

In the control and perturbed solutions made for this study, I found one more complete cycle to be sufficient for convergence of both real outputs and prices. Thus, three executions of the real-income model were performed and two executions of the price-wage model. Such a procedure for a 10-year solution would require about 20 minutes of "memory time" on the University of Maryland UNIVAC 1108; about eight times the amount now used for the real model running alone. Although the cost of running the complete model is substantial compared to the real model only, it is by no means prohibitive for carefully designed simulation studies that can be performed on the Maryland computer (presently \$6 per minute of "memory time").

Results

The multiplier effects for major aggregate indicators are shown in Table IX-1. The first-year impact multiplier for real GNP is 1.74 which agrees very well with the major quarterly macroeconometric models.[2] The multipliers generally decline in subsequent years, as is the pattern in most econometric models. However, the falling multipliers in these complete models is basically due to the contractionary effects via the monetary sector (i.e., rising nominal incomes increase the demand for money which, in turn puts upward pressure on interest rates). Since interest rates are the same for both solutions of the model here, we must look elsewhere for an explanation.

One of the primary reasons for the falling multiplier here stems apparently from the behavior of the disaggregated consumption equations when they are considered as a whole. Specifically, we should expect the long-run marginal propensity to consume (MPC) to exceed the short-term MCP of about .75, but by the fourth year the calculated marginal consumption/marginal income ratio has slipped to around .65. Imposing the same 1975 consumption/income ratio in the alternative solution as in the control solution, consumption would rise about 1.8 billion. Of course, second round income effects would amplify this figure.

The results here simply indicate that future simulation studies of this type will require consumption functions which have more careful dynamic behavior built into them. The current equations have been

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[2] See, for example, the aggregate multiplier results for various U.S. macro-models in Gary Fromm and Lawrence R. Klein, "The NBER/NSF Model Comparison Seminar: An Analysis of Results," Annals of Economic and Social Measurement, Vol. 5, No. 1 (Winter 1976), pp. 1-29.

TABLE X1-1

Effect of a $10 Billion Increase In Federal Government Purchases of Goods and Services (Nondefense)

Changes In:	1st Year	Multiplier	2nd Year	Multiplier	4th Year	Multiplier
GNP (72$)	17.4	1.74	16.4	1.64	14.3	1.43
Personal Consumption Expenditure (72$)	5.1	.51	5.0	.50	4.7	.47
Producer Durable Equipment (72$)	1.3	.13	1.5	.15	1.3	.13
Structures (72$)	1.6	.16	.8	.08	.9	.09
Imports (72$)	-1.0	-.10	-1.2	-.12	-1.6	-.154
Disposable Income (72$)	6.8	.68	7.4	.74	7.4	.74
Unemployment Rate (Percent)	-.9		-1.0		-.6	
PCE Deflator	.006		.014		.025	

estimated on the assumption that they would be used primarily for long-run forecasting applications. The trend effects in the individual equations may not completely net out in the aggregate and, thus, the aggregate long-run income elasticity seems to be biased, downward slightly.

The contractionary effects of the progressive federal individual income tax also contributes to the falling multipliers. Given the same effective tax rate in the alternative solution as the control solution, tax payments would have declined by about .7 billion dollars. Using a MPC of about .7 and an implicit multiplier of 1.7, real GNP would have been about .8 billion higher than that shown for alternative solution.

The rising multipliers in many of the quarterly models over the first four to eight quarters stems from the interaction of the accelerator and multiplier mechanisms. The first-year responses of investment, especially construction, is probably on the high side as seen in Table XI-1. The large first-year response for structures is attributable primarily to a charge-in-(personal) income term in the residential construction equation. The drop of nearly a billion dollars for structure expenditure in the succeeding years, of course, contributes to the smaller GNP multipliers.

Detailed Price Effects

Some of the potential of the full model is illustrated in Table XI-2. There we compare the annual average price levels under both solutions for each of the INFORUM sectors. The prices of our "exogenous" sectors are the same under both runs.

TABLE XI-2

Industry Price Effects from a $10 Billion Increase in Federal Spending

STANDARD RUN : CONTROL SOLUTION
ALTERNATIVE RUN : $10 BILLION INCREASE IN FED. SPENDING

ANNUAL AVERAGE PRICE LEVELS 1972 = 1.0

			1973			1974			1976			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	201	WHOLESALE PRICE INDEX	1.361	1.363	.002	1.556	1.568	.012	1.702	1.728	.026	201
MODEL	202	INDUSTRIAL COMPONENT	1.276	1.279	.002	1.466	1.481	.015	1.669	1.700	.031	202
MODEL	203	GROSS NATIONAL PRODUCT : DEFL	1.087	1.092	.005	1.196	1.210	.014	1.337	1.365	.028	203
MODEL	204	PERSONAL CONSUMPTION EXPEND	1.090	1.096	.006	1.199	1.213	.014	1.338	1.363	.025	204
MODEL	205	DURABLES	1.078	1.089	.011	1.136	1.157	.020	1.260	1.292	.033	205
MODEL	206	NON-DURABLES	1.114	1.119	.005	1.258	1.271	.014	1.372	1.399	.026	206
MODEL	207	SERVICES	1.073	1.078	.005	1.167	1.178	.011	1.332	1.355	.022	207
MODEL	208	GROSS PRIVATE FIXED INVESTM	1.071	1.075	.004	1.172	1.186	.015	1.332	1.366	.035	208
MODEL	209	BUSINESS STRUCTURES	1.065	1.069	.004	1.178	1.193	.015	1.355	1.390	.036	209
MODEL	210	PRODUCERS' DURABLE EQUIP	1.071	1.074	.003	1.155	1.169	.014	1.293	1.324	.031	210
MODEL	211	RESIDENTIAL CONSTRUCTION	1.067	1.072	.005	1.178	1.194	.016	1.353	1.392	.040	211
MODEL	212	EXPORTS	1.156	1.158	.002	1.335	1.346	.010	1.434	1.458	.024	212
MODEL	213	GOVERNMENT EXPENDITURES	1.065	1.068	.003	1.177	1.189	.013	1.342	1.374	.031	213
MODEL	214	FEDERAL	1.069	1.071	.002	1.176	1.188	.011	1.331	1.362	.031	214
MODEL	215	STATE AND LOCAL	1.064	1.069	.005	1.176	1.189	.014	1.341	1.372	.030	215
EXOG	1	DAIRY FARM PRODUCTS	1.186	1.186	.000	1.413	1.413	.000	1.650	1.650	.000	1
EXOG	2	POULTRY AND EGGS	1.637	1.637	.000	1.537	1.537	.000	1.688	1.688	.000	2
EXOG	3	MEAT ANIMALS, OTH LIVESTK	1.348	1.348	.000	1.203	1.203	.000	1.222	1.222	.000	3
EXOG	4	COTTON	1.638	1.638	.000	1.690	1.690	.000	1.986	1.986	.000	4
EXOG	5	GRAINS	1.784	1.784	.000	2.506	2.506	.000	2.001	2.001	.000	5
EXOG	6	TOBACCO	1.133	1.133	.000	1.256	1.256	.000	1.336	1.336	.000	6
EXOG	7	FRUIT,VEGETABLES,OTH CROPS	1.491	1.491	.000	1.647	1.647	.000	1.510	1.510	.000	7
EXOG	8	FORESTRY PRODUCTS	1.640	1.640	.000	1.800	1.800	.000	1.790	1.790	.000	8
EXOG	9	FISHERY PRODUCTS	1.239	1.239	.000	1.170	1.170	.000	1.316	1.316	.001	9
MODEL	10	AGR,FORESTRY+FISH SERVICES	1.078	1.076	.000	1.116	1.115	.000	1.173	1.181	.000	10
EXOG	11	IRON ORES	1.042	1.042	.000	1.233	1.233	.000	1.639	1.640	.001	11
EXOG	12	COPPER ORE	1.162	1.162	.000	1.510	1.510	.000	1.284	1.285	.000	12
EXOG	13	OTHER NON-FERROUS ORES	1.129	1.129	.000	1.708	1.708	.000	1.835	1.835	.001	13
EXOG	14	COAL MINING	1.126	1.126	.000	1.715	1.715	.000	1.942	1.942	.001	14
EXOG	15	NATURAL GAS	1.102	1.102	.000	1.428	1.428	.000	2.403	2.403	.000	15
EXOG	16	CRUDE PETROLEUM (DOMESTIC)	1.277	1.277	.000	1.826	1.826	.000	2.188	2.188	.000	16
EXOG	17	STONE AND CLAY MINING	1.027	1.027	.000	1.111	1.111	.000	1.310	1.326	.016	17
EXOG	18	CHEMICAL FERTILIZER MINING	1.089	1.089	.000	1.918	1.918	.000	2.901	2.903	.001	18
MODEL	19	NEW CONSTRUCTION	1.035	1.039	.004	1.127	1.143	.015	1.397	1.453	.056	19
MODEL	20	MAINTENANCE CONSTRUCTION	1.051	1.054	.000	1.156	1.170	.000	1.391	1.436	.000	20
MODEL	21	COMPLETE GUIDED MISSILES	1.032	1.083	.000	1.209	1.224	.000	1.398	1.456	.000	21
MODEL	22	AMMUNITION	1.074	1.074	-.001	1.208	1.219	.011	1.387	1.415	.028	22
MODEL	23	OTHER ORDNANCE	1.073	1.073	.000	1.195	1.205	.000	1.383	1.415	.000	23
MODEL	24	MEAT PRODUCTS	1.271	1.272	.000	1.266	1.270	.003	1.346	1.354	.008	24
MODEL	25	DAIRY PRODUCTS	1.077	1.077	.001	1.305	1.310	.005	1.482	1.496	.014	25
MODEL	26	CANNED AND FROZEN FOODS	1.134	1.135	.001	1.257	1.266	.009	1.372	1.395	.023	26
MODEL	27	GRAIN MILL PRODUCTS	1.305	1.306	.001	1.743	1.749	.006	1.702	1.717	.015	27
MODEL	28	BAKERY PRODUCTS	1.108	1.106	.000	1.301	1.303	.002	1.415	1.443	.028	28
EXOG	29	SUGAR	1.099	1.099	.000	2.853	2.853	.000	1.672	1.672	.000	29
MODEL	30	CONFECTIONERY PRODUCTS	1.169	1.169	.001	1.446	1.453	.007	1.473	1.497	.024	30
MODEL	31	ALCOHOLIC BEVERAGES	1.078	1.078	.000	1.176	1.181	.005	1.238	1.249	.011	31
MODEL	32	SOFT DRINKS AND FLAVORINGS	1.066	1.065	.002	1.237	1.250	.013	1.325	1.356	.031	32
MODEL	33	FATS AND OILS	1.510	1.512	.002	1.512	1.519	.006	1.498	1.511	.013	33
MODEL	34	MISC FOOD PRODUCTS	1.158	1.160	.003	1.281	1.291	.010	1.377	1.401	.024	34
MODEL	35	TOBACCO PRODUCTS	1.048	1.048	.001	1.115	1.121	.006	1.225	1.241	.016	35
MODEL	36	BROAD AND NARROW FABRICS	1.104	1.109	.005	1.254	1.281	.027	1.386	1.428	.042	36
MODEL	37	YARN AND THREAD AND FINS	1.136	1.140	.004	1.321	1.344	.022	1.559	1.600	.041	37
MODEL	38	FLOOR COVERINGS	1.087	1.090	.003	1.221	1.239	.019	1.422	1.457	.035	38

TABLE XI-2 (Cont.)

Industry Price Effects from a $10 Billion Increase in Federal Spending

STANDARD RUN : CONTROL SOLUTION
ALTERNATIVE RUN : $10 BILLION INCREASE IN FED. SPENDING

ANNUAL AVERAGE PRICE LEVELS 1972 = 1.0

			1973			1974			1976			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	39	MISC TEXTILES	1.118	1.122	.004	1.243	1.264	.020	1.443	1.477	.034	39
MODEL	40	KNITTING	1.081	1.086	.005	1.199	1.226	.026	1.342	1.386	.044	40
MODEL	41	APPAREL	1.062	1.063	.001	1.230	1.250	.020	1.353	1.400	.047	41
MODEL	42	HOUSEHOLD TEXTILES	1.072	1.074	.002	1.238	1.260	.022	1.350	1.396	.045	42
MODEL	43	LOGGING CAMPS	1.292	1.294	.002	1.538	1.550	.013	1.538	1.555	.017	43
MODEL	44	SAW AND PLANING MILLS	1.147	1.150	.004	1.368	1.399	.021	1.410	1.446	.035	44
MODEL	45	VENEER AND PLYWOOD	1.122	1.125	.003	1.326	1.348	.021	1.388	1.422	.034	45
MODEL	46	MILLWORK AND WOOD PRODUCTS	1.086	1.089	.002	1.260	1.281	.021	1.336	1.373	.037	46
MODEL	47	WOODEN CONTAINERS	1.099	1.102	.003	1.273	1.296	.023	1.305	1.342	.037	47
MODEL	48	HOUSEHOLD FURNITURE	1.062	1.064	.002	1.188	1.207	.019	1.290	1.331	.042	48
MODEL	49	OTHER FURNITURE	1.062	1.063	.002	1.174	1.193	.019	1.298	1.339	.041	49
EXOG	50	PULP MILLS	1.151	1.151	.000	1.954	1.954	.000	2.542	2.543	.000	50
MODEL	51	PAPER AND PAPERBOARD MILLS	1.095	1.098	.003	1.288	1.299	.011	1.504	1.529	.025	51
MODEL	52	PAPER PRODUCTS, NEC	1.071	1.074	.003	1.196	1.206	.010	1.391	1.416	.025	52
MODEL	53	WALL AND BUILDING PAPER	1.091	1.094	.003	1.244	1.255	.011	1.410	1.435	.025	53
MODEL	54	PAPERBOARD CONTAINERS	1.074	1.077	.003	1.195	1.206	.011	1.382	1.408	.027	54
MODEL	55	NEWSPAPERS	1.072	1.082	.010	1.175	1.196	.021	1.342	1.380	.039	55
MODEL	56	PERIODICALS	1.066	1.073	.000	1.157	1.175	.000	1.311	1.345	.000	56
MODEL	57	BOOKS	1.045	1.050	.000	1.127	1.142	.000	1.289	1.327	.000	57
MODEL	58	BUSINESS FORMS, BLANK BOOK	1.063	1.070	.000	1.163	1.183	.000	1.302	1.338	.000	58
MODEL	59	COMMERCIAL PRINTING	1.066	1.073	.000	1.160	1.181	.000	1.300	1.339	.000	59
MODEL	60	OTHER PRINTING, PUBLISHING	1.059	1.067	.000	1.140	1.163	.000	1.259	1.296	.000	60
EXOG	61	STEEL SCRAP	1.616	1.616	.000	3.066	3.066	.000	2.128	2.128	.000	61
EXOG	62	OILSEEDS	1.937	1.937	.000	1.782	1.782	.000	1.520	1.520	.001	62
EXOG	63	COCOA BEANS	1.965	1.965	.000	2.987	2.987	.000	2.205	2.206	.001	63
MODEL	64	INDUSTRIAL CHEMICALS	1.078	1.082	.004	1.307	1.318	.012	1.485	1.507	.022	64
MODEL	65	FERTILIZERS	1.067	1.072	.004	1.226	1.240	.014	1.468	1.492	.025	65
MODEL	66	PESTICIDES + AGRIC. CHEM.	1.071	1.077	.005	1.157	1.173	.017	1.270	1.297	.028	66
MODEL	67	MISC CHEMICAL PRODUCTS	1.076	1.081	.005	1.193	1.209	.016	1.330	1.360	.030	67
MODEL	68	PLASTIC MAT'LS. + RESINS	1.096	1.099	.003	1.548	1.556	.009	1.804	1.821	.017	68
MODEL	69	SYNTHETIC RUBBER	1.061	1.064	.003	1.175	1.190	.015	1.311	1.342	.032	69
MODEL	70	CELLULOSIC FIBERS	1.061	1.064	.003	1.243	1.257	.014	1.472	1.501	.029	70
MODEL	71	NON-CELLULOSIC FIBERS	1.068	1.071	.003	1.191	1.205	.014	1.334	1.364	.030	71
MODEL	72	DRUGS	1.058	1.064	.006	1.125	1.146	.020	1.208	1.243	.036	72
MODEL	73	CLEANING + TOILET PROD.	1.059	1.063	.004	1.148	1.164	.016	1.287	1.320	.033	73
MODEL	74	PAINTS	1.091	1.096	.005	1.252	1.269	.017	1.420	1.449	.028	74
EXOG	75	EFFECTIVE CRUDE OIL PRICE	1.160	1.160	.000	2.286	2.286	.000	2.731	2.731	.000	75
MODEL	76	PETROLEUM REFINING	1.120	1.120	.001	1.860	1.861	.001	2.203	2.212	.008	76
MODEL	77	FUEL OIL	1.123	1.123	.000	1.865	1.867	.001	2.210	2.218	.008	77
MODEL	78	PAVING AND ASPHALT	1.045	1.046	.001	1.240	1.241	.001	1.474	1.505	.031	78
MODEL	80	TIRES AND INNER TUBES	1.046	1.048	.002	1.120	1.133	.013	1.245	1.277	.032	80
MODEL	81	RUBBER PRODUCTS	1.058	1.061	.003	1.148	1.166	.018	1.283	1.325	.042	81
MODEL	82	MISC PLASTIC PRODUCTS	1.040	1.040	.000	1.210	1.220	.000	1.426	1.465	.000	82
MODEL	83	LEATHER + IND LTHR PROD	1.034	1.037	.003	1.126	1.147	.021	1.294	1.343	.050	83
MODEL	84	FOOTWEAR(EXC. RUBBER)	1.024	1.028	.003	1.097	1.119	.021	1.226	1.274	.047	84
MODEL	85	OTHER LEATHER PRODUCTS	1.048	1.050	.003	1.152	1.172	.019	1.326	1.372	.047	85
MODEL	86	GLASS	1.052	1.055	.003	1.129	1.140	.011	1.310	1.340	.030	86
MODEL	87	STRUCTURAL CLAY PRODUCTS	1.047	1.053	.006	1.119	1.135	.015	1.293	1.325	.032	87
MODEL	88	POTTERY	1.050	1.057	.007	1.114	1.131	.019	1.235	1.269	.034	88
MODEL	89	CEMENT, CONCRETE, GYPSUM	1.052	1.054	.002	1.131	1.139	.008	1.298	1.329	.031	89
MODEL	90	OTHER STONE + CLAY PROD.	1.054	1.060	.006	1.127	1.143	.017	1.254	1.287	.033	90
MODEL	91	STEEL	1.102	1.106	.004	1.270	1.289	.018	1.411	1.416	.005	91
MODEL	92	COPPER	1.099	1.104	.005	1.299	1.314	.015	1.307	1.322	.015	92
MODEL	93	LEAD	1.076	1.079	.003	1.337	1.349	.012	1.511	1.531	.020	93

TABLE XI-2 (Cont.)

Industry Price Effects from a $10 Billion Increase in Federal Spending

STANDARD RUN : CONTROL SOLUTION
ALTERNATIVE RUN : $10 BILLION INCREASE IN FED. SPENDING

ANNUAL AVERAGE PRICE LEVELS 1972 = 1.0

			1973			1974			1976			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	94	ZINC	1.080	1.085	.004	1.302	1.318	.016	1.466	1.490	.024	94
MODEL	95	ALUMINUM	1.077	1.079	.003	1.217	1.228	.012	1.388	1.408	.020	95
MODEL	96	OTH PRIM NON-FER METALS	1.074	1.090	.006	1.215	1.235	.020	1.345	1.373	.028	96
MODEL	97	OTH NON-FER ROLL + DRAW	1.065	1.069	.000	1.186	1.202	.000	1.344	1.373	.000	97
MODEL	98	NON-FERROUS WIRE DRAWING	1.077	1.081	.004	1.231	1.248	.018	1.352	1.379	.026	98
MODEL	99	NON-FER CASTING + FORGING	1.074	1.079	.005	1.202	1.220	.019	1.357	1.388	.031	99
MODEL	100	METAL CANS	1.085	1.087	.002	1.212	1.225	.013	1.408	1.424	.016	100
MODEL	101	METAL BARRELS AND DRUMS	1.067	1.069	.002	1.172	1.188	.015	1.301	1.326	.025	101
MODEL	102	PLUMBING + HEATING EQUIP.	1.061	1.063	.003	1.166	1.181	.014	1.294	1.321	.028	102
MODEL	103	BOILER SHOPS	1.071	1.074	.002	1.189	1.204	.015	1.316	1.339	.024	103
MODEL	104	OTH STRUCTURAL METAL PRD.	1.067	1.070	.002	1.180	1.194	.015	1.308	1.332	.023	104
MODEL	105	SCREW MACHINE PRODUCTS	1.057	1.058	.001	1.164	1.179	.016	1.308	1.341	.033	105
MODEL	106	METAL STAMPINGS EXC. AUTO	1.064	1.065	.001	1.178	1.195	.017	1.316	1.343	.027	106
MODEL	107	CUTLERY,HAND TOOLS,HARDWR	1.064	1.064	.000	1.171	1.189	.017	1.304	1.338	.034	107
MODEL	108	MISC FABRICATED WIRE PRODUCTS	1.066	1.067	.001	1.180	1.195	.015	1.313	1.335	.023	108
MODEL	109	PIPES, VALVES, FITTINGS	1.059	1.060	.001	1.166	1.181	.016	1.295	1.329	.033	109
MODEL	110	OTH FABRICATED METAL PROD.	1.058	1.059	.001	1.165	1.180	.015	1.272	1.305	.034	110
MODEL	111	ENGINES AND TURBINES	1.057	1.060	.003	1.140	1.154	.014	1.251	1.278	.027	111
MODEL	112	FARM MACHINERY	1.062	1.062	.001	1.165	1.177	.012	1.329	1.357	.028	112
MODEL	113	CONSTR,MINE,OILFIELD MACH	1.069	1.070	.000	1.179	1.191	.012	1.352	1.379	.027	113
MODEL	114	MATERIALS HANDLING MACH.	1.070	1.070	.000	1.182	1.194	.012	1.353	1.379	.026	114
MODEL	115	MACH. TOOLS, METAL CUTTING	1.080	1.084	.000	1.195	1.214	.000	1.361	1.401	.000	115
MODEL	116	MACH TOOLS, METAL FORMING	1.081	1.085	.000	1.199	1.218	.000	1.363	1.401	.000	116
MODEL	117	OTHER METAL WORKING MACH	1.080	1.085	.005	1.191	1.212	.020	1.349	1.391	.041	117
MODEL	118	SPECIAL INDUSTRIAL MACH	1.058	1.061	.003	1.143	1.157	.014	1.275	1.305	.030	118
MODEL	119	PUMPS,COMPRESSORS,BLOWERS	1.068	1.071	.003	1.172	1.186	.014	1.334	1.365	.030	119
MODEL	120	BALL AND ROLLER BEARINGS	1.065	1.068	.004	1.167	1.181	.015	1.319	1.347	.029	120
MODEL	121	POWER TRANSMISSION EQUIP	1.068	1.072	.004	1.172	1.186	.015	1.333	1.364	.030	121
MODEL	122	INDUSTRIAL PATTERNS	1.067	1.070	.003	1.168	1.182	.014	1.329	1.360	.031	122
MODEL	123	COMPUTERS + RELATED MACH.	1.031	1.031	-.000	1.096	1.107	.011	1.203	1.245	.042	123
MODEL	124	OTHER OFFICE MACHINERY	1.030	1.029	-.000	1.092	1.106	.013	1.170	1.214	.044	124
MODEL	125	SERVICE INDUSTRY MACHINERY	1.060	1.061	.002	1.154	1.165	.011	1.291	1.319	.028	125
MODEL	126	MACHINE SHOP PRODUCTS	1.041	1.044	.003	1.123	1.137	.014	1.254	1.283	.029	126
EXOG	127	RAW SUGAR	1.061	1.061	.000	2.629	2.629	.000	1.195	1.196	.001	127
EXOG	128	GREEN COFFEE	1.259	1.259	.000	1.315	1.315	.000	1.506	1.506	.001	128
MODEL	129	ELECTRICAL MEASURING INSTRUME	1.019	1.016	-.003	1.098	1.102	.004	1.268	1.301	.033	129
MODEL	130	TRANSFORMERS + SWITCHGEAR	1.034	1.031	-.003	1.132	1.138	.006	1.301	1.332	.030	130
MODEL	131	MOTORS AND GENERATORS	1.059	1.057	-.002	1.172	1.179	.007	1.329	1.359	.030	131
MODEL	132	INDUSTRIAL CONTROLS	1.053	1.050	-.002	1.171	1.180	.009	1.324	1.360	.036	132
MODEL	133	WELDING APP, GRAPHITE PROD	1.070	1.072	.002	1.198	1.211	.013	1.366	1.397	.031	133
MODEL	134	HOUSEHOLD APPLIANCES	1.045	1.044	-.001	1.144	1.152	.008	1.295	1.324	.029	134
MODEL	135	ELEC LIGHTING + WIRING EQ.	1.033	1.031	-.002	1.139	1.146	.006	1.334	1.364	.030	135
MODEL	136	RADIO AND TV RECEIVING	1.027	1.026	-.002	1.103	1.109	.006	1.269	1.300	.031	136
MODEL	137	PHONOGRAPH RECORDS	1.030	1.030	-.001	1.120	1.125	.005	1.316	1.338	.022	137
MODEL	138	COMMUNICATION EQUIPMENT	1.036	1.035	-.001	1.131	1.141	.009	1.293	1.329	.036	138
MODEL	139	ELECTRONIC COMPONENTS	.993	.990	-.003	1.065	1.073	.008	1.184	1.222	.038	139
MODEL	140	BATTERIES	1.049	1.049	.000	1.170	1.179	.008	1.377	1.401	.024	140
MODEL	141	ENGINE ELECTRICAL EQUIP.	1.058	1.058	.000	1.164	1.173	.009	1.347	1.370	.024	141
MODEL	142	X-RAY, ELEC EQUIP,NEC	1.052	1.054	.000	1.156	1.169	.000	1.335	1.371	.000	142
MODEL	143	AUTO STAMPINGS	1.000	1.000	.000	1.000	1.000	.000	1.000	1.000	.000	143
MODEL	144	TRUCK, BUS, TRAILER BODIES	1.075	1.079	.000	1.124	1.136	.000	1.284	1.308	.000	144
MODEL	145	MOTOR VEHICLES	1.075	1.080	.005	1.085	1.100	.012	1.246	1.269	.023	145
MODEL	147	AIRCRAFT	1.055	1.055	.000	1.151	1.163	.000	1.295	1.342	.000	147
MODEL	148	AIRCRAFT ENGINES	1.060	1.061	.000	1.168	1.183	.000	1.308	1.352	.000	148

TABLE XI-2 (Cont.)

Industry Price Effects from a $10 Billion Increase in Federal Spending

STANDARD RUN : CONTROL SOLUTION
ALTERNATIVE RUN : $10 BILLION INCREASE IN FED. SPENDING

ANNUAL AVERAGE PRICE LEVELS 1972 = 1.0

			1973			1974			1976			
			STD	ALT	DIFF	STD	ALT	DIFF	STD	ALT	DIFF	
MODEL	149	AIRCRAFT EQUIPMENT, NEC	1.059	1.060	.000	1.164	1.179	.000	1.301	1.347	.000	149
MODEL	150	SHIP AND BOAT BUILDING	1.058	1.055	.000	1.185	1.187	.000	1.366	1.409	.000	150
MODEL	153	TRAILER COACHES	1.075	1.075	.000	1.213	1.225	.000	1.381	1.417	.000	153
MODEL	156	ENGR. + SCIENTIFIC INSTR.	1.084	1.089	.000	1.191	1.210	.000	1.343	1.384	.000	156
MODEL	157	MECH. MEASURING DEVICES	1.067	1.073	.000	1.157	1.175	.000	1.308	1.347	.000	157
MODEL	158	OPTICAL + OPHTHALMIC GOODS	1.044	1.051	.007	1.099	1.118	.019	1.205	1.239	.034	158
MODEL	159	MEDICAL + SURGICAL INSTR.	1.074	1.080	.006	1.166	1.187	.021	1.292	1.332	.040	159
MODEL	160	PHOTOGRAPHIC EQUIPMENT	1.053	1.062	.008	1.099	1.119	.020	1.199	1.228	.028	160
MODEL	162	WATCHES AND CLOCKS	1.064	1.067	.003	1.169	1.182	.013	1.315	1.347	.032	162
MODEL	163	JEWELRY AND SILVERWARE	1.040	1.040	.001	1.164	1.178	.014	1.294	1.336	.042	163
MODEL	164	TOYS,SPORT,MUSICAL INSTR.	1.037	1.038	.001	1.166	1.181	.014	1.298	1.338	.040	164
MODEL	165	OFFICE SUPPLIES	1.035	1.035	.001	1.167	1.182	.015	1.298	1.344	.046	165
MODEL	166	MISC MANUFACTURING, NEC	1.050	1.051	.001	1.201	1.216	.015	1.347	1.390	.044	166
MODEL	167	RAILROADS	1.069	1.068	-.001	1.169	1.182	.013	1.303	1.322	.019	167
MODEL	168	BUSSES AND LOCAL TRANSIT	1.067	1.090	.024	1.144	1.191	.047	1.238	1.306	.068	168
MODEL	169	TRUCKING	1.067	1.077	.010	1.154	1.188	.034	1.264	1.286	.022	169
MODEL	170	WATER TRANSPORTATION	1.048	1.050	.002	1.160	1.172	.012	1.377	1.414	.037	170
MODEL	171	AIRLINES	1.063	1.069	.006	1.130	1.140	.010	1.277	1.301	.024	171
MODEL	172	PIPELINES	1.048	1.049	.000	1.129	1.134	.000	1.506	1.542	.000	172
MODEL	173	FREIGHT FORWARDING	1.062	1.072	.000	1.112	1.132	.000	1.293	1.338	.000	173
MODEL	174	TELEPHONE AND TELEGRAPH	1.087	1.115	.028	1.123	1.166	.043	1.158	1.166	.008	174
MODEL	175	RADIO AND TV BROADCASTING	1.045	1.055	.000	1.112	1.137	.000	1.143	1.190	.000	175
MODEL	176	ELECTRIC UTILITIES (AVE. PRIC	1.060	1.060	-.000	1.234	1.241	.007	1.461	1.486	.025	176
MODEL	177	ELEC. UTILITIES (WHOLESALE PR	1.064	1.064	-.000	1.239	1.246	.008	1.466	1.492	.026	177
MODEL	178	NATURAL GAS	1.063	1.068	.005	1.167	1.176	.009	1.575	1.596	.022	178
MODEL	179	WATER AND SEWER SERVICES	1.062	1.068	.006	1.116	1.128	.013	1.321	1.352	.030	179
MODEL	180	WHOLESALE TRADE	1.076	1.083	.007	1.196	1.213	.017	1.242	1.266	.024	180
MODEL	181	RETAIL TRADE	1.061	1.074	.013	1.132	1.156	.024	1.254	1.289	.034	181
MODEL	182	BANKS,CREDIT AGEN.,BROKERS	1.083	1.094	.000	1.111	1.131	.000	1.251	1.282	.000	182
MODEL	183	INSURANCE	1.072	1.077	.004	1.160	1.174	.014	1.301	1.324	.023	183
EXOG	184	OWNER-OCCUPIED DWELLINGS	1.051	1.051	.000	1.111	1.111	.000	1.225	1.226	.001	184
EXOG	185	REAL ESTATE	1.051	1.051	.000	1.111	1.111	.000	1.225	1.226	.001	185
MODEL	186	HOTEL AND LODGING PLACES	1.060	1.061	.001	1.161	1.167	.006	1.314	1.335	.021	186
MODEL	187	PERSONAL + REPAIR SERVICES	1.024	1.019	-.006	1.160	1.164	.004	1.222	1.257	.035	187
MODEL	188	BUSINESS SERVICES	1.045	1.049	.000	1.117	1.127	.000	1.231	1.249	.000	188
MODEL	189	ADVERTISING	1.066	1.072	.000	1.155	1.173	.000	1.309	1.345	.000	189
MODEL	190	AUTO REPAIR	1.048	1.052	.005	1.169	1.182	.013	1.322	1.346	.024	190
MODEL	191	MOVIES + AMUSEMENTS	1.094	1.099	.006	1.203	1.219	.016	1.283	1.308	.026	191
MODEL	192	MEDICAL SERVICES	1.053	1.055	.001	1.175	1.179	.004	1.399	1.430	.030	192
MODEL	193	PRIVATE SCHOOLS + NPO	1.081	1.085	.000	1.162	1.172	.000	1.309	1.318	.000	193

A reassuring result of the price model is the relative movements of the three component indexes for personal consumption expenditures. The greater inelasticity of durables supply as compared to nondurables is reflected by the 1.007 change in durables/nondurables relative price for 1976 (1.033 ÷ 1.026). The price of services experiences the smallest price increase from the change in government spending.

The results for the detailed sectors display both labor market and product market impact on price changes. The strong unemployment rate effects upon the wage structure appears to noticeably affect both relative wages and relative prices of textiles, apparel, and leather products (in a positive direction); and steel, metal cans, and automobiles (in a negative direction). In a longer simulation, these short-run price effects resulting from a shift in the wage structure would be dwarfed by the more pervasive influences on relative prices; namely, differential growths in labor productivity by industry.

Conclusions

Compared to the more sophisticated types of multiplier analysis performed on previous econometric models, our procedure here may appear rather rudimentary. However, given the size and complexity of the integrated model, important progress has been made. First, we have gained valuable experience in solving the real-income and price-wage models in tandem and have shown the equation structures to be dynamically stable. Second, the model exhibits aggregate multipliers that are, at least to a first approximation, consistent with a number of existing large-scale models. More plausible multi-period multipliers may be achieved with respecification of the consumption and investment equations in the real model.

11.2 Model Forecast

In this section we present a forecast of the income model through 1982. The income forecasts by industry are those implied by the real output forecast presented at the June, 1977 sponsors' meeting of the INFORUM Project. That is, real outputs are taken as given; we have not made a complete, consistent solution for the entire system as we described in the previous section. As our experience grows with the income and price models, future forecasts should approach equilibrium solutions for the complete model.

The assumptions for the major exogenous variables are shown in Table XI-3. As the first line shows, we have pegged the effective federal personal income tax at a constant value for the forecast period. In runs with the merged real and income models, using the tax elasticities derived in the Brookings Study (see Chapter 7, Section 3), a considerable "fiscal drag" as growth in income pushed up effective tax rates. On the assumption that Congress would continually enact legislation to maintain roughly constant average tax rates, the average rate over the 1955-75 period (tax revenues/adjusted gross income, .118) was entered.

The transfer payment values are simply an aggregation of the various items that were discussed in Section 7.5. In the model those values are inflated to current dollars after multiplication by the projected Personal Consumption Deflators.

Equations for Net Interest and Rental Income of persons that were estimated in Section 7.1 have not yet been implemented in the model. For the present, exogenous estimates have been made for the path of these variables in current dollars.

TABLE XI-3

Major Exogenous Assumptions for Income Forecast

	1976	1977	1978	1980	1982
Effective federal personal income tax rate (%)	11.8	11.8	11.8	11.8	11.8
Social Security tax rate (%)	5.85	5.85	6.05	6.05	6.20
Transfer payments (excluding unemployment insurance) billions of 72$	134.6	144.8	155.0	179.0	206.2
Net interest	122.8	142.0	158.4	189.7	222.2
Rental income of persons	23.6	27.2	30.9	38.2	45.5
Federal debt held by the public (billions)	440.0	480.0	510.0	540.0	560.0

Prices

Prices for domestic crude petroleum, wellhead price of natural gas, and coal grow 3 percent per year faster than overall WPI after 1977:1. All other exogenous prices (see Section 9.7) rise at same rate as WPI after last known observation, 1977:2.

Federal debt held by the public is an explanatory variable in the equation forecasting (net) government interest payments to persons. The estimates here assume that the budget deficits will diminish by 1982, but that a completely balanced budget will not be achieved.

The assumptions for the set of exogenous prices are described at the bottom of Table XI-3. The energy price assumptions are roughly in line with Federal Energy Agency projections as of the spring and summer of 1977. At this writing, the Congress is debating natural gas pricing; the 3 percent annual relative price increase is probably too low with respect to complete deregulation. A neutral assumption is made in regard to the relative prices of the other exogenous commodities; their prices simply rise with the WPI (with a one quarter lag).

Forecast Display

The computer output for the income model forecast is shown on pages 499 to 518 at the back of this chapter. The output is divided into four sections. The first three pages show aggregate items from the real and income models. The program also computes year-to-year growth rates for most of these items. In section two, which comprises the next three pages, the major components of Gross Product Originating are shown for 15 broad industry groups. Ratios of GPO components to total GPO are shown in section 3 for the same broad industry groups. The final eleven pages show the income forecasts for 55 income model sectors (Rest of the World is exlcuded).

The first page of the forecast (page 499 is entitled "GNP Expenditure Components and Other Selected Indicators." As the growth rates show, the short-run scenario in summer 1977 INFORUM forecast was for continuing high growth in real GNP in 1977 and 1978, and then a sharp deceleration in 1979. As would be expected, the cyclical fluctuations in growth rates is most apparent in structures and producer durable equipment.

"The Relation of Gross National Product, Net National Product, National Income, and Personal Income," shown on the succeeding page, is a slightly expanded version of the table by the same name (Table 1.9) in the U.S. National Accounts. Growth rates of nominal GNP are above 10 percent for the remainder of the decade (except for 1979), since the overall inflation rate is not expected to diminish from its current level of around 6 percent. As we expect from the behavior built into the price-wage model, corporate profits, on a percentage basis, are the most cyclically sensitive income share. The pause in overall activity projected for 1979 causes nominal profits to actually decline slightly from their 1978 level. As the economy rebounds in 1980, corporate profits increase more than proportionately to national income, rising by 20 percent.

"Personal Income and Its Distribution" is shown in the third page of the forecast output. This is a slightly expanded version of Table 2.1 in the National Accounts; I have included more detail in the breakdown for transfer payments and contributions for social insurance.

Line 37 of the table shows the 1972-dollar disposable per capital incomes that results from the model. On line 38 we show the real disposable incomes that were assumed for the July, 1977 INFORUM Model. As the growth rates indicate, a significant divergence between the assumed and calculated incomes begins in 1977. The interrelationships of the complete model make the exact sources of this discrepancy difficult to pin down, but some study indicates several problem areas that are contributing factors.

We may preface our discussion by noting that, to a first approximation, real disposable personal income per capita is:

$$(11.1)\quad DPI = \frac{\text{manhours worked}}{\text{population}} * \frac{\text{wage rate}}{\text{PCE deflator}} * (1 - \text{tax rate})$$

If, as a first step, we assume that manhours move in proportion to real GNP and real wages are fixed, then we have a simple, textbook income determination problem. The reader at this point may refer again to the growth rates of the GNP components of the real forecast on page .

A curious feature of the real forecast used here is that while the exogenous or "semi-exogenous" components of structures, PDE, and government expenditures all show acceleration from 1976 to 1977, the growth rate of personal consumption expenditures is actually lower in 1977 than 1976. With a stable savings rate, this result is surely counterintuitive; the income model reflects the higher level of income (for 1977) when it is endogenous to the model. Part of the problem lies in the fact that the savings rate implied by the aggregate consumption equations fell by .008 from 1976 to 1977. Thus, to calibrate total GNP (to some "outside" value) with an exogenous DPI, the growth in DPI from 1976 to 1977 had to be lower than what it otherwise would have been. Of course, in a model where income is endogenous, the lower the savings rate, the higher is the resulting level of income.

Note that here we are not evaluating the forecast real GNP components against their probable outcomes in 1977. Rather, it appears that there is some internal inconsistency between the exogenous components of final demand versus the level of personal consumption expenditures.

Another source of the problem appears to lie in the total manhours forecasts of the real model in 1976 and 1977. As real private GNP increases by 6.4 percent from 1975 to 1976, manhours in the private economy are "forecasted" by the model to increase by only 1.9 percent. The actual increase in total manhours was 3.8 percent. (This problem may be caused by coefficients on the first difference of output in the productivity equations that are to large (see 1985: Interindustry Forecasts of the American Economy, Chapter 8).

This large increase in productivity works it way through the price-wage model to produce large increases in the real wage. Because of the lags in the price-wage model, the increase in the real wage is overstated for 1976 and probably for 1977. As equation (11.1) shows, this result impinges directly on the forecasts of real disposable income.

The above factors relate to the disposable income discrepancy for 1976-78. Beyond 1978, increases in the discrepancy may be due to inconsistent assumptions regarding personal tax rates. Assuming that the implicit tax rates in the standard forecast would yield a balanced government budget (or at least a constant deficit each year), we would suspect an increasing government deficit given the results shown here. A preliminary execution of a routine to calculate the government deficit indeed shows this to be the case. The combined federal, state, and local deficit jumps 44 billion dollars from 1978 to 1980. If we were to increase personal taxes in 1980 by 44 billion dollars, the difference in the two disposable incomes would be only 120 dollars per capita, slightly less than that for 1978.

As a general statement, we note that in several areas — consumption, investment, and productivity — the present INFORUM specification needs some additional refinement to handle short-run cyclical fluctuations. The July, 1977 forecast reflects some of these weaknesses as equations are "turned on" after the 1974-76 rollercoaster movements in the economy. As these refinements are added and we gain more experience with the income model, future forecasts should be able to incorporate more consistent estimates for disposable income.

Industry Forecasts

We mentioned above the stability of GPO shares for 1976 to 1977 for the private economy. Another look at page 505 shows that the ratio of labor income to GPO is very stable through 1982. Thus, although the price equations for the two-digit SIC income sectors incorporate falling or rising trends of GPO/labor compensation, these trends effectively cancel out in the aggregate.

The reader may pursue the forecasts for the two-digit income sector at his leisure. With the exception of Petroleum refining,[3] the forecasts of other property income appear reasonable in every sector. This general result shows that the price equations and GPO determination relations are behaving properly.

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[3]The problem in the Petroleum Refining Industry stems from an (as yet undetermined) inconsistency in actual prices for petroleum refining input and output prices. Since value-added comprises a very small proportion of gross output of this industry, small errors in either input or output prices can produce large errors in the computed profit figures.

The real gross product (72$) figure on line 9 for each panel is derived by aggregating the INFORUM constant-dollar gross output with 1972 value-added weights. The implicit GPO deflator on line 10 of each panel is, of course, computed by dividing line 1 by line 9. Changes in markup rates, labor productivity, and relative wages all affect the dispersion of GPO prices that are forecast for 1982.

Conclusion

The multiplier and forecasting exercises presented in this chapter complement the tests of the previous chapter in validating the complete model. First, calculation of dynamic multipliers in general yields reasonable results. We have been able to identify some specific areas for improvement which should bring the behavior of the model in closer alignment with that of the more thoroughly tested macroeconomic models.

The results for the unconditional forecast are difficult to evaluate in isolation. We can say that the income model appears to be generating predicted values that could easily be expected, given the output of the real model. In addition, our results by industry show that our income distribution mechanism holds together well for forecasts that extend more than just a few years beyond the base period.

GNP EXPENDITURE COMPONENTS (72$) AND OTHER SELECTED INDICATORS

		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	GROSS NATIONAL PRODUCT	1175.6	1245.4	1222.3	1200.5	1266.7	1340.6	1407.7	1430.3	1484.7	1529.2	1568.4
2	PERSONAL CONSUMPTION EXPEN.	739.1	771.6	762.0	774.0	817.3	860.4	891.2	903.6	937.6	965.0	993.1
3	STRUCTURES	101.9	102.3	85.1	72.2	78.1	90.7	102.5	101.2	109.3	112.2	115.2
4	PRODUCER DURABLE EQUIPMENT	74.3	85.E	86.4	74.7	77.3	87.0	99.9	101.9	106.5	111.0	114.4
5	INVENTORY CHANGE	7.7	15.5	4.4	-10.4	7.3	14.9	18.3	17.1	13.5	15.1	14.1
6	EXPORTS	71.2	85.6	94.6	88.8	94.1	91.5	94.5	96.7	100.2	104.0	108.0
7	IMPORTS	-76.0	-77.7	-76.7	-68.0	-79.6	-86.4	-92.3	-94.8	-99.9	-103.3	-109.6
8	GOVERNMENT PURCHASES - FEDERAL	101.7	98.0	99.0	98.2	98.9	101.6	105.4	108.9	113.2	115.6	117.9
9	GOVERNMENT PURCHASES - STATE AND L	155.6	164.3	167.6	170.9	173.2	181.0	188.2	195.7	204.4	209.7	215.3
10	UNEMPLOYMENT RATE	5.6	4.9	5.6	8.6	7.8	6.8	6.1	6.0	6.0	5.7	5.6
11	EFFECTIVE FED. PERS. TAX RATE	.000	.114	.126	.114	.113	.115	.118	.118	.118	.118	.118

PERCENTAGE GROWTH RATES

		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	GROSS NATIONAL PRODUCT		5.9	-1.9	-1.8	5.5	5.8	5.0	1.6	3.8	3.0	2.6
2	PERSONAL CONSUMPTION EXPEN.		4.4	-1.2	1.6	5.6	5.3	3.6	1.4	3.8	2.9	2.9
3	STRUCTURES		.3	-16.9	-15.1	8.1	16.1	13.0	-1.3	8.0	2.6	2.7
4	PRODUCER DURABLE EQUIFMENT		15.6	.7	-13.6	3.4	12.6	14.8	2.1	4.5	4.2	3.1
6	EXPORTS		20.4	10.4	-6.1	6.0	-2.8	3.3	2.4	3.5	3.8	3.8
7	IMPORTS		2.3	-1.3	-11.4	17.1	8.6	6.8	2.7	5.4	3.4	6.1
8	GOVERNMENT PURCHASES - FEDERAL		-3.7	1.0	-.8	.7	2.7	3.7	3.4	3.9	2.1	2.0
9	GOVERNMENT PURCHASES - STATE AND L		5.6	2.0	2.0	1.3	4.5	4.0	4.0	4.4	2.6	2.6

RELATION OF GROSS NATIONAL PRODUCT, NET NATIONAL PRODUCT, NATIONAL INCOME, AND PERSONAL INCOME

		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	GROSS NATIONAL PRODUCT	1171.1	1319.5	1431.1	1517.5	1704.2	1917.1	2143.9	2322.4	2584.2	2850.2	3132.1
2	LESS: CAP. CON. ALLOWANCES	99.5	110.9	121.3	128.9	138.2	151.5	166.3	182.7	200.6	221.0	243.0
3	CCA ADJUSTMENT	17.0	8.5	16.3	28.6	31.9	34.3	36.6	39.0	41.3	43.7	46.0
4	EQUALS: NET NATIONAL PRODUCT	1055.1	1200.4	1293.5	1360.0	1534.1	1731.3	1940.9	2100.8	2342.3	2585.5	2843.1
5	LESS: INDIRECT BUSINESS TAXES	111.0	118.1	127.2	136.9	149.0	162.5	176.2	188.7	204.7	221.6	240.4
6	EXCISE AND CUSTOMS TAXES	16.0	18.4	18.5	18.0	19.2	20.5	21.5	21.8	22.5	23.0	24.2
7	SALES TAXES	35.5	42.2	45.7	49.7	54.5	60.2	66.1	70.8	78.0	85.5	93.8
8	PROPERTY AND OTHER	544.9	57.5	63.0	69.2	75.4	81.8	88.7	96.1	104.3	113.0	122.4
9	BUSINESS TRANSFERS	4.7	5.5	6.2	7.2	8.3	9.5	10.7	11.8	13.5	15.2	17.1
10	STATISTICAL DISCREPANCY	1.7	2.6	6.6	4.4	5.2	5.5	5.8	6.1	6.4	6.8	7.1
11	PLUS: SUBSIDIES LESS CURRENT SURPLUS	3.6	3.9	.7	2.0	2.3	2.5	2.7	2.8	3.0	3.1	3.1
12	EQUALS: NATIONAL INCOME	946.5	1077.9	1154.2	1213.5	1373.9	1556.4	1750.8	1896.9	2120.6	2345.0	2581.7
13	LESS: CORPORATE PROFITS AND IVA	92.2	100.7	93.2	97.4	146.2	171.9	201.2	199.0	238.9	268.4	301.4
14	CORPORATE IVA	-7.0	-14.6	-37.7	-27.9	-21.7	-25.3	-25.8	-28.7	-36.4	-42.4	-47.2
15	FEDERAL INCOME TAXES	36.5	43.7	49.7	47.6	64.5	75.5	86.4	86.2	104.7	118.1	132.5
16	STATE AND LOCAL TAXES	5.0	6.0	6.8	6.5	8.7	10.3	11.8	11.8	14.3	16.2	18.1
17	PROFITS AFTER TAX	57.7	65.6	74.4	71.1	94.7	111.5	128.8	129.7	156.3	176.5	198.0
18	DIVIDENDS	24.6	26.7	29.4	31.2	35.2	40.1	46.0	51.0	57.8	65.5	74.1
19	UNDISTRIBUTED PROFITS	30.3	38.9	45.0	39.9	59.5	71.3	82.8	78.7	98.5	111.0	123.9
20	LESS: CONTRIBUTIONS FOR SOCIAL INS.	73.0	92.7	107.1	114.8	125.3	139.2	157.7	173.4	191.9	212.3	234.1
21	PLUS: GOVERNMENT TRANSFER PAYMENTS	98.6	116.0	136.1	168.5	187.2	207.1	233.1	265.4	303.9	347.0	397.5
22	INTEREST PAID BY CON. AND GOV.	33.0	31.1	32.5	32.5	40.8	46.9	50.1	51.8	55.3	58.3	61.6
23	DIVIDENDS	27.3	26.7	29.4	31.2	35.2	40.1	46.0	51.0	57.8	65.5	74.1
24	BUSINESS TRANSFER PAYMENTS	4.6	5.5	6.2	7.2	8.3	9.5	10.7	11.8	13.5	15.2	17.1
25	EQUALS: PERSONAL INCOME	944.9	1062.4	1162.1	1254.7	1388.8	1564.9	1748.9	1922.7	2139.3	2370.4	2617.5

PERCENTAGE GROWTH RATES

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	GROSS NATIONAL PRODUCT	12.7	8.5	6.0	12.3	12.5	11.8	8.3	11.3	10.3	9.9
2	LESS: CAP. CON. ALLOWANCES	11.5	9.4	6.2	7.2	9.6	9.8	9.8	9.8	10.2	9.9
3	CCA ADJUSTMENT	-51.5	97.0	75.9	11.7	7.3	6.8	6.4	6.0	5.7	5.4
4	EQUALS: NET NATIONAL PRODUCT	13.8	7.8	5.1	12.8	12.9	12.1	8.2	11.5	10.4	10.0
5	LESS: INDIRECT BUSINESS TAXES	6.4	7.7	7.7	8.9	9.0	8.5	7.1	8.5	8.3	8.5
6	EXCISE AND CUSTOMS TAXES	15.1	.6	-2.9	7.0	6.5	4.8	1.6	3.0	2.6	4.9
7	SALES TAXES	18.7	8.2	8.9	9.6	10.5	9.8	7.1	10.1	9.7	9.6
8	PROPERTY AND OTHER	-89.4	9.5	9.9	8.8	8.5	8.4	8.4	8.5	8.4	8.3
9	BUSINESS TRANSFERS	17.3	12.8	15.8	14.6	14.1	13.5	10.2	14.4	12.2	12.3
10	STATISTICAL DISCREPANCY	56.4	152.0	-33.3	17.7	6.0	5.6	5.3	5.1	4.8	4.6
11	PLUS: SUBSIDIES LESS CURRENT SURPLUS	7.4	-81.2	180.8	15.5	6.5	6.1	5.7	5.4	3.2	3.1
12	EQUALS: NATIONAL INCOME	13.9	7.1	5.1	13.2	13.3	12.5	8.3	11.8	10.6	10.1
13	LESS: CORPORATE PROFITS AND IVA	9.3	-7.5	4.5	50.1	17.6	17.1	-1.1	20.0	12.3	12.3
15	FEDERAL INCOME TAXES	19.7	13.7	-4.2	35.4	17.1	14.5	-.3	21.4	12.9	12.2
16	STATE AND LOCAL TAXES	20.5	13.5	-4.3	34.0	17.5	15.1	.3	20.9	12.9	12.2
17	PROFITS AFTER TAX	13.8	13.4	-4.3	33.0	17.7	15.6	.7	20.6	12.9	12.2
18	DIVIDENDS	8.6	9.9	6.3	12.6	14.2	14.7	10.8	13.4	13.3	13.1
19	UNDISTRIBUTED PROFITS	28.3	15.7	-11.3	49.0	19.9	16.1	-4.9	25.2	12.7	11.6
20	LESS: CONTRIBUTIONS FOR SOCIAL INS.	26.9	15.6	7.2	9.1	11.1	13.3	9.9	10.7	10.6	10.3
21	PLUS: GOVERNMENT TRANSFER PAYMENTS	17.6	17.4	23.8	11.1	10.6	12.5	13.9	14.5	14.2	14.6
22	INTEREST PAID BY CON. AND GOV.	-5.8	4.5	-.1	25.6	15.0	7.0	3.4	6.7	5.5	5.5
23	DIVIDENDS	-2.3	9.9	6.3	12.6	14.2	14.7	10.8	13.4	13.3	13.1
24	BUSINESS TRANSFER PAYMENTS	21.6	12.8	15.8	14.6	14.1	13.5	10.2	14.4	12.2	12.3
25	EQUALS: PERSONAL INCOME	12.4	9.4	8.0	10.7	12.7	11.8	9.9	11.3	10.8	10.4

PERSONAL INCOME AND ITS DISTRIBUTION

		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	PERSONAL INCOME	944.9	1062.4	1162.1	1254.7	1388.8	1564.9	1748.9	1922.7	2139.3	2370.4	2617.5
2	WAGE AND SALARY PAYMENTS	626.8	707.5	777.6	821.3	896.6	1004.0	1117.8	1218.4	1340.2	1473.4	1612.9
3	OTHER LABOR INCOME	41.7	46.8	51.5	55.0	61.9	71.9	83.6	93.9	106.9	121.6	137.3
4	WAGE SUPPLEMENTS	80.3	95.8	107.9	115.5	127.9	145.4	167.0	185.7	208.6	234.2	261.7
5	LESS: EMPLOYER CONT. FOR S. INS.	38.6	49.0	56.4	60.5	66.1	73.6	83.4	91.8	101.7	112.6	124.3
6	OASDI	23.3	32.0	37.6	40.0	43.8	48.9	56.2	61.9	68.7	76.1	84.0
7	FEDERAL EMPLOYEES	2.9	3.2	3.5	3.9	4.5	4.7	5.2	5.7	6.4	7.2	8.1
8	STATE AND LOCAL	6.3	6.7	7.6	8.5	9.1	10.0	11.0	12.1	13.4	14.8	16.3
9	UI INSURANCE	4.2	6.9	7.5	8.0	8.7	9.7	10.8	11.8	13.0	14.3	15.6
10	PROPRIETORS' INCOME (+ CCA ADJ.)	69.2	98.6	91.3	96.5	112.5	128.7	142.7	155.9	179.2	199.6	220.7
11	RENTAL INCOME	21.5	21.6	21.0	22.4	23.6	27.2	30.9	34.5	38.2	41.8	45.5
12	DIVIDENDS	27.3	26.7	29.4	31.2	35.2	40.1	46.0	51.0	57.8	65.5	74.1
13	PERSONAL INTEREST INCOME	74.6	83.4	99.6	107.1	122.8	142.0	158.4	173.2	189.7	205.9	222.2
14	NET INTEREST	47.0	52.3	67.1	74.6	82.0	95.1	108.2	121.3	134.4	147.6	160.7
15	GOVERNMENT INTEREST	9.7	11.0	12.7	13.1	14.8	16.8	17.3	17.8	18.3	18.8	19.3
16	INTEREST PAID BY CONSUMERS	17.9	20.2	19.8	19.4	25.0	30.1	32.9	34.0	37.0	39.5	42.2
17	TRANSFER PAYMENTS	104.1	121.5	142.4	175.8	195.5	216.6	243.8	277.3	317.4	362.2	414.5
18	UNEMPLOYMENT BENEFITS	5.6	6.3	8.2	16.1	14.8	12.9	11.4	11.9	12.5	12.1	12.4
19	OASDI AND RAILROAD RETIREMENT	43.1	54.0	60.9	69.5	79.3	89.8	103.1	118.6	137.0	158.3	182.9
20	MEDICARE	8.6	9.8	12.5	15.5	18.8	20.6	22.9	25.5	28.4	31.6	35.1
21	GOVERNMENT EMPLOYEE PENSIONS	13.5	16.1	19.1	22.5	25.4	28.4	32.1	36.5	41.6	47.4	54.2
22	VETERANS BENEFITS	8.9	9.6	10.8	13.8	13.4	15.2	17.4	20.1	23.2	26.8	30.9
23	PUBLIC ASSISTANCE	11.0	11.5	14.1	16.3	18.6	21.1	24.2	27.9	32.2	37.2	43.0
24	OTHER GOVERNMENT TRANSFERS	7.0	8.7	10.5	14.8	16.9	19.1	21.9	25.2	29.1	33.6	38.9
25	BUSINESS TRANSFERS	4.7	5.5	6.2	7.2	8.3	9.5	10.7	11.8	13.5	15.2	17.1
26	LESS: PERS. CONTRB. FOR SOC. INS.	34.2	43.7	50.7	54.3	59.2	65.6	74.3	81.6	90.2	99.6	109.8
27	OASDI AND RAILROAD	26.0	32.0	37.6	40.0	43.8	48.9	56.2	61.9	68.7	76.1	84.0
28	FEDERAL EMPLOYEES	2.1	2.1	2.4	2.6	2.9	3.1	3.5	3.8	4.3	4.8	5.4
29	STATE AND LOCAL EMPLOYEES	3.5	4.7	5.3	6.0	6.4	7.0	7.7	8.5	9.4	10.4	11.4
30	SELF-EMPLOYMENT TAX AND OTHER	2.4	2.7	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8
31	LESS: PERSONAL TAXES	141.2	155.1	181.3	178.8	196.2	228.8	255.7	279.7	309.8	341.7	375.0
32	FEDERAL INCOME TAXES	102.7	112.2	134.6	129.4	141.5	166.8	186.4	203.8	225.6	248.7	272.9
33	FEDERAL ESTATE AND GIFT	5.4	5.5	6.0	6.3	7.1	8.2	9.3	10.3	11.5	12.8	14.2
34	STATE AND LOCAL	33.0	37.4	40.7	43.1	47.6	53.7	60.0	65.6	72.7	80.1	87.9
35	EQUALS: DISPOSABLE PERSONAL INCOME	801.3	907.3	980.8	1075.9	1192.6	1336.2	1493.2	1643.0	1829.5	2028.7	2242.4
36	DISPOSABLE PERSONAL INCOME (72$)	801.3	848.5	832.4	847.6	888.7	949.5	999.0	1031.9	1074.1	1113.3	1149.9
37	DIS. PERSONAL INCOME PER CAPITA (72$	3837.0	4033.0	3928.1	3969.2	4131.9	4379.3	4568.6	4676.5	4821.7	4948.7	5060.8
38	DPI ESTIMATE - LAST ITERATION	3837.0	4068.0	3981.0	4007.0	4141.0	4290.0	4430.0	4500.0	4625.0	4714.0	4803.0

PERCENTAGE GROWTH RATES

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	PERSONAL INCOME	12.4	9.4	8.0	10.7	12.7	11.8	9.9	11.3	10.8	10.4
2	WAGE AND SALARY PAYMENTS	12.9	9.9	5.6	9.2	12.0	11.3	9.0	10.0	9.9	9.5
3	OTHER LABOR INCOME	12.1	10.1	6.6	12.5	16.2	16.3	12.4	13.8	13.7	13.0
4	WAGE SUPPLEMENTS	19.3	12.7	7.0	10.8	13.7	14.8	11.2	12.4	12.3	11.7
5	LESS: EMPLOYER CONT. FOR S. INS.	27.0	15.2	7.3	9.2	11.3	13.4	10.0	10.8	10.8	10.4
10	PROPRIETORS' INCOME (+ CCA ADJ.)	42.5	-7.4	5.5	16.8	14.3	10.9	9.3	14.9	11.3	10.6
11	RENTAL INCOME	.1	-2.5	6.6	5.3	15.5	13.4	11.8	10.6	9.6	8.7
12	DIVIDENDS	-2.3	9.9	6.3	12.6	14.2	14.7	10.8	13.4	13.3	13.1
13	PERSONAL INTEREST INCOME	11.8	19.4	7.5	14.6	15.6	11.5	9.3	9.6	8.5	7.9
14	NET INTEREST	11.3	28.3	11.2	9.9	16.0	13.8	12.1	10.8	9.8	8.9
15	GOVERNMENT INTEREST	12.7	16.3	2.9	12.9	13.2	3.2	3.0	2.9	2.8	2.7
16	INTEREST PAID BY CONSUMERS	12.9	-2.0	-2.1	34.1	16.0	9.1	3.6	8.7	6.9	6.9
17	TRANSFER PAYMENTS	16.7	17.1	23.5	11.2	10.8	12.6	13.7	14.5	14.1	14.5
18	UNEMPLOYMENT BENEFITS	13.1	28.9	97.2	-8.3	-12.9	-11.2	3.6	5.0	-3.1	3.2
26	LESS: PERS. CONTRB. FOR SOC. INS.	27.8	16.1	7.1	9.0	10.8	13.2	9.8	10.5	10.5	10.2
27	OASDI AND RAILROAD	23.1	17.3	6.3	9.5	11.7	14.9	10.2	10.9	10.8	10.4
28	FEDERAL EMPLOYEES	-.2	10.5	9.5	11.1	9.5	9.9	10.5	11.7	12.3	12.2
29	STATE AND LOCAL EMPLOYEES	35.0	12.5	12.6	7.1	9.7	9.8	9.7	11.0	10.5	10.4
30	SELF-EMPLOYMENT TAX AND OTHER	11.6	18.6	5.8	5.1	5.1	5.1	5.1	5.1	5.1	5.1
31	LESS: PERSONAL TAXES	9.8	16.9	-1.3	9.7	16.6	11.8	9.4	10.8	10.3	9.8
32	FEDERAL INCOME TAXES	9.2	20.0	-3.9	9.3	17.9	11.7	9.3	10.7	10.2	9.7
33	FEDERAL ESTATE AND GIFT	2.3	8.7	6.2	12.3	15.1	13.5	10.7	12.1	11.4	10.7
34	STATE AND LOCAL	13.2	8.7	5.9	10.5	12.9	11.7	9.3	10.7	10.2	9.7
35	EQUALS: DISPOSABLE PERSONAL INCOME	13.2	8.1	9.7	10.8	12.0	11.8	10.0	11.4	10.9	10.5
36	DISPOSABLE PERSONAL INCOME (72$)	5.9	-1.9	1.8	4.8	6.8	5.2	3.3	4.1	3.6	3.3
37	DIS. PERSONAL INCOME PER CAPITA (72$	5.1	-2.6	1.0	4.1	6.0	4.3	2.4	3.1	2.6	2.3
38	DPI ESTIMATE - LAST ITERATION	6.0	-2.1	.7	3.3	3.6	3.3	1.6	2.8	1.9	1.9

COMPONENTS OF GROSS PRODUCT ORIGINATING

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1 ALL INDUSTRIES, TOTAL											
GROSS PRODUCT ORIGINATING	1169.3	1316.9	1424.5	1513.1	1699.0	1911.6	2138.1	2316.3	2577.8	2843.4	3125.0
WAGES AND SALARIES	634.4	707.5	777.6	821.3	896.6	1004.0	1117.8	1218.4	1340.2	1473.4	1612.9
WAGE SUPPLEMENTS	80.5	95.8	107.9	115.5	127.9	145.4	167.0	185.7	208.6	234.2	261.7
FEDERAL EXCISE AND CUSTOMS	18.0	18.4	18.5	18.0	19.2	20.5	21.5	21.8	22.5	23.0	24.2
PROPERTY AND SALES TAXES	92.9	99.7	108.7	118.9	129.8	142.0	154.7	166.9	182.2	198.6	216.2
CAP. CONSUMPTION ALLOW.	100.5	110.9	121.3	128.9	138.2	151.5	166.3	182.7	200.6	221.0	243.0
PROPRIETOR INCOME	76.1	98.6	91.3	96.3	112.5	128.7	142.7	155.9	179.2	199.6	220.7
OTHER PROPERTY INCOME	166.7	186.1	199.2	214.2	274.7	319.5	368.1	384.9	444.4	493.6	546.5
REAL GROSS PRODUCT (72$)	1159.9	1231.0	1235.1	1200.0	1302.0	1400.6	1477.0	1510.5	1572.2	1629.2	1676.8
IMPLICIT GPO DEFLATOR	1.008	1.070	1.153	1.261	1.305	1.365	1.448	1.533	1.640	1.745	1.864
2 PRIVATE ECONOMY (DOMESTIC)											
GROSS PRODUCT ORIGINATING	1007.5	1139.3	1227.4	1296.3	1466.1	1658.8	1863.1	2017.1	2249.0	2482.6	2729.1
WAGES AND SALARIES	496.9	556.9	611.2	637.7	699.6	790.4	885.8	966.2	1063.2	1169.9	1280.4
WAGE SUPPLEMENTS	65.7	78.4	88.1	93.0	103.4	118.2	136.5	151.6	170.2	190.8	212.7
FEDERAL EXCISE AND CUSTOMS	18.0	18.4	18.5	18.0	19.2	20.5	21.5	21.8	22.5	23.0	24.2
PROPERTY AND SALES TAXES	92.9	99.7	108.7	118.9	129.8	142.0	154.7	166.9	182.2	198.6	216.2
CAP. CONSUMPTION ALLOW.	100.5	110.9	121.3	128.9	138.2	151.5	166.3	182.7	200.6	221.0	243.0
PROPRIETOR INCOME	76.1	98.6	91.3	96.3	112.5	128.7	142.7	155.9	179.2	199.6	220.7
OTHER PROPERTY INCOME	157.3	176.4	188.3	203.4	263.3	307.6	355.7	372.0	431.0	479.7	532.0
REAL GROSS PRODUCT (72$)	1007.5	1076.1	1076.8	1039.0	1141.9	1238.6	1313.1	1345.2	1405.0	1459.9	1505.5
IMPLICIT GPO DEFLATOR	1.000	1.059	1.140	1.248	1.284	1.339	1.419	1.500	1.601	1.700	1.813
3 AGRICULTURE,FORESTRY,&FISHERI											
GROSS PRODUCT ORIGINATING	35.4	60.8	59.5	55.6	59.5	66.2	73.5	80.1	88.4	97.6	107.8
WAGES AND SALARIES	5.8	7.7	9.4	10.8	12.5	13.3	13.7	14.1	14.6	15.1	15.6
WAGE SUPPLEMENTS	.5	.7	.9	1.0	1.2	1.3	1.3	1.4	1.5	1.6	1.7
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	2.2	2.2	2.3	2.5	2.6	2.7	2.9	3.0	3.1	3.3	3.4
CAP. CONSUMPTION ALLOW.	5.9	6.2	7.1	8.0	8.8	10.0	10.9	11.7	12.7	13.8	15.3
PROPRIETOR INCOME	21.2	39.7	34.9	29.6	30.6	34.5	39.7	44.5	50.6	57.4	64.6
OTHER PROPERTY INCOME	-.2	4.2	4.9	3.7	3.9	4.3	4.9	5.3	5.9	6.5	7.1
REAL GROSS PRODUCT (72$)	35.4	35.8	33.9	35.2	39.3	41.5	42.6	43.5	44.4	45.5	46.4
IMPLICIT GPO DEFLATOR	1.000	1.696	1.753	1.576	1.515	1.595	1.723	1.842	1.990	2.146	2.320
4 MINING											
GROSS PRODUCT ORIGINATING	18.9	23.8	35.7	40.5	42.8	48.0	56.5	63.9	73.5	85.0	96.2
WAGES AND SALARIES	6.6	7.4	8.8	11.1	11.6	12.0	12.6	13.5	15.0	16.5	18.1
WAGE SUPPLEMENTS	1.2	1.4	1.6	2.1	2.2	2.3	2.6	2.8	3.2	3.6	4.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.4	2.5	2.7	2.8
CAP. CONSUMPTION ALLOW.	4.7	4.8	5.0	5.3	5.5	5.8	6.0	6.3	6.6	6.8	7.1
PROPRIETOR INCOME	.1	.4	.6	.7	.6	.8	1.0	1.1	1.3	1.5	1.7
OTHER PROPERTY INCOME	4.8	8.3	17.9	19.5	20.8	25.0	32.0	37.7	45.0	53.9	62.5
REAL GROSS PRODUCT (72$)	18.9	19.0	18.8	17.9	18.5	19.5	20.7	21.0	21.6	22.2	22.6
IMPLICIT GPO DEFLATOR	1.000	1.249	1.896	2.259	2.318	2.465	2.727	3.034	3.407	3.823	4.262
5 CONTRACT CONSTRUCTION											
GROSS PRODUCT ORIGINATING	56.6	61.6	62.7	63.0	73.6	88.6	100.0	105.6	121.2	132.6	147.1
WAGES AND SALARIES	38.9	44.6	47.9	45.1	50.1	58.1	66.2	71.9	81.0	89.3	98.7
WAGE SUPPLEMENTS	4.1	5.0	5.6	5.3	6.0	7.0	8.2	9.2	10.6	11.9	13.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.1	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.1	2.2
CAP. CONSUMPTION ALLOW.	3.0	4.0	4.7	4.6	4.7	4.8	5.5	6.2	7.0	8.0	9.1
PROPRIETOR INCOME	7.0	6.4	5.1	6.4	8.8	11.9	13.1	12.6	15.3	16.2	18.0
OTHER PROPERTY INCOME	2.5	.6	-1.7	.4	2.7	5.4	5.4	3.8	5.5	5.1	5.6
REAL GROSS PRODUCT (72$)	56.6	57.7	52.0	46.2	49.8	56.0	61.1	61.4	65.0	66.6	68.1
IMPLICIT GPO DEFLATOR	1.000	1.069	1.205	1.362	1.477	1.582	1.637	1.722	1.865	1.991	2.160

COMPONENTS OF GROSS PRODUCT ORIGINATING

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
6 MANUFACTURING											
GROSS PRODUCT ORIGINATING	288.7	316.1	337.8	342.4	398.9	463.2	524.5	561.9	623.3	686.8	748.5
WAGES AND SALARIES	175.5	196.4	214.0	215.4	239.1	274.8	308.4	335.6	369.2	405.6	440.9
WAGE SUPPLEMENTS	27.8	32.9	36.5	37.2	41.7	48.4	55.6	61.4	68.6	76.6	84.7
FEDERAL EXCISE AND CUSTOMS	11.2	11.0	11.2	11.2	11.6	12.3	12.8	13.0	13.4	13.8	14.1
PROPERTY AND SALES TAXES	7.8	7.2	8.0	8.8	9.7	10.7	11.9	13.0	14.3	15.7	17.2
CAP. CONSUMPTION ALLOW.	24.8	27.6	31.3	33.4	36.4	40.6	46.1	51.4	56.0	62.0	68.2
PROPRIETOR INCOME	1.9	2.3	2.2	2.4	2.4	2.9	3.0	3.4	3.5	3.9	4.1
OTHER PROPERTY INCOME	39.6	38.8	34.6	33.9	58.0	73.5	86.6	84.1	98.2	109.2	119.4
REAL GROSS PRODUCT (72$)	288.7	312.0	313.0	283.4	321.7	355.6	380.4	387.2	403.2	418.7	428.8
IMPLICIT GPO DEFLATOR	1.000	1.013	1.079	1.208	1.240	1.302	1.379	1.451	1.546	1.640	1.746
7 NONDURABLE GOODS											
GROSS PRODUCT ORIGINATING	116.8	121.5	135.1	142.3	159.9	178.2	198.9	215.0	237.6	261.4	285.0
WAGES AND SALARIES	66.9	72.3	77.7	79.5	87.8	99.3	110.3	120.9	133.6	146.8	160.2
WAGE SUPPLEMENTS	9.6	11.0	12.1	12.6	14.0	15.9	18.2	20.2	22.8	25.5	28.3
FEDERAL EXCISE AND CUSTOMS	11.2	10.9	11.1	11.2	11.5	12.2	12.7	12.9	13.3	13.7	14.0
PROPERTY AND SALES TAXES	3.4	3.4	3.7	4.1	4.5	5.0	5.5	6.0	6.6	7.2	7.9
CAP. CONSUMPTION ALLOW.	10.1	11.1	12.3	13.3	14.6	16.4	18.6	20.6	22.8	24.9	27.1
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	15.6	12.9	18.2	21.8	27.5	29.4	33.6	34.3	38.6	43.3	47.5
REAL GROSS PRODUCT (72$)	116.8	122.4	124.3	117.4	131.0	141.9	149.3	152.9	158.8	164.9	169.8
IMPLICIT GPO DEFLATOR	1.000	.993	1.087	1.213	1.221	1.256	1.332	1.406	1.496	1.586	1.679
8 DURABLE GOODS											
GROSS PRODUCT ORIGINATING	171.9	194.7	202.7	200.1	239.0	285.0	325.6	346.9	385.7	425.3	463.4
WAGES AND SALARIES	108.6	124.1	136.3	136.0	151.3	175.5	198.1	214.7	235.6	258.7	280.8
WAGE SUPPLEMENTS	18.2	21.9	24.4	24.6	27.7	32.5	37.4	41.1	45.8	51.1	56.3
FEDERAL EXCISE AND CUSTOMS	.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
PROPERTY AND SALES TAXES	4.4	3.8	4.3	4.7	5.2	5.7	6.4	7.0	7.7	8.5	9.3
CAP. CONSUMPTION ALLOW.	14.7	16.5	19.0	20.1	21.8	24.2	27.5	30.9	33.2	37.1	41.0
PROPRIETOR INCOME	1.9	2.3	2.2	2.4	2.4	2.9	3.0	3.4	3.5	3.9	4.1
OTHER PROPERTY INCOME	24.0	25.9	16.5	12.2	30.5	44.1	53.1	49.7	59.7	65.9	71.8
REAL GROSS PRODUCT (72$)	171.9	189.7	188.7	166.0	190.7	213.7	231.0	234.3	244.4	253.9	259.0
IMPLICIT GPO DEFLATOR	1.000	1.026	1.074	1.205	1.253	1.333	1.409	1.481	1.578	1.675	1.789
9 TRANSPORTATION											
GROSS PRODUCT ORIGINATING	46.2	53.1	55.6	57.6	67.0	77.3	88.4	96.9	107.5	118.8	129.8
WAGES AND SALARIES	28.1	31.8	35.0	35.7	39.6	46.3	53.5	59.1	64.6	71.4	77.6
WAGE SUPPLEMENTS	3.8	4.6	5.2	5.4	6.0	7.1	8.4	9.4	10.5	11.8	13.1
FEDERAL EXCISE AND CUSTOMS	.7	.9	1.0	1.1	1.3	1.6	1.8	2.0	2.3	2.6	2.9
PROPERTY AND SALES TAXES	2.2	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.9	4.2
CAP. CONSUMPTION ALLOW.	6.3	6.7	6.9	7.5	7.8	8.2	8.9	9.6	10.5	11.1	11.7
PROPRIETOR INCOME	1.5	2.0	1.8	2.1	2.5	2.8	3.1	3.5	3.9	4.4	4.8
OTHER PROPERTY INCOME	3.6	4.9	3.3	3.3	7.1	6.3	9.6	9.8	12.1	13.6	15.5
REAL GROSS PRODUCT (72$)	46.2	50.8	51.3	49.8	54.9	59.8	63.8	66.1	69.8	73.0	76.0
IMPLICIT GPO DEFLATOR	1.000	1.046	1.082	1.156	1.221	1.291	1.385	1.466	1.542	1.627	1.707
10 COMMUNICATION											
GROSS PRODUCT ORIGINATING	29.4	33.2	35.2	37.7	44.7	50.5	59.5	65.9	71.6	77.2	83.3
WAGES AND SALARIES	11.5	13.0	14.3	16.2	18.7	21.7	24.9	27.8	29.8	32.2	34.9
WAGE SUPPLEMENTS	3.1	3.6	4.1	4.7	5.5	6.5	7.6	8.5	9.3	10.2	11.1
FEDERAL EXCISE AND CUSTOMS	1.8	1.6	1.8	1.6	1.6	1.4	1.3	1.0	.7	.3	.4
PROPERTY AND SALES TAXES	2.2	2.1	2.3	2.5	2.8	3.0	3.3	3.6	3.9	4.2	4.6
CAP. CONSUMPTION ALLOW.	5.6	6.1	6.8	7.3	7.8	8.9	10.3	11.9	13.7	15.5	17.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	5.1	6.5	7.0	5.5	8.2	9.1	12.2	13.2	14.3	14.8	15.3
REAL GROSS PRODUCT (72$)	29.4	32.5	33.8	34.6	37.6	41.4	44.6	46.3	49.6	53.3	56.9
IMPLICIT GPO DEFLATOR	1.000	1.023	1.071	1.092	1.187	1.220	1.335	1.422	1.443	1.448	1.463
11 ELECTRIC,GAS & SANITARY											
GROSS PRODUCT ORIGINATING	28.0	31.1	33.5	38.4	42.4	48.0	53.0	56.9	63.7	69.9	77.2
WAGES AND SALARIES	7.9	8.7	9.4	9.9	11.0	12.6	14.1	15.5	17.0	18.5	20.2
WAGE SUPPLEMENTS	1.4	1.6	1.8	1.9	2.1	2.5	2.8	3.1	3.5	3.9	4.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	4.2	3.9	4.2	4.6	5.0	5.2	5.4	5.6	5.9	6.2	6.6
CAP. CONSUMPTION ALLOW.	6.1	6.8	7.5	8.2	8.5	9.1	10.0	10.9	11.9	13.0	14.1
PROPRIETOR INCOME	.3	.3	.4	.4	.5	.6	.7	.8	.9	.9	1.1
OTHER PROPERTY INCOME	8.0	9.8	10.3	13.4	15.2	18.0	20.0	21.1	24.6	27.4	31.0
REAL GROSS PRODUCT (72$)	28.0	29.1	29.0	28.8	30.1	31.7	32.7	32.9	33.8	34.3	34.8
IMPLICIT GPO DEFLATOR	1.000	1.067	1.158	1.331	1.406	1.516	1.621	1.731	1.887	2.035	2.219

COMPONENTS OF GROSS PRODUCT ORIGINATING

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
12 WHOLESALE AND RETAIL TRADE											
GROSS PRODUCT ORIGINATING	201.2	226.6	246.8	268.8	296.7	326.9	358.9	380.3	418.8	458.0	499.0
WAGES AND SALARIES	104.5	115.6	125.5	136.3	144.7	156.6	170.7	182.2	197.8	214.9	234.0
WAGE SUPPLEMENTS	10.9	13.0	14.5	16.0	17.1	18.7	21.1	23.0	25.6	28.5	31.8
FEDERAL EXCISE AND CUSTOMS	4.2	4.6	4.6	4.1	4.8	5.2	5.6	5.8	6.1	6.3	6.7
PROPERTY AND SALES TAXES	35.9	41.6	45.0	49.1	53.8	59.3	65.1	69.8	76.8	84.2	92.2
CAP. CONSUMPTION ALLOW.	11.2	12.4	13.3	13.9	14.8	16.2	16.5	17.6	19.2	21.2	23.4
PROPRIETOR INCOME	14.0	17.1	17.2	21.4	24.9	28.9	31.4	33.6	37.6	42.2	45.2
OTHER PROPERTY INCOME	20.5	22.3	26.6	28.1	36.6	42.0	48.4	48.1	55.7	60.7	65.7
REAL GROSS PRODUCT (72$)	201.2	217.3	216.0	212.6	231.5	248.8	262.0	267.9	279.6	290.2	299.9
IMPLICIT GPO DEFLATOR	1.000	1.043	1.143	1.264	1.282	1.314	1.370	1.419	1.498	1.578	1.664
13 FINANCE, INSURANCE & REAL EST											
GROSS PRODUCT ORIGINATING	168.6	184.3	196.9	212.9	237.4	265.0	294.8	320.1	355.5	393.7	434.7
WAGES AND SALARIES	33.3	36.9	40.0	41.8	46.6	54.0	61.9	67.5	74.2	83.3	92.5
WAGE SUPPLEMENTS	4.9	5.7	6.3	6.7	7.5	8.7	10.2	11.4	12.7	14.6	16.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	32.0	34.2	37.5	41.2	44.9	48.8	53.1	57.5	62.6	68.0	73.8
CAP. CONSUMPTION ALLOW.	24.9	27.4	28.9	30.6	32.9	35.9	39.1	42.4	46.6	51.0	55.8
PROPRIETOR INCOME	4.6	3.5	2.6	2.7	4.0	5.1	5.6	5.6	6.1	6.3	6.8
OTHER PROPERTY INCOME	69.0	76.7	81.6	89.9	101.5	112.5	124.8	135.6	153.3	170.5	189.2
REAL GROSS PRODUCT (72$)	168.6	179.2	184.9	187.6	203.1	217.5	228.4	235.2	245.0	254.6	263.1
IMPLICIT GPO DEFLATOR	1.000	1.029	1.065	1.135	1.169	1.218	1.291	1.361	1.451	1.546	1.652
14 SERVICES											
GROSS PRODUCT ORIGINATING	134.4	148.7	162.7	179.6	203.0	225.2	254.1	285.5	325.3	363.0	405.7
WAGES AND SALARIES	84.7	95.0	106.9	115.4	125.6	141.0	159.5	178.9	200.2	223.1	247.9
WAGE SUPPLEMENTS	8.1	9.9	11.6	12.8	14.0	15.9	18.6	21.4	24.6	28.1	32.1
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	3.8	3.7	4.2	4.6	5.1	5.7	6.2	6.8	7.6	8.3	9.2
CAP. CONSUMPTION ALLOW.	8.0	9.0	9.7	10.3	10.9	12.0	13.0	14.6	16.5	18.8	21.3
PROPRIETOR INCOME	25.3	26.7	26.5	30.7	38.2	41.1	45.0	50.5	60.0	66.7	74.5
OTHER PROPERTY INCOME	4.5	4.3	3.8	5.7	9.2	9.6	11.8	13.2	16.4	18.0	20.7
REAL GROSS PRODUCT (72$)	134.4	142.7	144.0	142.9	155.3	166.7	176.8	183.5	193.1	201.5	208.9
IMPLICIT GPO DEFLATOR	1.000	1.042	1.130	1.257	1.307	1.351	1.437	1.555	1.685	1.802	1.942
15 GOVERNMENT AND GOVERNMENT ENT											
GROSS PRODUCT ORIGINATING	154.8	168.5	187.6	206.8	222.4	241.7	263.4	287.2	316.3	347.9	382.4
WAGES AND SALARIES	137.6	150.5	166.4	183.6	197.0	213.7	232.1	252.2	276.9	303.5	332.5
WAGE SUPPLEMENTS	14.9	17.4	19.8	22.4	24.6	27.2	30.5	34.1	38.5	43.4	49.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.3	.6	1.4	.8	.8	.8	.9	.9	.9	.9	.9
REAL GROSS PRODUCT (72$)	152.5	154.9	158.3	161.0	160.2	162.0	163.9	165.3	167.2	169.2	171.3
IMPLICIT GPO DEFLATOR	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

COMPONENTS OF GROSS PRODUCT ORIGINATING (RATIOS TO GPO)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1 ALL INDUSTRIES, TOTAL											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.543	.537	.546	.543	.528	.525	.523	.526	.520	.518	.516
WAGE SUPPLEMENTS	.069	.073	.076	.076	.075	.076	.078	.080	.081	.082	.084
FEDERAL EXCISE AND CUSTOMS	.015	.014	.013	.012	.011	.011	.010	.009	.009	.008	.008
PROPERTY AND SALES TAXES	.079	.076	.076	.079	.076	.074	.072	.072	.071	.070	.069
CAP. CONSUMPTION ALLOW.	.086	.084	.085	.085	.081	.079	.078	.079	.078	.078	.078
PROPRIETOR INCOME	.065	.075	.064	.064	.066	.067	.067	.067	.070	.070	.071
OTHER PROPERTY INCOME	.143	.141	.140	.142	.162	.167	.172	.166	.172	.174	.175
2 PRIVATE ECONOMY (DOMESTIC)											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.493	.489	.498	.492	.477	.476	.475	.479	.473	.471	.469
WAGE SUPPLEMENTS	.065	.069	.072	.072	.071	.071	.073	.075	.076	.077	.078
FEDERAL EXCISE AND CUSTOMS	.018	.016	.015	.014	.013	.012	.012	.011	.010	.009	.009
PROPERTY AND SALES TAXES	.092	.088	.089	.092	.089	.086	.083	.083	.081	.080	.079
CAP. CONSUMPTION ALLOW.	.100	.097	.099	.099	.094	.091	.089	.091	.089	.089	.089
PROPRIETOR INCOME	.076	.087	.074	.074	.077	.078	.077	.077	.080	.080	.081
OTHER PROPERTY INCOME	.156	.155	.153	.157	.180	.185	.191	.184	.192	.193	.195
3 AGRICULTURE,FORESTRY,&FISHERI											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.164	.127	.159	.194	.210	.202	.186	.176	.165	.155	.145
WAGE SUPPLEMENTS	.014	.011	.015	.018	.020	.019	.018	.018	.017	.016	.016
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.063	.036	.039	.044	.043	.041	.039	.037	.035	.034	.032
CAP. CONSUMPTION ALLOW.	.166	.102	.120	.143	.149	.152	.149	.146	.144	.141	.142
PROPRIETOR INCOME	.600	.654	.586	.533	.514	.521	.541	.556	.572	.587	.600
OTHER PROPERTY INCOME	-.007	.069	.082	.067	.065	.066	.067	.067	.067	.067	.066
4 MINING											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.350	.309	.245	.275	.272	.251	.226	.212	.203	.195	.188
WAGE SUPPLEMENTS	.061	.057	.046	.052	.053	.049	.046	.044	.043	.042	.042
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.082	.067	.048	.045	.045	.043	.039	.037	.034	.031	.029
CAP. CONSUMPTION ALLOW.	.248	.202	.141	.131	.128	.120	.106	.098	.089	.080	.074
PROPRIETOR INCOME	.007	.016	.018	.016	.015	.017	.017	.018	.018	.018	.017
OTHER PROPERTY INCOME	.252	.349	.502	.481	.487	.520	.566	.591	.613	.634	.650
5 CONTRACT CONSTRUCTION											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.688	.723	.763	.716	.681	.655	.662	.681	.668	.673	.671
WAGE SUPPLEMENTS	.072	.082	.089	.085	.081	.079	.082	.087	.087	.090	.092
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.019	.017	.018	.020	.018	.017	.016	.017	.016	.016	.015
CAP. CONSUMPTION ALLOW.	.054	.065	.075	.073	.063	.054	.055	.059	.058	.060	.062
PROPRIETOR INCOME	.124	.104	.082	.101	.120	.135	.131	.121	.126	.122	.122
OTHER PROPERTY INCOME	.044	.009	-.028	.006	.036	.060	.054	.036	.045	.038	.038

COMPONENTS OF GROSS PRODUCT ORIGINATING (RATIOS TO GPO)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
6 MANUFACTURING											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.608	.621	.634	.629	.599	.593	.588	.597	.592	.591	.589
WAGE SUPPLEMENTS	.096	.104	.106	.109	.105	.105	.106	.109	.110	.112	.113
FEDERAL EXCISE AND CUSTOMS	.039	.035	.033	.033	.029	.026	.024	.023	.021	.020	.019
PROPERTY AND SALES TAXES	.027	.023	.024	.026	.024	.023	.023	.023	.023	.023	.023
CAP. CONSUMPTION ALLOW.	.086	.087	.093	.098	.091	.088	.088	.092	.090	.090	.091
PROPRIETOR INCOME	.007	.007	.006	.007	.006	.006	.006	.006	.006	.006	.005
OTHER PROPERTY INCOME	.137	.123	.103	.099	.145	.159	.165	.150	.158	.159	.159
7 NONDURABLE GOODS											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.573	.595	.575	.558	.549	.557	.555	.562	.562	.562	.562
WAGE SUPPLEMENTS	.092	.090	.090	.088	.088	.089	.091	.094	.096	.098	.099
FEDERAL EXCISE AND CUSTOMS	.096	.090	.082	.078	.072	.068	.064	.060	.056	.052	.049
PROPERTY AND SALES TAXES	.030	.028	.027	.029	.028	.028	.028	.028	.028	.027	.028
CAP. CONSUMPTION ALLOW.	.086	.091	.091	.093	.092	.092	.094	.096	.096	.095	.095
PROPRIETOR INCOME	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
OTHER PROPERTY INCOME	.134	.106	.134	.153	.172	.165	.169	.160	.162	.166	.167
8 DURABLE GOODS											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.632	.638	.673	.680	.633	.616	.608	.619	.611	.608	.606
WAGE SUPPLEMENTS	.106	.113	.120	.123	.116	.114	.115	.119	.119	.120	.122
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.026	.020	.021	.024	.022	.020	.020	.020	.020	.020	.020
CAP. CONSUMPTION ALLOW.	.086	.085	.094	.101	.091	.085	.085	.089	.086	.087	.088
PROPRIETOR INCOME	.011	.012	.011	.012	.010	.010	.009	.010	.009	.009	.009
OTHER PROPERTY INCOME	.139	.133	.081	.061	.128	.155	.163	.143	.155	.155	.155
9 TRANSPORTATION											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.607	.599	.630	.619	.590	.599	.605	.610	.601	.601	.598
WAGE SUPPLEMENTS	.083	.087	.094	.093	.090	.091	.095	.097	.098	.099	.101
FEDERAL EXCISE AND CUSTOMS	.016	.017	.019	.019	.020	.020	.020	.021	.021	.022	.023
PROPERTY AND SALES TAXES	.047	.042	.043	.045	.041	.038	.036	.035	.034	.033	.032
CAP. CONSUMPTION ALLOW.	.136	.125	.124	.130	.116	.107	.101	.099	.097	.094	.090
PROPRIETOR INCOME	.033	.038	.032	.037	.037	.036	.035	.036	.036	.037	.037
OTHER PROPERTY INCOME	.078	.092	.059	.057	.106	.108	.108	.101	.113	.114	.119
10 COMMUNICATION											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.392	.390	.394	.428	.419	.429	.419	.421	.416	.418	.419
WAGE SUPPLEMENTS	.106	.110	.113	.125	.124	.128	.127	.129	.130	.132	.134
FEDERAL EXCISE AND CUSTOMS	.063	.055	.048	.042	.035	.028	.021	.015	.010	.004	.004
PROPERTY AND SALES TAXES	.074	.063	.064	.067	.062	.060	.055	.054	.054	.054	.055
CAP. CONSUMPTION ALLOW.	.190	.185	.188	.192	.176	.175	.173	.181	.191	.200	.204
PROPRIETOR INCOME	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
OTHER PROPERTY INCOME	.175	.197	.193	.145	.184	.180	.204	.200	.199	.192	.184
11 ELECTRIC,GAS & SANITARY											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.283	.280	.280	.258	.260	.263	.267	.272	.267	.265	.261
WAGE SUPPLEMENTS	.051	.052	.053	.050	.050	.051	.053	.055	.055	.055	.056
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.151	.125	.125	.121	.117	.109	.101	.098	.092	.089	.085
CAP. CONSUMPTION ALLOW.	.218	.218	.225	.213	.201	.190	.188	.191	.187	.185	.183
PROPRIETOR INCOME	.012	.011	.011	.011	.012	.012	.013	.013	.014	.014	.014
OTHER PROPERTY INCOME	.285	.315	.307	.348	.360	.375	.378	.371	.385	.391	.402

COMPONENTS OF GROSS PRODUCT ORIGINATING (RATIOS TO GPO)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
12 WHOLESALE AND RETAIL TRADE											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.519	.510	.509	.507	.488	.479	.476	.479	.472	.469	.469
WAGE SUPPLEMENTS	.054	.057	.059	.059	.058	.057	.059	.061	.061	.062	.064
FEDERAL EXCISE AND CUSTOMS	.021	.020	.018	.015	.016	.016	.016	.015	.015	.014	.013
PROPERTY AND SALES TAXES	.178	.183	.183	.183	.181	.181	.181	.184	.183	.184	.185
CAP. CONSUMPTION ALLOW.	.056	.055	.054	.052	.050	.049	.046	.046	.046	.046	.047
PROPRIETOR INCOME	.070	.076	.070	.080	.084	.088	.087	.088	.090	.092	.091
OTHER PROPERTY INCOME	.102	.099	.108	.105	.123	.128	.135	.127	.133	.133	.132
13 FINANCE, INSURANCE & REAL EST											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.197	.200	.203	.197	.196	.204	.210	.211	.209	.212	.213
WAGE SUPPLEMENTS	.029	.031	.032	.031	.032	.033	.035	.035	.036	.037	.038
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.190	.186	.190	.193	.189	.184	.180	.180	.176	.173	.170
CAP. CONSUMPTION ALLOW.	.148	.148	.147	.144	.139	.136	.133	.132	.131	.130	.128
PROPRIETOR INCOME	.027	.019	.013	.012	.017	.019	.019	.018	.017	.016	.016
OTHER PROPERTY INCOME	.409	.416	.414	.422	.428	.424	.424	.424	.431	.433	.435
14 SERVICES											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.630	.639	.657	.643	.618	.626	.628	.627	.615	.614	.611
WAGE SUPPLEMENTS	.060	.067	.071	.071	.069	.070	.073	.075	.076	.078	.079
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.028	.025	.026	.026	.025	.025	.024	.024	.023	.023	.023
CAP. CONSUMPTION ALLOW.	.060	.061	.059	.058	.054	.053	.051	.051	.051	.052	.053
PROPRIETOR INCOME	.188	.180	.163	.171	.188	.183	.177	.177	.185	.184	.184
OTHER PROPERTY INCOME	.034	.029	.024	.032	.045	.043	.046	.046	.050	.050	.051
15 GOVERNMENT AND GOVERNMENT ENT											
GROSS PRODUCT ORIGINATING	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WAGES AND SALARIES	.889	.893	.887	.888	.886	.884	.881	.878	.876	.873	.869
WAGE SUPPLEMENTS	.096	.103	.106	.108	.110	.113	.116	.119	.122	.125	.128
FEDERAL EXCISE AND CUSTOMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPERTY AND SALES TAXES	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
CAP. CONSUMPTION ALLOW.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
PROPRIETOR INCOME	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
OTHER PROPERTY INCOME	.015	.004	.007	.004	.004	.004	.003	.003	.003	.003	.002

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1 FARMS											
GROSS PRODUCT ORIGINATING	32.0	55.5	54.7	51.9	54.8	60.9	67.5	73.9	81.8	90.6	100.3
WAGES AND SALARIES	4.2	5.7	7.6	9.0	10.5	11.4	11.8	12.3	12.9	13.5	14.2
WAGE SUPPLEMENTS	.3	.5	.7	.8	.9	1.0	1.1	1.2	1.3	1.4	1.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1
CAP. CONSUMPTION ALLOW.	5.4	5.7	6.6	7.5	8.2	9.3	10.1	10.9	11.9	12.9	14.3
PROPRIETOR INCOME	20.5	38.0	33.1	28.8	29.1	32.6	37.2	41.5	46.9	52.9	59.3
OTHER PROPERTY INCOME	-.5	3.4	4.5	3.6	3.6	4.1	4.7	5.3	6.0	6.9	7.9
REAL GROSS PRODUCT (72$)	32.0	32.1	30.4	31.9	35.5	37.5	38.4	39.2	40.0	40.9	41.7
IMPLICIT GPO DEFLATOR	1.000	1.729	1.797	1.630	1.545	1.625	1.758	1.887	2.046	2.216	2.404
2 AGRICULTURAL SERVICES, FOREST											
GROSS PRODUCT ORIGINATING	3.3	5.3	4.8	3.6	4.7	5.3	5.9	6.2	6.6	7.0	7.5
WAGES AND SALARIES	1.6	2.0	1.8	1.8	2.0	2.0	1.9	1.8	1.7	1.6	1.5
WAGE SUPPLEMENTS	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.2	.2	.2	.2	.2	.2	.3	.3
CAP. CONSUMPTION ALLOW.	.5	.5	.5	.5	.6	.7	.8	.8	.9	.9	1.0
PROPRIETOR INCOME	.8	1.7	1.7	.8	1.4	1.9	2.5	3.1	3.7	4.5	5.3
OTHER PROPERTY INCOME	.3	.8	.4	.1	.3	.3	.2	.1	-.1	-.4	-.7
REAL GROSS PRODUCT (72$)	3.3	3.8	3.5	3.4	3.8	4.0	4.2	4.3	4.5	4.6	4.7
IMPLICIT GPO DEFLATOR	1.000	1.416	1.368	1.073	1.235	1.314	1.401	1.441	1.482	1.528	1.582
3 METAL MINING											
GROSS PRODUCT ORIGINATING	1.3	1.5	2.1	1.8	2.0	2.3	2.6	2.8	3.1	3.4	3.8
WAGES AND SALARIES	.9	1.0	1.1	1.3	1.5	1.7	1.8	1.9	2.1	2.3	2.5
WAGE SUPPLEMENTS	.2	.2	.2	.3	.3	.4	.4	.4	.5	.5	.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.2	.2	.2	.2	.2	.3	.3	.3
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-.2	-.1	.4	-.1	-.2	-.2	-.0	.0	.1	.1	.2
REAL GROSS PRODUCT (72$)	1.3	1.3	1.3	1.2	1.3	1.5	1.6	1.6	1.7	1.7	1.7
IMPLICIT GPO DEFLATOR	1.000	1.150	1.654	1.597	1.521	1.548	1.647	1.751	1.874	2.009	2.158
4 COAL MINING											
GROSS PRODUCT ORIGINATING	3.1	3.6	6.4	8.1	7.8	9.2	11.4	13.5	16.5	19.9	23.9
WAGES AND SALARIES	1.8	2.0	2.3	3.2	3.5	3.7	4.1	4.6	5.4	6.4	7.4
WAGE SUPPLEMENTS	.4	.5	.6	.8	.9	1.0	1.1	1.2	1.5	1.8	2.1
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.2	.2	.2	.2	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.4	.5	.6	.7	.7	.8	.8	.9	1.1	1.2	1.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	.5	2.8	3.2	2.6	3.6	5.2	6.5	8.3	10.4	12.8
REAL GROSS PRODUCT (72$)	3.1	3.1	3.2	3.3	3.5	3.7	4.1	4.4	4.8	5.2	5.6
IMPLICIT GPO DEFLATOR	1.000	1.154	2.021	2.413	2.239	2.447	2.747	3.054	3.426	3.835	4.299
5 CRUDE PETROLEUM & NATURAL GAS											
GROSS PRODUCT ORIGINATING	12.3	16.3	23.9	26.9	28.6	31.5	36.8	41.4	47.1	53.9	60.0
WAGES AND SALARIES	2.8	3.1	3.9	5.1	4.9	4.8	4.9	4.9	5.0	5.2	5.2
WAGE SUPPLEMENTS	.4	.5	.6	.8	.8	.8	.8	.8	.9	.9	.9
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.9	2.0	2.1
CAP. CONSUMPTION ALLOW.	3.6	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.6	4.7	4.7
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	4.4	8.0	14.4	15.8	17.4	20.2	25.2	29.5	34.8	41.3	47.2
REAL GROSS PRODUCT (72$)	12.3	12.2	11.9	11.2	11.2	11.6	12.1	12.0	12.0	12.0	11.8

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
IMPLICIT GPO DEFLATOR	1.000	1.331	2.014	2.398	2.555	2.726	3.042	3.447	3.940	4.493	5.069
6 MINING AND QUARRYING OF NONME											
GROSS PRODUCT ORIGINATING	2.3	2.4	3.2	3.7	4.4	5.0	5.8	6.2	6.8	7.6	8.5
WAGES AND SALARIES	1.1	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.7	3.0
WAGE SUPPLEMENTS	.1	.2	.2	.2	.2	.3	.3	.3	.4	.4	.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.5	.5	.5	.5	.6	.7	.7	.7	.7	.7	.8
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.4	.3	1.0	1.3	1.7	2.1	2.6	2.8	3.2	3.6	4.0
REAL GROSS PRODUCT (72$)	2.3	2.4	2.5	2.2	2.5	2.7	2.9	3.0	3.2	3.3	3.4
IMPLICIT GPO DEFLATOR	1.000	1.011	1.297	1.665	1.784	1.866	1.975	2.044	2.163	2.309	2.478
7 CONTRACT CONSTRUCTION											
GROSS PRODUCT ORIGINATING	56.6	61.6	62.7	63.0	73.6	88.6	100.0	105.6	121.2	132.6	147.1
WAGES AND SALARIES	38.9	44.6	47.9	45.1	50.1	58.1	66.2	71.9	81.0	89.3	98.7
WAGE SUPPLEMENTS	4.1	5.0	5.6	5.3	6.0	7.0	8.2	9.2	10.6	11.9	13.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.1	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.1	2.2
CAP. CONSUMPTION ALLOW.	3.0	4.0	4.7	4.6	4.7	4.8	5.5	6.2	7.0	8.0	9.1
PROPRIETOR INCOME	7.0	6.4	5.1	6.4	8.8	11.9	13.1	12.8	15.3	16.2	18.0
OTHER PROPERTY INCOME	2.5	.6	-1.7	.4	2.7	5.4	5.4	3.8	5.5	5.1	5.6
REAL GROSS PRODUCT (72$)	56.6	57.7	52.0	46.2	49.8	56.0	61.1	61.4	65.0	66.6	68.1
IMPLICIT GPO DEFLATOR	1.000	1.069	1.205	1.362	1.477	1.582	1.637	1.722	1.865	1.991	2.160
8 FOOD AND KINDRED PRODUCTS											
GROSS PRODUCT ORIGINATING	27.6	26.1	33.7	39.3	40.7	41.1	46.1	50.5	55.1	60.1	65.6
WAGES AND SALARIES	14.7	15.5	16.6	17.6	19.3	21.6	23.7	25.8	28.2	30.8	33.5
WAGE SUPPLEMENTS	2.2	2.4	2.7	2.8	3.1	3.5	4.0	4.4	4.9	5.5	6.1
FEDERAL EXCISE AND CUSTOMS	4.3	4.2	4.5	4.6	4.7	5.1	5.3	5.4	5.6	5.8	5.9
PROPERTY AND SALES TAXES	1.3	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.7	2.9	3.2
CAP. CONSUMPTION ALLOW.	2.1	2.3	2.5	2.6	2.8	3.0	3.4	3.7	4.1	4.3	4.6
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	3.0	.3	6.1	10.1	9.0	5.9	7.6	8.7	9.6	10.8	12.2
REAL GROSS PRODUCT (72$)	27.6	27.8	29.0	27.9	30.1	31.7	32.5	33.3	34.1	35.1	35.9
IMPLICIT GPO DEFLATOR	1.000	.937	1.165	1.411	1.352	1.295	1.417	1.515	1.615	1.715	1.826
9 TOBACCO MANUFACTURES											
GROSS PRODUCT ORIGINATING	4.2	4.6	5.1	5.7	6.0	6.4	6.8	7.3	7.7	8.2	8.6
WAGES AND SALARIES	.6	.7	.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5
WAGE SUPPLEMENTS	.1	.2	.2	.2	.2	.3	.3	.3	.3	.4	.4
FEDERAL EXCISE AND CUSTOMS	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.6	2.6	2.7
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.2	.2	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.2	.2	.3	.3	.3	.3	.3	.4	.4	.5	.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.0	1.0	1.4	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3
REAL GROSS PRODUCT (72$)	4.2	4.3	4.3	4.3	4.5	4.5	4.6	4.6	4.7	4.8	4.9
IMPLICIT GPO DEFLATOR	1.000	1.059	1.175	1.315	1.348	1.431	1.494	1.574	1.645	1.708	1.769
10 TEXTILE MILL PRODUCTS											
GROSS PRODUCT ORIGINATING	9.3	9.8	10.3	9.9	12.0	14.4	16.3	17.6	19.9	22.0	24.1
WAGES AND SALARIES	6.7	7.4	7.6	7.3	8.4	9.6	10.8	11.7	13.0	14.3	15.5
WAGE SUPPLEMENTS	.8	.9	.9	.9	1.1	1.2	1.4	1.6	1.8	2.0	2.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.2	.2	.3	.3	.3	.3	.4	.4
CAP. CONSUMPTION ALLOW.	.8	.9	.9	.9	1.0	1.1	1.2	1.4	1.5	1.6	1.7
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.9	.4	.7	.6	1.3	2.2	2.5	2.6	3.2	3.8	4.3
REAL GROSS PRODUCT (72$)	9.3	10.1	9.9	9.3	10.6	11.8	12.5	12.7	13.3	13.7	14.2
IMPLICIT GPO DEFLATOR	1.000	.967	1.042	1.066	1.132	1.227	1.301	1.388	1.499	1.605	1.705

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
11 APPAREL											
GROSS PRODUCT ORIGINATING	9.9	10.6	11.1	11.3	12.8	14.5	15.7	17.0	19.3	21.5	23.8
WAGES AND SALARIES	7.6	8.1	8.6	8.6	9.7	10.7	11.8	13.0	14.4	15.9	17.4
WAGE SUPPLEMENTS	.9	1.0	1.1	1.1	1.3	1.5	1.7	1.8	2.1	2.4	2.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.2	.2	.2	.2	.3	.3	.3	.3	.4
CAP. CONSUMPTION ALLOW.	.2	.3	.3	.3	.4	.4	.4	.5	.5	.6	.6
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.1	1.0	1.0	1.1	1.3	1.7	1.6	1.5	1.9	2.3	2.7
REAL GROSS PRODUCT (72$)	9.9	10.9	10.6	9.8	11.9	12.5	13.0	12.9	13.4	13.6	13.9
IMPLICIT GPO DEFLATOR	1.000	.970	1.050	1.147	1.079	1.158	1.210	1.324	1.441	1.584	1.710
12 LUMBER AND WOOD PRODUCTS											
GROSS PRODUCT ORIGINATING	8.9	9.5	11.1	10.4	11.9	14.6	17.1	18.5	20.5	23.0	25.4
WAGES AND SALARIES	4.6	5.2	5.5	5.2	5.9	6.7	7.7	8.5	9.5	10.5	11.4
WAGE SUPPLEMENTS	.6	.8	.8	.8	.9	1.0	1.2	1.4	1.6	1.8	2.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.3	.3	.3	.3	.4	.4	.4	.5
CAP. CONSUMPTION ALLOW.	.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.1	2.4
PROPRIETOR INCOME	.6	.5	.7	.6	.7	.8	1.0	1.0	1.1	1.2	1.4
OTHER PROPERTY INCOME	1.9	1.8	2.6	2.2	2.7	4.3	5.2	5.6	6.1	7.0	7.9
REAL GROSS PRODUCT (72$)	8.9	9.1	8.8	8.1	9.3	10.4	11.3	11.3	11.9	12.3	12.6
IMPLICIT GPO DEFLATOR	1.000	1.045	1.263	1.278	1.272	1.399	1.518	1.636	1.721	1.872	2.023
13 FURNITURE AND FIXTURES											
GROSS PRODUCT ORIGINATING	4.8	5.3	5.3	4.8	5.6	7.1	8.4	9.3	10.6	12.0	13.1
WAGES AND SALARIES	3.6	4.0	4.3	3.9	4.2	5.1	6.1	6.9	7.7	8.7	9.5
WAGE SUPPLEMENTS	.4	.5	.6	.5	.6	.7	.9	1.0	1.2	1.3	1.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.2	.2	.2	.2	.2	.2	.3	.3
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.5	.4	.1	.1	.4	.9	1.0	1.0	1.3	1.5	1.7
REAL GROSS PRODUCT (72$)	4.8	5.3	5.1	4.4	5.0	5.7	6.2	6.2	6.5	6.7	6.7
IMPLICIT GPO DEFLATOR	1.000	.989	1.040	1.106	1.121	1.240	1.358	1.483	1.629	1.788	1.950
14 PAPER AND ALLIED PRODUCTS											
GROSS PRODUCT ORIGINATING	11.0	12.1	13.3	14.1	16.5	19.3	21.7	23.6	26.2	28.9	31.6
WAGES AND SALARIES	6.7	7.4	7.8	7.9	9.1	10.6	11.9	13.1	14.4	15.9	17.3
WAGE SUPPLEMENTS	1.0	1.1	1.2	1.3	1.5	1.7	2.0	2.2	2.5	2.8	3.1
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.3	.3	.3	.4	.4	.4	.5	.5	.6	.6	.7
CAP. CONSUMPTION ALLOW.	1.2	1.2	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.3
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.8	2.0	2.5	3.1	4.0	4.9	5.6	5.9	6.7	7.5	8.3
REAL GROSS PRODUCT (72$)	11.0	11.7	11.6	10.7	11.9	13.0	13.6	13.9	14.4	14.9	15.3
IMPLICIT GPO DEFLATOR	1.000	1.035	1.144	1.321	1.391	1.484	1.597	1.700	1.819	1.936	2.063
15 PRINTING AND PUBLISHING											
GROSS PRODUCT ORIGINATING	14.6	15.5	15.9	16.3	18.0	20.3	23.1	25.3	28.7	32.1	35.5
WAGES AND SALARIES	10.1	10.8	11.5	11.8	12.5	13.9	15.7	17.2	19.1	21.1	23.2
WAGE SUPPLEMENTS	1.1	1.3	1.4	1.5	1.6	1.8	2.1	2.3	2.6	3.0	3.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.3	.3	.3	.3	.3	.4	.4	.4	.5	.5	.6
CAP. CONSUMPTION ALLOW.	.8	1.0	1.1	1.1	1.3	1.4	1.6	1.6	1.8	2.0	2.2
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.3	2.2	1.6	1.6	2.3	2.8	3.4	3.7	4.7	5.5	6.2
REAL GROSS PRODUCT (72$)	14.6	15.5	15.6	15.0	16.1	17.1	18.0	18.5	19.3	20.0	20.6
IMPLICIT GPO DEFLATOR	1.000	1.004	1.019	1.085	1.117	1.183	1.284	1.369	1.485	1.604	1.725
16 CHEMICALS AND ALLIED PRODUCTS											

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
GROSS PRODUCT ORIGINATING	21.5	23.2	25.7	25.5	30.4	35.5	39.8	42.1	45.5	49.7	53.5
WAGES AND SALARIES	11.2	12.1	13.6	14.3	15.6	17.8	19.7	21.6	23.6	25.8	28.1
WAGE SUPPLEMENTS	1.7	1.9	2.2	2.4	2.6	3.0	3.4	3.8	4.2	4.7	5.2
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.6	.6	.6	.7	.7	.8	.9	1.0	1.1	1.2	1.3
CAP. CONSUMPTION ALLOW.	2.9	3.0	3.4	3.8	4.1	4.6	5.2	5.5	6.2	6.9	7.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	5.2	5.6	5.8	4.4	7.3	9.3	10.7	10.2	10.4	11.1	11.4
REAL GROSS PRODUCT (72$)	21.5	22.8	23.6	22.1	25.4	28.7	31.1	32.3	33.8	35.8	37.3
IMPLICIT GPO DEFLATOR	1.000	1.016	1.087	1.158	1.194	1.240	1.281	1.305	1.347	1.388	1.435
17 PETROLEUM REFINING											
GROSS PRODUCT ORIGINATING	7.6	8.0	7.8	8.5	9.8	10.9	11.7	12.3	13.2	14.2	15.3
WAGES AND SALARIES	2.3	2.3	2.8	3.2	3.5	3.7	4.0	4.3	4.7	5.1	5.5
WAGE SUPPLEMENTS	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4	1.5	1.7
FEDERAL EXCISE AND CUSTOMS	3.9	3.7	3.6	3.6	3.8	4.0	4.2	4.3	4.4	4.5	4.5
PROPERTY AND SALES TAXES	.4	.4	.4	.4	.5	.5	.6	.6	.7	.7	.8
CAP. CONSUMPTION ALLOW.	1.1	1.3	1.6	2.0	2.5	3.0	3.7	4.4	5.0	5.7	6.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-.7	-.4	-1.4	-1.6	-1.4	-1.5	-1.9	-2.6	-2.9	-3.3	-3.7
REAL GROSS PRODUCT (72$)	7.6	8.0	7.8	7.7	8.4	9.0	9.5	9.7	9.9	10.1	10.3
IMPLICIT GPO DEFLATOR	1.000	1.002	.996	1.103	1.165	1.206	1.236	1.268	1.339	1.404	1.479
18 RUBBER AND MISC. PLASTICS											
GROSS PRODUCT ORIGINATING	9.0	9.6	10.0	9.5	11.4	12.9	14.4	15.6	17.9	19.9	21.9
WAGES AND SALARIES	5.3	6.2	6.5	6.1	6.8	7.9	9.0	10.0	11.4	12.6	14.0
WAGE SUPPLEMENTS	1.0	1.2	1.2	1.2	1.3	1.5	1.8	2.0	2.4	2.7	3.0
FEDERAL EXCISE AND CUSTOMS	.8	.8	.8	.6	.7	.7	.7	.7	.8	.8	.8
PROPERTY AND SALES TAXES	.2	.1	.1	.2	.2	.2	.2	.2	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.6	.7	.8	.8	.8	.9	1.0	1.1	1.1	1.2	1.2
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.1	.7	.6	.7	1.6	1.7	1.7	1.6	2.0	2.4	2.6
REAL GROSS PRODUCT (72$)	9.0	9.3	9.9	8.7	10.2	11.5	12.4	12.9	13.8	14.5	15.2
IMPLICIT GPO DEFLATOR	1.000	1.031	1.011	1.090	1.113	1.123	1.160	1.212	1.296	1.369	1.445
19 LEATHER AND LEATHER PRODUCTS											
GROSS PRODUCT ORIGINATING	2.1	2.1	2.1	2.1	2.4	2.8	3.2	3.6	4.2	4.8	5.1
WAGES AND SALARIES	1.8	1.8	1.8	1.8	2.0	2.3	2.7	3.0	3.5	3.9	4.2
WAGE SUPPLEMENTS	.2	.2	.3	.3	.3	.3	.4	.4	.5	.6	.7
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.1	.1	.1	.1	.1	.1
CAP. CONSUMPTION ALLOW.	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	-.1	-.1	-.0	.0	.0	.0	-.1	.0	.1	.0
REAL GROSS PRODUCT (72$)	2.1	2.0	1.9	1.8	2.0	2.1	2.2	2.2	2.2	2.3	2.2
IMPLICIT GPO DEFLATOR	1.000	1.059	1.119	1.181	1.238	1.368	1.476	1.630	1.878	2.083	2.288
20 STONE, CLAY, AND GLASS PRODUC											
GROSS PRODUCT ORIGINATING	9.9	11.3	11.4	10.5	12.4	14.3	16.0	16.7	18.5	20.4	21.9
WAGES AND SALARIES	6.2	7.0	7.4	7.0	7.7	8.8	10.0	10.9	12.0	13.2	14.4
WAGE SUPPLEMENTS	.9	1.1	1.2	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.7
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.2	.3	.3	.3	.3	.4	.4	.4
CAP. CONSUMPTION ALLOW.	1.0	1.1	1.2	1.2	1.2	1.2	1.3	1.4	1.6	1.7	1.7
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.5	1.9	1.4	.9	2.0	2.5	2.7	2.2	2.5	2.7	2.8
REAL GROSS PRODUCT (72$)	9.9	11.0	11.2	9.9	11.6	13.0	14.1	14.3	15.0	15.6	15.9
IMPLICIT GPO DEFLATOR	1.000	1.026	1.013	1.060	1.071	1.101	1.135	1.171	1.238	1.308	1.377
21 PRIMARY METALS											
GROSS PRODUCT ORIGINATING	21.6	24.3	28.1	27.9	32.3	39.4	45.8	48.4	52.8	58.8	64.0

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
WAGES AND SALARIES	13.4	15.7	18.3	18.0	20.0	23.9	27.1	29.1	31.1	34.4	37.4
WAGE SUPPLEMENTS	2.7	3.3	3.9	3.9	4.3	5.2	6.0	6.5	7.1	8.0	8.8
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.6	.6	.7	.7	.8	.8	.9	1.0	1.1	1.2	1.3
CAP. CONSUMPTION ALLOW.	2.6	2.7	2.9	3.2	3.4	3.6	3.9	4.1	4.4	4.8	5.2
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.2	2.0	2.3	2.2	3.8	6.0	7.9	7.7	9.0	10.4	11.3
REAL GROSS PRODUCT (72$)	21.6	23.2	22.9	19.2	21.4	23.7	25.5	25.6	26.5	27.6	28.1
IMPLICIT GPO DEFLATOR	1.000	1.049	1.226	1.449	1.509	1.665	1.794	1.889	1.994	2.134	2.274
22 FABRICATED METAL PRODUCTS											
GROSS PRODUCT ORIGINATING	19.3	21.9	23.0	23.1	27.2	32.7	37.4	40.7	45.8	50.9	56.1
WAGES AND SALARIES	13.2	14.9	16.4	16.1	17.6	20.7	23.3	25.5	28.0	31.0	33.9
WAGE SUPPLEMENTS	2.1	2.6	2.9	2.8	3.1	3.7	4.3	4.7	5.3	6.0	6.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.5	.4	.5	.5	.6	.6	.7	.8	.9	.9	1.0
CAP. CONSUMPTION ALLOW.	1.1	1.2	1.3	1.4	1.5	1.6	1.8	2.0	2.0	2.2	2.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	2.5	2.8	1.9	2.2	4.4	6.1	7.4	7.7	9.5	10.8	12.1
REAL GROSS PRODUCT (72$)	19.3	21.3	21.3	18.8	21.1	23.5	25.3	25.6	26.6	27.5	28.1
IMPLICIT GPO DEFLATOR	1.000	1.027	1.081	1.230	1.288	1.390	1.477	1.585	1.718	1.849	1.995
23 MACHINERY, EXCEPT ELECTRICAL											
GROSS PRODUCT ORIGINATING	30.4	35.3	39.3	39.6	45.2	52.9	60.8	64.6	71.5	78.9	85.9
WAGES AND SALARIES	19.7	23.2	27.0	27.5	29.7	33.9	38.5	41.7	45.7	50.3	54.7
WAGE SUPPLEMENTS	3.0	3.7	4.4	4.5	4.9	5.7	6.6	7.2	8.1	9.1	10.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.7	.7	.7	.8	.9	1.0	1.1	1.3	1.4	1.5	1.7
CAP. CONSUMPTION ALLOW.	2.9	3.3	4.0	4.4	4.9	5.6	6.5	7.4	7.9	9.0	10.2
PROPRIETOR INCOME	.5	.5	.4	.5	.5	.6	.7	.7	.8	.8	.8
OTHER PROPERTY INCOME	3.6	3.8	2.8	2.0	4.2	6.1	7.4	6.4	7.6	8.1	8.4
REAL GROSS PRODUCT (72$)	30.4	34.2	36.5	32.9	36.1	40.3	44.2	45.0	47.0	49.2	50.8
IMPLICIT GPO DEFLATOR	1.000	1.032	1.078	1.203	1.253	1.313	1.374	1.436	1.521	1.604	1.690
24 ELECTRICAL MACHINERY											
GROSS PRODUCT ORIGINATING	26.6	30.5	31.9	31.3	36.3	43.0	49.5	53.7	60.6	67.3	73.4
WAGES AND SALARIES	17.2	19.5	21.2	21.2	23.3	27.2	31.0	33.9	37.7	41.6	44.9
WAGE SUPPLEMENTS	2.6	3.2	3.5	3.5	3.9	4.6	5.4	6.0	6.8	7.6	8.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.5	.5	.6	.7	.7	.8	.9	1.0	1.2	1.3	1.5
CAP. CONSUMPTION ALLOW.	2.2	2.6	3.1	3.3	3.7	4.3	5.1	6.0	6.5	7.5	8.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	4.0	4.7	3.5	2.7	4.7	6.1	7.1	6.9	8.4	9.4	10.1
REAL GROSS PRODUCT (72$)	26.6	30.5	30.6	25.5	29.3	34.2	37.4	38.3	40.2	42.1	41.6
IMPLICIT GPO DEFLATOR	1.000	1.001	1.044	1.229	1.239	1.258	1.325	1.403	1.507	1.600	1.763
25 TRANS. EQUIP. & ORDNANCE											
GROSS PRODUCT ORIGINATING	16.1	17.4	18.6	20.1	22.3	25.5	28.8	31.3	34.7	37.7	40.9
WAGES AND SALARIES	12.0	12.8	14.0	14.9	16.4	18.1	19.8	21.1	23.0	24.6	26.3
WAGE SUPPLEMENTS	2.1	2.3	2.6	2.8	3.1	3.4	3.8	4.1	4.6	5.0	5.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.6	.5	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3
CAP. CONSUMPTION ALLOW.	1.1	1.3	1.5	1.6	1.8	1.9	2.2	2.5	2.7	3.1	3.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	.5	.0	.1	.4	1.3	2.1	2.6	3.4	3.9	4.5
REAL GROSS PRODUCT (72$)	16.1	16.9	16.6	15.6	16.3	17.8	19.2	19.5	20.3	20.8	21.3
IMPLICIT GPO DEFLATOR	1.000	1.027	1.123	1.288	1.372	1.430	1.500	1.606	1.712	1.807	1.919
26 MOTOR VEHICLES											
GROSS PRODUCT ORIGINATING	22.6	25.6	19.1	17.8	28.9	35.9	38.8	38.1	41.5	43.5	46.0
WAGES AND SALARIES	11.0	13.1	12.4	12.6	15.8	19.1	20.9	22.0	23.8	25.4	27.3

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
WAGE SUPPLEMENTS	2.7	3.3	3.2	3.2	4.1	4.9	5.5	5.9	6.4	6.9	7.5
FEDERAL EXCISE AND CUSTOMS	.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
PROPERTY AND SALES TAXES	.7	.4	.5	.5	.6	.6	.7	.7	.8	.9	1.0
CAP. CONSUMPTION ALLOW.	2.0	2.2	2.6	2.6	2.7	3.1	3.6	4.1	4.2	4.6	5.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	6.1	6.5	.4	-1.2	5.6	8.0	8.0	5.3	6.1	5.5	5.2
REAL GROSS PRODUCT (72$)	22.6	24.8	21.9	19.1	26.4	29.4	30.8	30.7	31.9	32.6	33.6
IMPLICIT GPO DEFLATOR	1.000	1.034	.870	.935	1.096	1.218	1.260	1.242	1.303	1.332	1.372
27 INSTRUMENTS											
GROSS PRODUCT ORIGINATING	6.8	8.3	9.1	8.8	10.5	12.6	15.1	17.0	19.6	22.2	24.9
WAGES AND SALARIES	4.5	5.2	5.9	5.9	6.5	7.5	8.5	9.6	10.9	12.2	13.5
WAGE SUPPLEMENTS	.6	.7	.8	.9	1.0	1.1	1.3	1.5	1.7	2.0	2.2
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.2	.2	.2	.2	.2	.3	.3	.3
CAP. CONSUMPTION ALLOW.	.5	.6	.7	.7	.8	.9	1.0	1.1	1.2	1.3	1.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	1.1	1.7	1.6	1.2	2.1	3.0	4.1	4.6	5.6	6.4	7.4
REAL GROSS PRODUCT (72$)	6.8	8.1	8.4	7.6	8.6	9.4	10.3	10.8	11.4	12.0	12.4
IMPLICIT GPO DEFLATOR	1.000	1.027	1.092	1.171	1.224	1.333	1.460	1.573	1.718	1.858	2.005
28 MISC. MANUFACTURING INDUSTRIE											
GROSS PRODUCT ORIGINATING	4.9	5.4	5.7	5.7	6.5	7.1	8.0	8.6	9.6	10.7	11.7
WAGES AND SALARIES	3.2	3.5	3.8	3.8	4.1	4.6	5.2	5.6	6.2	6.8	7.4
WAGE SUPPLEMENTS	.4	.5	.5	.5	.6	.6	.8	.8	1.0	1.1	1.2
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.3	.3	.3	.3	.3	.3	.3	.4	.4	.4	.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.9	1.0	.9	1.1	1.3	1.4	1.5	1.6	1.9	2.2	2.5
REAL GROSS PRODUCT (72$)	4.9	5.4	5.4	5.0	5.7	6.3	6.7	6.9	7.2	7.5	7.7
IMPLICIT GPO DEFLATOR	1.000	1.003	1.053	1.147	1.130	1.132	1.186	1.249	1.341	1.426	1.516
29 RAILROADS											
GROSS PRODUCT ORIGINATING	10.3	12.3	13.0	13.4	15.2	17.4	19.1	20.5	22.0	23.2	24.3
WAGES AND SALARIES	6.8	7.8	8.5	8.4	9.0	10.2	11.5	12.6	13.1	13.8	14.3
WAGE SUPPLEMENTS	1.0	1.3	1.4	1.4	1.5	1.7	2.0	2.2	2.3	2.5	2.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.5	.5	.5	.5	.5	.5	.5	.5	.6	.6	.6
CAP. CONSUMPTION ALLOW.	1.6	1.7	1.8	1.9	2.0	2.1	2.4	2.7	3.0	3.2	3.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	1.1	.8	1.2	2.3	2.9	2.7	2.5	3.0	3.2	3.5
REAL GROSS PRODUCT (72$)	10.3	11.4	11.2	10.7	11.8	12.6	13.3	13.4	13.9	14.3	14.7
IMPLICIT GPO DEFLATOR	1.000	1.081	1.156	1.250	1.295	1.379	1.439	1.525	1.581	1.617	1.658
30 LOCAL, SUBURBAN, & HIGHWAY PA											
GROSS PRODUCT ORIGINATING	3.4	3.6	3.7	3.8	4.3	4.8	5.3	5.7	6.4	7.0	7.7
WAGES AND SALARIES	1.9	1.9	2.1	2.3	2.5	2.8	2.9	3.1	3.5	3.8	4.1
WAGE SUPPLEMENTS	.3	.3	.3	.4	.4	.5	.5	.5	.6	.7	.7
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.2	.2	.3	.3	.3	.3	.3	.4
CAP. CONSUMPTION ALLOW.	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
PROPRIETOR INCOME	.2	.3	.2	.3	.3	.3	.4	.4	.5	.5	.6
OTHER PROPERTY INCOME	.5	.6	.5	.3	.6	.6	.9	1.0	1.2	1.4	1.6
REAL GROSS PRODUCT (72$)	3.4	3.6	3.6	3.5	3.7	3.9	4.0	4.0	4.1	4.2	4.3
IMPLICIT GPO DEFLATOR	1.000	1.007	1.028	1.097	1.177	1.213	1.326	1.421	1.546	1.669	1.787
31 TRUCKING AND WAREHOUSING											
GROSS PRODUCT ORIGINATING	19.4	22.1	23.1	23.6	26.9	30.8	36.5	40.7	44.7	49.5	53.8
WAGES AND SALARIES	11.4	13.2	14.4	14.1	15.6	18.9	22.6	25.0	27.1	30.0	32.3
WAGE SUPPLEMENTS	1.4	1.8	2.0	2.0	2.2	2.7	3.3	3.7	4.1	4.6	5.1

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
FEDERAL EXCISE AND CUSTOMS	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2	.2
PROPERTY AND SALES TAXES	1.0	1.1	1.2	1.3	1.3	1.4	1.6	1.7	1.8	1.9	2.0
CAP. CONSUMPTION ALLOW.	2.1	2.3	2.5	3.2	3.5	3.7	4.0	4.3	4.6	4.9	5.2
PROPRIETOR INCOME	1.2	1.4	1.4	1.6	1.9	2.0	2.3	2.5	2.8	3.1	3.4
OTHER PROPERTY INCOME	2.1	2.2	1.4	1.4	2.3	2.0	2.7	3.3	4.1	4.7	5.4
REAL GROSS PRODUCT (72$)	19.4	21.1	21.3	20.9	23.3	25.7	27.7	29.0	30.8	32.5	34.1
IMPLICIT GPO DEFLATOR	1.000	1.048	1.082	1.129	1.155	1.200	1.317	1.404	1.449	1.520	1.577
32 WATER TRANSPORTATION											
GROSS PRODUCT ORIGINATING	2.7	3.0	3.2	3.4	4.0	4.4	4.9	5.4	6.2	6.9	7.7
WAGES AND SALARIES	2.1	2.3	2.6	2.6	3.0	3.5	4.0	4.5	5.1	5.8	6.5
WAGE SUPPLEMENTS	.2	.3	.3	.3	.4	.5	.5	.6	.7	.9	1.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-.1	-.1	-.2	-.1	.1	-.1	-.2	-.2	-.2	-.3	-.4
REAL GROSS PRODUCT (72$)	2.7	2.9	2.9	2.7	2.9	3.0	3.1	3.2	3.3	3.4	3.5
IMPLICIT GPO DEFLATOR	1.000	1.033	1.080	1.267	1.388	1.446	1.565	1.700	1.866	2.034	2.221
33 AIR TRANSPORTATION											
GROSS PRODUCT ORIGINATING	7.9	9.2	9.7	10.1	12.6	15.2	17.3	18.7	21.5	24.5	27.8
WAGES AND SALARIES	4.6	5.1	5.9	6.5	7.5	8.7	9.9	11.0	12.6	14.4	16.3
WAGE SUPPLEMENTS	.7	.8	1.0	1.1	1.3	1.5	1.7	1.9	2.3	2.6	3.0
FEDERAL EXCISE AND CUSTOMS	.6	.8	1.0	1.0	1.2	1.5	1.7	1.8	2.1	2.4	2.7
PROPERTY AND SALES TAXES	.2	.3	.3	.3	.4	.4	.5	.5	.6	.7	.7
CAP. CONSUMPTION ALLOW.	1.4	1.5	1.4	1.1	1.1	1.1	1.2	1.4	1.5	1.7	1.8
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.3	.6	.3	.0	1.2	2.0	2.3	2.0	2.5	2.9	3.2
REAL GROSS PRODUCT (72$)	7.9	9.0	9.4	9.2	10.2	11.3	12.2	12.8	13.7	14.5	15.4
IMPLICIT GPO DEFLATOR	1.000	1.027	1.029	1.094	1.229	1.345	1.417	1.460	1.572	1.688	1.808
34 PIPELINE TRANSPORTATION											
GROSS PRODUCT ORIGINATING	1.0	1.0	1.0	1.2	1.6	1.9	2.2	2.4	2.8	3.2	3.6
WAGES AND SALARIES	.2	.2	.2	.3	.3	.3	.4	.4	.5	.5	.6
WAGE SUPPLEMENTS	.0	.0	.0	.1	.1	.1	.1	.1	.1	.1	.1
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
CAP. CONSUMPTION ALLOW.	.3	.3	.3	.3	.3	.4	.4	.4	.4	.4	.4
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.4	.5	.4	.5	.8	1.1	1.3	1.5	1.7	2.1	2.4
REAL GROSS PRODUCT (72$)	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5
IMPLICIT GPO DEFLATOR	1.000	.963	.971	1.164	1.400	1.566	1.674	1.796	2.002	2.226	2.462
35 TRANSPORTATION SERVICES											
GROSS PRODUCT ORIGINATING	1.6	1.8	1.9	2.0	2.4	2.8	3.2	3.5	4.0	4.5	5.0
WAGES AND SALARIES	1.0	1.2	1.3	1.4	1.6	1.9	2.2	2.4	2.8	3.2	3.6
WAGE SUPPLEMENTS	.1	.1	.1	.2	.2	.2	.3	.3	.3	.4	.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.3
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.2	.3	.2	.2	.3	.4	.4	.4	.4	.5	.5
REAL GROSS PRODUCT (72$)	1.6	1.8	1.8	1.7	1.9	2.1	2.2	2.3	2.5	2.6	2.7
IMPLICIT GPO DEFLATOR	1.000	1.035	1.072	1.166	1.252	1.332	1.409	1.495	1.612	1.731	1.856
36 TELEPHONE AND TELEGRAPH											
GROSS PRODUCT ORIGINATING	26.9	30.6	33.4	35.0	41.9	47.7	56.4	62.5	68.0	73.3	79.1
WAGES AND SALARIES	10.0	11.4	12.6	14.6	17.1	19.9	23.0	25.8	27.7	30.0	32.5
WAGE SUPPLEMENTS	3.0	3.5	3.9	4.6	5.4	6.3	7.4	8.3	9.0	9.9	10.8
FEDERAL EXCISE AND CUSTOMS	1.8	1.8	1.8	1.6	1.6	1.4	1.3	1.0	.7	.3	.4

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
PROPERTY AND SALES TAXES	2.1	2.0	2.2	2.4	2.7	2.9	3.1	3.4	3.7	4.0	4.4
CAP. CONSUMPTION ALLOW.	5.3	5.9	6.5	7.0	7.6	8.6	10.0	11.6	13.3	15.0	16.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	4.6	6.0	6.4	4.9	7.6	8.6	11.6	12.5	13.6	14.1	14.6
REAL GROSS PRODUCT (72$)	26.9	29.9	31.3	32.2	35.1	38.7	41.8	43.5	46.7	50.3	53.9
IMPLICIT GPO DEFLATOR	1.000	1.023	1.069	1.089	1.194	1.233	1.351	1.437	1.455	1.457	1.468
37 RADIO AND TELEVISION BROADCAS											
GROSS PRODUCT ORIGINATING	2.5	2.7	2.8	2.7	2.8	2.8	3.1	3.4	3.6	3.9	4.1
WAGES AND SALARIES	1.5	1.6	1.7	1.6	1.6	1.7	1.9	2.0	2.1	2.3	2.4
WAGE SUPPLEMENTS	.1	.2	.2	.2	.2	.2	.2	.2	.2	.3	.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
CAP. CONSUMPTION ALLOW.	.3	.3	.3	.3	.3	.3	.3	.3	.4	.4	.5
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.5	.6	.6	.6	.6	.5	.6	.7	.7	.7	.7
REAL GROSS PRODUCT (72$)	2.5	2.6	2.5	2.4	2.5	2.7	2.8	2.8	2.9	3.0	3.0
IMPLICIT GPO DEFLATOR	1.000	1.021	1.092	1.133	1.098	1.036	1.095	1.194	1.247	1.295	1.370
38 ELECTRIC, GAS, AND SANITARY S											
GROSS PRODUCT ORIGINATING	28.0	31.1	33.5	38.4	42.4	48.0	53.0	56.9	63.7	69.9	77.2
WAGES AND SALARIES	7.9	8.7	9.4	9.9	11.0	12.6	14.1	15.5	17.0	18.5	20.2
WAGE SUPPLEMENTS	1.4	1.6	1.8	1.9	2.1	2.5	2.8	3.1	3.5	3.9	4.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	4.2	3.9	4.2	4.6	5.0	5.2	5.4	5.6	5.9	6.2	6.6
CAP. CONSUMPTION ALLOW.	6.1	6.8	7.5	8.2	8.5	9.1	10.0	10.9	11.9	13.0	14.1
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	8.3	10.1	10.6	13.8	15.8	18.6	20.7	21.9	25.4	28.3	32.1
REAL GROSS PRODUCT (72$)	28.0	29.1	29.0	28.8	30.1	31.7	32.7	32.9	33.8	34.3	34.8
IMPLICIT GPO DEFLATOR	1.000	1.067	1.158	1.331	1.406	1.516	1.621	1.731	1.887	2.035	2.219
39 WHOLESALE TRADE											
GROSS PRODUCT ORIGINATING	82.4	97.7	111.8	115.7	132.2	151.3	167.2	176.5	195.3	214.4	233.1
WAGES AND SALARIES	39.0	44.1	48.4	51.7	56.5	61.2	67.5	72.3	78.5	85.7	93.2
WAGE SUPPLEMENTS	4.2	5.1	5.8	6.3	6.9	7.6	8.6	9.5	10.5	11.7	13.1
FEDERAL EXCISE AND CUSTOMS	3.8	4.2	4.2	3.7	4.3	4.7	5.1	5.2	5.5	5.7	6.1
PROPERTY AND SALES TAXES	16.1	18.5	20.0	21.8	23.9	26.4	28.9	31.0	34.1	37.3	40.9
CAP. CONSUMPTION ALLOW.	4.3	5.0	5.6	5.6	6.2	7.0	7.2	7.7	8.4	9.3	10.2
PROPRIETOR INCOME	3.8	6.1	7.5	8.5	10.9	14.7	16.4	17.7	20.3	23.3	25.1
OTHER PROPERTY INCOME	11.2	14.7	20.2	18.1	23.7	29.8	33.5	33.1	38.0	41.3	44.4
REAL GROSS PRODUCT (72$)	82.4	91.0	92.1	89.7	98.4	107.1	114.2	117.9	124.0	129.8	135.0
IMPLICIT GPO DEFLATOR	1.000	1.074	1.214	1.290	1.344	1.413	1.464	1.497	1.575	1.651	1.727
40 RETAIL TRADE											
GROSS PRODUCT ORIGINATING	118.8	128.9	135.0	153.1	164.5	175.6	191.7	203.8	223.5	243.6	265.9
WAGES AND SALARIES	65.5	71.5	77.1	84.6	88.4	95.4	103.3	109.9	119.3	129.2	140.7
WAGE SUPPLEMENTS	6.6	7.8	8.7	9.7	10.2	11.1	12.5	13.6	15.1	16.8	18.7
FEDERAL EXCISE AND CUSTOMS	.4	.4	.4	.4	.4	.5	.5	.5	.6	.6	.6
PROPERTY AND SALES TAXES	19.7	23.1	25.0	27.2	29.9	33.0	36.2	38.8	42.7	46.8	51.3
CAP. CONSUMPTION ALLOW.	6.9	7.4	7.7	8.3	8.7	9.2	9.3	10.0	10.8	11.9	13.2
PROPRIETOR INCOME	10.2	11.0	9.7	12.9	13.9	14.2	15.0	15.9	17.3	18.9	20.1
OTHER PROPERTY INCOME	9.4	7.7	6.4	10.0	12.9	12.2	14.9	15.0	17.7	19.4	21.2
REAL GROSS PRODUCT (72$)	118.8	126.2	123.9	122.9	133.1	141.7	147.7	150.0	155.5	160.3	164.9
IMPLICIT GPO DEFLATOR	1.000	1.021	1.089	1.245	1.236	1.239	1.298	1.358	1.437	1.520	1.612
41 BANKING AND CREDIT AGENCIES											
GROSS PRODUCT ORIGINATING	22.6	23.5	23.7	27.1	32.5	36.1	39.3	41.5	46.4	50.7	55.1
WAGES AND SALARIES	15.5	16.6	18.0	19.5	21.7	23.6	27.0	29.8	33.3	37.2	41.5
WAGE SUPPLEMENTS	2.5	2.8	3.1	3.4	3.8	4.2	4.9	5.5	6.2	7.1	8.0
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.7	1.6	1.7	1.9	2.1	2.4	2.6	2.9	3.2	3.6	3.9

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
CAP. CONSUMPTION ALLOW.	2.1	2.2	2.2	2.4	2.7	3.0	3.2	3.4	3.9	4.3	4.8
PROPRIETOR INCOME	.8	.4	.7	.4	.7	.5	.7	.5	.7	.5	.7
OTHER PROPERTY INCOME	.0	-.1	-2.0	-.5	1.5	2.4	.9	-.6	-.9	-2.0	-3.8
REAL GROSS PRODUCT (72$)	22.6	23.4	23.5	24.4	27.0	29.3	31.3	32.7	34.5	36.1	37.6
IMPLICIT GPO DEFLATOR	1.000	1.004	1.008	1.113	1.204	1.231	1.258	1.268	1.344	1.405	1.467
42 INSURANCE AGENTS AND BROKERS											
GROSS PRODUCT ORIGINATING	21.1	23.2	24.8	26.1	29.0	33.3	37.0	40.4	44.6	49.1	54.3
WAGES AND SALARIES	11.8	13.2	14.4	14.4	15.7	18.9	21.4	23.4	25.6	28.8	32.0
WAGE SUPPLEMENTS	1.8	2.1	2.3	2.4	2.6	3.1	3.6	4.0	4.5	5.2	5.8
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	2.4	2.2	2.4	2.7	2.9	3.2	3.5	3.8	4.2	4.6	5.0
CAP. CONSUMPTION ALLOW.	.8	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.1
PROPRIETOR INCOME	2.1	2.2	2.3	2.5	2.8	3.1	3.4	3.6	3.9	4.2	4.6
OTHER PROPERTY INCOME	2.3	2.5	2.4	3.1	4.0	3.8	3.9	4.0	4.8	4.5	4.8
REAL GROSS PRODUCT (72$)	21.1	22.2	22.2	21.2	22.8	24.8	26.3	27.1	28.4	29.6	30.6
IMPLICIT GPO DEFLATOR	1.000	1.047	1.121	1.229	1.274	1.340	1.407	1.493	1.568	1.658	1.773
43 REAL ESTATE AND COMBINATION O											
GROSS PRODUCT ORIGINATING	124.9	137.6	148.3	159.7	175.9	195.6	218.4	238.2	264.6	293.9	325.2
WAGES AND SALARIES	6.0	7.0	7.6	7.9	9.2	11.5	13.5	14.2	15.3	17.3	19.0
WAGE SUPPLEMENTS	.6	.8	.9	1.0	1.1	1.4	1.7	1.8	2.0	2.3	2.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	27.9	30.4	33.3	36.6	39.8	43.3	46.9	50.8	55.2	59.9	65.0
CAP. CONSUMPTION ALLOW.	21.9	24.1	25.8	27.1	29.2	31.7	34.6	37.6	41.1	44.8	48.9
PROPRIETOR INCOME	1.8	.9	-.4	-.2	.5	1.5	1.5	1.5	1.5	1.5	1.5
OTHER PROPERTY INCOME	66.7	74.3	81.2	87.4	96.1	106.3	120.1	132.2	149.5	168.1	188.2
REAL GROSS PRODUCT (72$)	124.9	133.6	139.2	142.0	153.3	163.3	170.8	175.5	182.0	188.9	194.9
IMPLICIT GPO DEFLATOR	1.000	1.030	1.066	1.125	1.147	1.198	1.279	1.358	1.454	1.556	1.669
44 HOTELS AND OTHER LODGING PLAC											
GROSS PRODUCT ORIGINATING	7.2	8.0	8.6	9.4	10.5	11.7	13.3	14.4	16.0	17.6	19.3
WAGES AND SALARIES	4.2	4.7	5.2	5.6	6.0	6.6	7.5	8.1	8.8	9.6	10.5
WAGE SUPPLEMENTS	.4	.5	.6	.6	.7	.8	.9	1.0	1.1	1.2	1.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.5	.5	.5	.6	.6	.7	.7	.8	.8	.9	1.0
CAP. CONSUMPTION ALLOW.	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.4	1.5	1.7	1.8
PROPRIETOR INCOME	.2	.4	.2	.5	.5	.7	.7	.9	1.0	1.1	1.2
OTHER PROPERTY INCOME	.8	.8	.9	1.0	1.5	1.7	2.1	2.3	2.8	3.0	3.5
REAL GROSS PRODUCT (72$)	7.2	7.8	7.9	8.0	8.7	9.5	10.1	10.5	11.1	11.6	12.1
IMPLICIT GPO DEFLATOR	1.000	1.026	1.081	1.174	1.198	1.232	1.311	1.377	1.441	1.509	1.596
45 PERSONAL SERVICES											
GROSS PRODUCT ORIGINATING	11.5	12.0	12.5	13.5	15.1	16.0	17.8	19.3	20.8	22.4	24.3
WAGES AND SALARIES	6.2	6.6	7.1	7.2	7.8	8.7	9.4	10.2	10.8	11.6	12.7
WAGE SUPPLEMENTS	.6	.7	.8	.8	.9	1.0	1.1	1.2	1.3	1.4	1.6
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.4	.4	.5	.5	.6	.6	.7	.8	.9	.9	1.0
CAP. CONSUMPTION ALLOW.	.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.7	1.9
PROPRIETOR INCOME	2.9	2.8	2.8	3.3	3.9	3.9	4.4	4.8	5.2	5.5	5.9
OTHER PROPERTY INCOME	.5	.5	.4	.6	.8	.7	.9	1.0	1.0	1.2	1.2
REAL GROSS PRODUCT (72$)	11.5	12.0	11.7	11.4	12.7	13.2	13.6	14.2	14.7	15.3	15.9
IMPLICIT GPO DEFLATOR	1.000	1.002	1.074	1.180	1.181	1.212	1.291	1.359	1.413	1.461	1.530
46 MISC. BUSINESS SERVICES											
GROSS PRODUCT ORIGINATING	39.5	45.2	48.3	52.4	60.0	68.8	79.6	89.9	102.9	116.1	131.7
WAGES AND SALARIES	22.2	26.0	29.1	30.4	33.9	39.9	46.4	52.3	58.9	66.9	75.8
WAGE SUPPLEMENTS	2.1	2.7	3.1	3.3	3.7	4.4	5.3	6.1	7.0	8.2	9.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.5	.5	.6	.6	.7	.8	.9	1.0	1.1	1.3	1.4
CAP. CONSUMPTION ALLOW.	2.5	3.0	3.0	3.2	3.4	3.9	4.4	5.0	5.9	6.8	7.8

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
PROPRIETOR INCOME	10.6	11.7	12.0	13.2	15.2	16.7	18.8	20.9	23.9	26.4	29.6
OTHER PROPERTY INCOME	1.6	1.5	.5	1.6	3.1	3.2	4.0	4.6	6.1	6.5	7.5
REAL GROSS PRODUCT (72$)	39.5	43.1	43.2	42.1	46.4	50.9	54.6	56.6	59.6	62.5	64.9
IMPLICIT GPO DEFLATOR	1.000	1.049	1.118	1.245	1.294	1.352	1.462	1.590	1.725	1.857	2.030
47 AUTOMOBILE REPAIR AND GARAGES											
GROSS PRODUCT ORIGINATING	6.4	7.4	9.6	11.4	13.3	14.4	16.0	18.2	20.6	23.3	26.5
WAGES AND SALARIES	2.8	3.4	4.1	4.8	5.1	5.6	6.2	6.9	7.6	8.5	9.6
WAGE SUPPLEMENTS	.3	.4	.5	.6	.6	.7	.8	.9	1.0	1.1	1.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.2	.2	.2	.3	.3	.3	.4	.4	.4	.5	.5
CAP. CONSUMPTION ALLOW.	1.7	2.0	2.5	2.9	3.1	3.4	3.7	4.2	4.8	5.6	6.5
PROPRIETOR INCOME	1.0	.9	1.3	1.6	2.3	2.4	2.7	3.1	3.6	3.9	4.3
OTHER PROPERTY INCOME	.4	.5	.9	1.2	1.8	2.0	2.4	2.8	3.2	3.7	4.3
REAL GROSS PRODUCT (72$)	6.4	7.1	7.4	7.5	8.1	8.6	8.9	9.2	9.5	9.9	10.3
IMPLICIT GPO DEFLATOR	1.000	1.051	1.301	1.512	1.643	1.678	1.797	1.987	2.171	2.353	2.571
48 AMUSEMENT AND RECREATION SERV											
GROSS PRODUCT ORIGINATING	7.8	8.4	9.2	9.6	10.6	11.8	13.1	14.2	15.8	17.5	19.3
WAGES AND SALARIES	4.3	4.7	5.1	5.3	5.6	6.4	6.9	7.5	8.3	9.3	10.2
WAGE SUPPLEMENTS	.5	.6	.6	.6	.7	.8	.9	1.0	1.1	1.3	1.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	1.5	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.9	3.2	3.5
CAP. CONSUMPTION ALLOW.	.9	1.1	1.1	1.1	1.2	1.3	1.4	1.5	1.7	2.0	2.2
PROPRIETOR INCOME	.3	.4	.3	.4	.5	.6	.6	.7	.7	.8	.8
OTHER PROPERTY INCOME	.3	.2	.3	.2	.6	.5	.8	.8	1.0	1.0	1.1
REAL GROSS PRODUCT (72$)	7.8	8.1	8.2	7.9	8.6	9.1	9.5	9.7	10.1	10.5	10.7
IMPLICIT GPO DEFLATOR	1.000	1.036	1.128	1.208	1.231	1.292	1.379	1.468	1.559	1.669	1.802
49 MEDICAL AND OTHER HEALTH SERV											
GROSS PRODUCT ORIGINATING	37.7	41.4	46.3	53.4	59.4	64.1	69.4	78.7	91.2	100.6	110.3
WAGES AND SALARIES	22.8	26.1	31.0	35.8	37.8	40.7	45.1	51.9	59.2	65.3	72.2
WAGE SUPPLEMENTS	2.7	3.3	4.0	4.7	5.0	5.4	6.2	7.3	8.5	9.6	10.8
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.3	.3	.4	.4	.5	.5	.5	.5	.6	.6	.6
CAP. CONSUMPTION ALLOW.	.8	.8	.8	.8	.8	.8	.9	.9	.9	1.0	1.0
PROPRIETOR INCOME	10.3	10.1	9.3	10.8	14.2	15.3	15.5	16.6	20.3	22.3	23.6
OTHER PROPERTY INCOME	.9	.9	.8	.9	1.2	1.3	1.3	1.4	1.7	1.9	2.0
REAL GROSS PRODUCT (72$)	37.7	40.3	41.7	42.6	46.0	49.1	51.7	53.8	56.3	58.6	60.8
IMPLICIT GPO DEFLATOR	1.000	1.028	1.110	1.254	1.292	1.307	1.343	1.464	1.618	1.716	1.815
50 EDUCATIONAL SERVICES											
GROSS PRODUCT ORIGINATING	19.1	20.9	22.9	24.2	28.2	31.8	37.8	43.3	50.1	57.0	65.0
WAGES AND SALARIES	17.0	18.3	20.0	20.8	23.4	26.8	31.3	34.8	38.8	43.4	47.9
WAGE SUPPLEMENTS	1.5	1.7	2.0	2.1	2.4	2.7	3.3	3.8	4.4	5.0	5.7
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.3	.3	.3	.4	.4	.5	.6	.7	.8	1.0	1.2
CAP. CONSUMPTION ALLOW.	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
PROPRIETOR INCOME	.1	.5	.5	.9	1.7	1.6	2.2	3.5	5.4	6.7	9.1
OTHER PROPERTY INCOME	.0	.1	.1	.1	.2	.2	.2	.4	.6	.7	1.0
REAL GROSS PRODUCT (72$)	19.1	19.4	19.4	18.8	20.4	21.9	23.8	25.3	27.3	28.6	29.9
IMPLICIT GPO DEFLATOR	1.000	1.078	1.185	1.289	1.385	1.455	1.586	1.710	1.833	1.990	2.175
51 PRIVATE HOUSEHOLDS											
GROSS PRODUCT ORIGINATING	5.3	5.4	5.3	5.6	6.1	6.5	6.9	7.5	8.1	8.7	9.4
WAGES AND SALARIES	5.2	5.3	5.2	5.5	5.9	6.3	6.8	7.2	7.8	8.4	9.0
WAGE SUPPLEMENTS	.1	.1	.1	.1	.1	.2	.2	.2	.3	.3	.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

COMPONENTS OF GROSS PRODUCT ORIGINATING BY TWO-DIGIT INDUSTRY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
REAL GROSS PRODUCT (72$)	5.3	5.0	4.6	4.5	4.5	4.5	4.4	4.4	4.4	4.4	4.4
IMPLICIT GPO DEFLATOR	1.000	1.076	1.163	1.261	1.360	1.458	1.565	1.686	1.830	1.981	2.144
52 FEDERAL - ENTERPRISES											
GROSS PRODUCT ORIGINATING	8.3	7.4	9.6	10.2	11.9	13.2	14.7	16.5	18.5	20.8	23.4
WAGES AND SALARIES	8.6	9.4	10.4	11.2	12.7	13.8	15.2	16.7	18.4	20.4	22.5
WAGE SUPPLEMENTS	.7	.8	1.0	1.1	1.3	1.5	1.7	2.0	2.4	2.8	3.3
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	-1.0	-2.8	-1.8	-2.0	-2.1	-2.1	-2.2	-2.2	-2.3	-2.3	-2.4
REAL GROSS PRODUCT (72$)	9.3	9.5	9.7	9.6	10.1	10.3	10.5	10.7	10.9	11.1	11.4
IMPLICIT GPO DEFLATOR	.891	.781	.989	1.066	1.179	1.285	1.402	1.536	1.698	1.871	2.059
53 STATE AND LOCAL - ENTERPRIS											
GROSS PRODUCT ORIGINATING	8.6	9.5	10.2	10.9	11.1	12.1	13.2	14.4	15.9	17.6	19.4
WAGES AND SALARIES	4.9	5.6	6.5	7.5	7.5	8.4	9.3	10.4	11.7	13.1	14.7
WAGE SUPPLEMENTS	.4	.5	.6	.6	.7	.7	.8	.9	1.1	1.2	1.4
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	3.3	3.4	3.1	2.8	2.9	3.0	3.0	3.1	3.2	3.2	3.3
REAL GROSS PRODUCT (72$)	5.3	5.6	6.0	6.4	6.0	6.2	6.4	6.6	6.9	7.1	7.4
IMPLICIT GPO DEFLATOR	1.633	1.698	1.691	1.713	1.855	1.948	2.053	2.171	2.312	2.461	2.621
54 FEDERAL - GENERAL											
GROSS PRODUCT ORIGINATING	50.3	53.2	57.8	62.3	67.2	71.9	77.2	83.2	90.4	98.8	107.9
WAGES AND SALARIES	46.5	49.0	53.0	56.9	61.0	65.0	69.4	74.4	80.3	87.1	94.4
WAGE SUPPLEMENTS	3.8	4.2	4.8	5.4	6.2	6.9	7.8	8.8	10.1	11.7	13.5
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
REAL GROSS PRODUCT (72$)	50.3	49.2	49.0	48.4	48.0	47.7	47.4	47.1	46.7	46.8	46.9
IMPLICIT GPO DEFLATOR	1.000	1.082	1.178	1.288	1.398	1.508	1.629	1.768	1.934	2.111	2.302
55 STATE AND LOCAL - GENERAL											
GROSS PRODUCT ORIGINATING	87.5	98.3	110.1	123.3	132.3	144.5	158.4	173.1	191.5	210.7	231.7
WAGES AND SALARIES	77.6	86.5	96.6	108.1	115.8	126.4	138.2	150.8	166.5	183.0	200.9
WAGE SUPPLEMENTS	9.9	11.9	13.5	15.3	16.4	18.1	20.2	22.3	24.9	27.7	30.8
FEDERAL EXCISE AND CUSTOMS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPERTY AND SALES TAXES	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CAP. CONSUMPTION ALLOW.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PROPRIETOR INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OTHER PROPERTY INCOME	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
REAL GROSS PRODUCT (72$)	87.5	90.6	93.6	96.7	96.0	97.8	99.6	100.9	102.6	104.2	105.7
IMPLICIT GPO DEFLATOR	1.000	1.085	1.176	1.276	1.377	1.477	1.590	1.716	1.865	2.023	2.193

CHAPTER XII

SUMMARY AND DIRECTIONS FOR FUTURE WORK

The model described in the previous chapters provides a framework to study prices, wages, and income flows within a highly disaggregated interindustry context. Two major linkages with the standard INFORUM model, which has heretofore operated solely in real terms, have been firmly established by this work. First, we have a means of generating relative prices, to be used in the forecasting of consumption by product, that are consistent with the overall forecasts of productivity growth, "aggregate" demand, and specified exogenous prices. Secondly, we have a way of checking the reasonableness of our real disposable income forecasts with an explicit set of assumed tax rates. These aggregate incomes are completely consistent with the industry output, employment, price, and wage rate forecasts.

We have pulled together a wide variety of data sources for the analysis here. The construction of the model, in a broad sense, is a test of the compatibility of many of the industry-oriented data bodies that currently are available in the U.S. In some instances (namely in the CCA and labor compensation work) we have been able to "bridge" successfully between diverse sources by means of regression. In other cases, where a regression approach could not be used for lack of explicit knowledge on structural change, our conclusions are more tentative. The relation of factor incomes to published price information was not satisfactory for a number of manufacturing sectors for the specific period, 1973-75. Future work is required to untangle the effects of imperfections in the I/O classifications and, perhaps, the abnormal circumstances of this particular period.

We can divide some specific accomplishments into those that have relevance outside of the INFORUM project and those that may be important to the INFORUM model-building effort in the future. Of the former, we may list the first attempt of which I am aware to use explicitly a vintage stocks approach in the forecasting of capital consumption allowances by industry in an econometric model. Although the procedure developed here needs refinement, it offers the possibility of testing the sensitivity of depreciation allowances to rather specific changes in tax regulations.

The work on wage determination, while developing no new theoretical contributions, nonetheless should be useful to potential builders of long-term, disaggregated models. Relative wage equations by industry have been derived as a reduced form of an explicit "spill-over" behavioral model. These equations should contribute to the accuracy of our predictions of relative price behavior, both for medium and long term horizons. The work on more aggregative (by industry) wage change equations finds that the consumer price index provides a more satisfactory explanation of contemporary wage behavior than alternative price measures that have been touted by other researchers recently. These equations, when simulated within a full price-wage system, help to track adequately the acceleration and deceleration of inflation over the 1973-75 period.

The equations for proprietors' income, while having an industry orientation in the work here, may be useful in other more aggregative settings. The specification allows the data to determine the proper mix of wage and profit components comprising the behavior of incomes of the self-employed.

For the INFORUM project, in particular, the model constructed here has both direct and indirect impacts. Two of the most important direct impacts were cited at the beginning of the chapter. An additional direct benefit is the enhanced ability of the complete model to make conditional forecasts. In this mode of operation, the model automatically provides the income-multiplier effects for changes in fiscal policy, export scenarios, and - as contrasted to aggregate models - changes in specific prices (via their effects on real incomes). The income model provides forecasts of industry income distributions that may be useful in their own right. These industry forecasts are compatible with the industry detail of the U.S. national accounts - the Gross Product Originating series by two-digit SIC classification.

With regard to the industry distributions - and especially the other property income components including corporate profits - we have to candidly admit that the model cannot, as yet, be regarded as a reliable forecasting tool across all of our detailed sectors. However, we only learn from our mistakes and since the income model reflects errors (or unusual behavior) in labor productivity, capital-output ratios, unemployment rates, exogenous prices, wages, and input-output coefficients, the operation of the model provides a continual consistency check on other parts of (potential) INFORUM forecasts. This benefit is what I would term an important indirect impact on the overall INFORUM model. The operation of a disaggregated model requires the manipulation of large quantities of data and errors, despite the best of our intentions, sometimes creep into the model at various stages of the computer processing. The development of the income model has lead, in a half dozen or so instances, to the correction of data problems elsewhere in the model. These errors were not so apparent in the operation of the real model by itself, but showed up more plainly by distorting the results of the price-wage or income models.

Future Work

Future work on the price-wage and income models may be of either an extensive or intensive variety. Of the first case, the most ambitious effort would be to truly make the INFORUM model capable of operating as a "conventional" macroeconomic model. For this a monetary sector is probably of first priority. If outputs (and employment) are made sufficiently responsive with respect to interest rates or wealth, the effects on the various demand measures in the price-wage system will lead to a rise in the overall price level. The model here may ultimately be able to trace the relative as well as the absolute price level effects of various monetary policies. The forecasts of interest rates would also close the personal interest income equations.

As part of this same work, one may consider the construction of a scheme for generating the budget surplus or deficit for the federal (and state and local) government. Most of the necessary functions are in place for such a calculation. This work would help in specifying tax rates and constant-dollar government expenditures for medium-term forecasts.

Two other extensions of the model both involve price determination. The first would be to develop regression equations to explain as many as possible of the now exogenous raw material prices. The prices of many of these items are determined in competitive world markets. Thus, in choosing appropriate demand variables one would need to look beyond solely U.S. data. INFORUM's work in constructing input-output models of the major U.S. trading partners could provide an easily accessible source of such data.

The other area dealing with prices is in regard to linking consumer to wholesale prices. The procedure used in the work so far has not incorporated any regression analysis of observed individual prices contained in both the WPI and CPI. The influence of imports, trade margins, and lags would all require explicit attention. The place to begin such work is probably by a search of the literature; linkage equations are common at least at aggregate levels. And finally, whatever approach is chosen, there should be some means of using the results to forecast incomes in the trade sectors.

The areas of future work just discussed extend the model in new directions. More work may also be envisioned in improving areas of the model for which a start has been made in this work. In general terms, some parts of the model may require relaxation of our consistency objectives in order to obtain more reliable forecasts. The short-term forecasting of farm income is one such area (which we discussed in Chapter X) where, given major farm commodity prices, we may do better by a regression approach than going through the input-output procedure. We may wish to use the same approach in the mining sectors where commodity prices would be obtained by specific regression equations. One should move toward such abandonments of our strict accounting structure with caution. Regressions have a great ability to absorb conceptual errors into constant terms and elasticities; they should only be used when the data appear hopelessly incompatible.

More work is required to eliminate the effects of aggregation problems that showed up in the price simulation work. In particular, a major research effort may be needed to improve our work in the chemicals industry. The forthcoming 1972 input-output table based on the 1972 Census of Manufactures may provide further disaggregation that would help here. Some of the aggregation problems stem from the manhours aggregation currently in the standard model. We are presently assuming that the labor productivity growth rates for each 200-order sector within an 88-order employment sector are identical. This appears to be a strong assumption for sectors such as Other transportation and Finance and Services. Productivity equations estimated for the full set of 200-order sectors, would be beneficial, especially in the nonmanufacturing area.

As in any other research project, there will always be some feature that can be added to the model or improvement made to the existing structure. The important point is an operational system that consistently links industry prices, wages and income flows is now in place.

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