MIDE: A MACROECONOMIC MULTISECTORAL MODEL

OF THE SPANISH ECONOMY

by

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Abstract

When Spain joined the European Community in 1986, its economy began to bustle. For the years 1986 through 1991, its GDP growth was substantially higher than any of its EC partners. A dramatic acceleration in investment paced this growth. However, while imports have exploded, export growth has been disappointing, and a large current account deficit has evolved. Furthermore, inflation is above the EC average, but unemployment, originally produced by stagnation in the early eighties, remains disturbingly high. These circumstances have produced uncertainty over the future course of the economy, especially their implications in the context of the continuing EC integration process.

Comprehensive empirical models can increase the understanding of the evolution of an economy, and decrease uncertainty surrounding the future, by providing a bridge between economic theory and the real world. This work describes the construction and application of a macroeconomic, dynamic, multisectoral simulation and forecasting model of the Spanish economy (MIDE). Using the data and accounting structure of the Spanish 43 sector input-output table for 1980 and the annual national accounts, MIDE is constructed by combining the classical input-output formulation with extensive use of regression analysis. The model is a comprehensive representation of economy, so it can analyze the economy wide effects of macroeconomic developments. However, the framework allows for a highly disaggregated treatment of economic variables. For example, total capital investment, total imports and total income are not determined directly but are computed from the sum of their parts: investment in specific goods, imports by production branch, and labor compensation by industry. This "bottom-up" approach gives the model the ability to describe the effects of developments in one industry on related sectors and the overall economy.

Following a general outline of MIDE’s structure, the dissertation presents functional specifications and estimation results for the model’s macroeconomic and commodity level econometric behavioral equations. MIDE is part of the INFORUM system of trade-linked multisectoral models. Using this system, the study illustrates the impacts on the Spanish economy of the European single market which is to begin in 1993. Once the various single market measures are integrated into the model, a forecast to the year 2000 is presented. The results demonstrate that the Spanish economy can reach "monetary convergence" with the rest of the EC without suffering significant decreases in growth of income and employment. Detailed industry-level projections indicate the potential course of structural change. They illustrate a maturing economy becoming even more integrated with the international economy.

PREFACE

Three years ago, I was given the opportunity to move to Madrid and write my dissertation concerning the construction of the INFORUM model of the Spanish economy (MIDE). This model serves as the focus of economic research and consulting activities at the Center for Economic Studies of the Fundación Tomillo. The development of the model was particularly challenging, since when I arrived in Madrid I knew very little about Spain or its economy. The work also provided me with a unique learning experience, since the Spanish economy is presently one of the most dynamic and fastest growing in the industrialized world. However, this dissertation is only one product of the marvelous experience of being a guest of the Spanish people. The most important souvenir that my family and I will take from Spain is the memory of the hospitality and kindness extended to us throughout our stay.

All completing doctoral students owe debts to many people. I am certain, however, that my case is distinguished by the large number of people who assisted me in this endeavor. The Spanish Ministry of Education and Science provided considerable support for my research over two years. I would also like to thank my colleagues at INFORUM, Margaret McCarthy, who taught me many tricks of the trade, and Doug Nyhus and Costas Christou who formulated the Europe 1992 scenarios which formed the foundation for Chapter 8 of this work. At Fundación Tomillo, I enjoyed invaluable guidance and assistance from Vincente Antón, Juan Carlos Collado, Antonio Diaz, Jose Fierros and Mario Tomba. There is no doubt that the work could not have been completed without them. I am also indebted to Carlos Nuñez and Elena Alonso for cheerfully performing tedious research assistance, and Jose Muñoz, who helped me deal with the day-to-day business of life in a foreign country.

I would also like to thank Maurizio Grassini, who, in two short trips to Madrid, taught me more about interindustry modeling than I would have learned in several months on my own.

I am much indebted to Clopper Almon for recommending me for the position at Fundación Tomillo, and for allowing me the independence to conduct my dissertation research several thousand miles away. I hope that I have justified his confidence in my abilities. The greatest thanks of all must be reserved for Javier Lantero, whose patience, generosity and foresight provided me the opportunity not only to write this dissertation, but also to enjoy three wonderul years with the Spanish people. While I know that I could never repay his kindness in full, I hope that my work at Fundación Tomillo will establish a solid base for a fruitful and enduring economic research program.

Madrid, May 14, 1992

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CHAPTER 1: INTRODUCTION

Empirical models offer a fruitful approach to understand an economy. In the first place, their construction forces the analyst to examine each and every part of the economic process. Further, it tests whether his understanding of the parts adds up to an understanding of the whole. Once a model is built, the presentation of its structure and empirical results motivate and focus economic discussions by economists and non-economists alike. In my experience, economic forecasts never fail to attract interesting analysis and opinions from any group of informed observers. Careful and honest use of models has even been known to be useful to economists, business managers or government officials for quantitative analysis and decision making.

This work presents the construction and application of a macroeconomic, dynamic, multisectoral forecasting model of the Spanish economy (MIDE).[1] The foundation of the MIDE model is a 43 sector input-output table embedded in the structure of the Spanish national accounts. Combining the classical input-output formulation with extensive use of regression analysis, MIDE employs a "bottom-up" approach to macroeconomic modeling. For example, total capital investment, total imports and total wage income are not projected directly but are computed from the sum of their parts: investment by specific goods, imports by production branch, and labor compensation by industry. This bottom-up technique possesses several desirable properties for analyzing an economy. First, the model works like the actual economy, building the macroeconomic totals from details of industry activity, rather than distributing predetermined macroeconomic quantities among industries. Second,

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[1] In Spanish, MIDE stands for *El Modelo **M**acroeconómico **I**ntersectorial **d**e **E**spaña*. It is also the third person present tense of the verb *medir*, "to measure."

the model describes the effects of changes in one industry, such as increasing productivity or changing input-output coefficients, on other, related sectors and the aggregate quantities. Third, parameters in the behavioral equations differ among products, reflecting differences in consumer preferences, price elasticities in foreign trade, and industrial structure. Fourth, the detailed level of disaggregation permits the modeling of prices by industry, allowing one to explore the causes of relative price changes.

Another important feature of the MIDE model is the importance given to the dynamic determination of endogenous variables. For example, investment depends on a distributed lag in the output growth of investing industries. Therefore, MIDE model solutions are not static, but are fully capable of projecting a time path for the endogenous quantities. Finally, the MIDE model is linked to other, similar models with the INFORUM[2] international trade model. Countries included in this system include the U.S., Japan, and major European economies. Through this system, sectoral exports and imports of the Spanish economy respond to sectoral level demand and price variables projected by models of its trading partners. In brief, the MIDE model is particularly suited for examining and assessing the macroeconomic impacts of the changing composition of consumption, production, foreign trade and employment as the economy grows through time.

MIDE consists of three components: the production block, the price-income block, and the macroeconomic accountant. The production block estimates final demand using individual, econometrically estimated behavioral equations for each of the commodity and

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[2] INFORUM is the Interindustry Forecasting Project at the University of Maryland, U.S.A., founded by Clopper Almon in 1967. This research group has, in collaboration with other international partners, developed a foreign trade linked system of models for the countries of the Austria, Belgium, Canada, France, Italy, Japan, Mexico, South Korea, Spain, the United States and West Germany. Several other country models, including ones for Poland and the United Kingdom, have been developed and await integration into the international model.

sectoral-specific quantities. Real output by industry is then determined with the Leontief input-output identity, where the interindustry technical coefficients vary over time. The price-income block computes industry income and prices using behavioral equations for primary input costs and an input-output price identity. The accountant determines the magnitude of national income and distributes this income among households, governments and firms. It also computes the current account and government balances. Relationships specified among the variables of the three model components close the model.

The addition of the MIDE model to the small inventory of empirical models of Spain is particularly timely. The MIDE model is the only multisectoral, dynamic, macroeconomic model of the Spanish economy with significant (i.e., over twelve sectors) disaggregation. Therefore, it can be used for applications where other, existing models are inadequate. Specifically, I employ the MIDE model here to investigate the short and longer-run macroeconomic and industry level implications of Spanish integration in the European Community (EC) single market.

Along with the rest of Europe, the Spanish economy is in the midst of transition. In 1975, Spain entered a long period of stagnation which produced a restructuring of its production base and high unemployment. Since joining the EC in 1986, however, the economy has been growing rapidly. An acceleration in investment for capital goods, non-residential construction and housing paced this growth. However, foreign trade has become a concern. Strong interior demand, coupled with EC mandated trade liberalization, led to dramatic import increases which have not been compensated with similar export growth. As a result, the current account registers a fat deficit. Recent increases in real wages and steady appreciation of the peseta has exacerbated the problem. This deficit produces uneasiness surrounding the future of the economy.

The most important influence on the course of the Spanish economy for the next decade will be the continuing integration of the EC. The *Europe 1992* program will eliminate all barriers to trade, capital and labor movements between the Community countries. Many Spaniards feel that with the arrival of the single market in 1993, the external imbalance will become unsustainable and another deep retraction will be required. This prospect is most discouraging because, despite five years of vigorous growth, the official unemployment rate still stands at over 15 percent.

Another preoccupation among the Spaniards concerns whether the nation will reach "monetary convergence" with the rest of the EC in preparation for Economic and Monetary union (EMU). Under agreements made in the recent EC Maastricht summit, the union will start in 1997 if a majority of the current EC members meet the "convergence criteria" required to join. Currently, the magnitudes of Spain’s inflation and interest rates, as well as its government budget deficit, would exclude it from the union. While the nation has five years to progress on these fronts, it is by no means certain that convergence can be accomplished.

The MIDE model, as a comprehensive representation of the Spanish economy, is a convenient tool for investigation of the impact of EC integration. Of course, the effects of the EC single market will differ across sectors of the economy. For example, since EC membership in 1986, high-growth, export-orientated industries, such as automobiles, have benefitted. On the other hand, import-competing industries, such as textiles and apparel, have suffered significant market penetration into their previously closed markets. Existing aggregate models of the Spanish economy cannot project the course of individual industries, nor can they consider the macroeconomic impacts of sectoral developments. As stressed above, the multisectoral framework of the MIDE model provides both of these capabilities.

Moreover, the dynamic character of the model permits a quantification of the short-run costs which may accompany the long-run benefits of Spain's full integration into the European single market. This is in contrast to disaggregated models which contribute a comparative static approach to the issue. Finally, the inclusion of the MIDE model in the INFORUM trade-linkage system provides a particularly useful framework for assessing the effects of continuing European integration, since developments in the economies of Spain's trading partners can be taken into account.

I would like to emphasize that, although MIDE is the Spanish representative of the INFORUM system, its construction was not simply an application of a general model form. The specification and estimation of the MIDE model explicitly integrates particular characteristics of the Spanish economy. This strategy is indispensable in order to assure the relevance and realism of the model. Moreover, because of the dearth of disaggregated econometric studies of the Spanish economy, some of the sectoral-level equation estimations constitute unique studies on their own. I hope that this work will be found useful to researchers of both the Spanish and of other economies.

The specification and estimation of any empirical model is necessarily dependent on the historic evolution and institutional framework of the economy examined. The second chapter of this dissertation, therefore, provides a brief history and a current assessment of the modern Spanish economy. Touching upon macroeconomic, institutional and sectoral characteristics, this chapter supplies the raw material for construction of the MIDE model and a point of reference for its projections. The description of the MIDE model found here will refer to other models of the Spanish economy. To provide a background for these references, the third chapter presents a survey of the other empirical models of the Spanish economy, comparing and contrasting these models with the MIDE model.

The fourth chapter opens with a presentation of the general-equilibrium framework and solution process of the MIDE model. It discusses each of the model's three components separately, and then describes the integration of these parts. The main focus of this portrait is to trace the linkages among the economic variables and explain the theory underlying these interactions. The chapter then addresses philosophical and practical considerations of econometric estimation for a model the size and detail of MIDE. The special nature and design of a macroeconomic, multisectoral model mandates a simple and direct approach for the specification and estimation of econometric behavioral equations. Functional forms and parameter estimates must be evaluated considering their realistic portrayal of economic behavior and their interaction in the full forecasting model. Because of the number of equations, they must also be relatively easy to estimate.

The following three chapters present the functional specifications and estimation results for the roughly 300 behavioral equations of the MIDE model. Chapter 5 covers the consumption and investment equations; Chapter 6 covers foreign trade, productivity and employment; and Chapter 7 presents the wage and gross profit functions.

Chapter 8 presents an application of the MIDE model. It is used to investigate the potential impacts of various aspects of the European single market program. Once the various single market measures are integrated into the model, a forecast to the year 2000 is presented. The forecast demonstrates that with successful adaptation to the single market, governmental budgetary restraint, wage moderation and some luck in export markets, the Spanish economy can approach "monetary convergence" with the rest of the EC. Moreover, convergence can be accomplished without suffering significant decreases in the growth of income and employment. The model also provides detailed industry-level projections indicate the potential course of structural change. The projections illustrate a maturing economy which becomes even more integrated in the international economy. The final chapter summarizes the present work and outlines some plans and future directions for work on the MIDE model.

In addition to the construction and application of the MIDE model, this project has made a further contribution to the study of the Spanish economy. Given various shortcomings of existing time series data of the Spanish economy, implementation of the model required the assembly of a homogeneous time-series of sectoral-level accounts, which were previously unavailable. The compilation of the data base necessitated the use of data from a wide array of sources and the application of techniques of homogenization, interpolation, aggregation and disaggregation. This comprehensive, detailed data base is now available for anyone interested in the Spanish economy. For this reason, I have included an Appendix which describes the nature and construction of this data base.

CHAPTER 2:

HISTORICAL OVERVIEW AND SECTORAL CHARACTERISTICS OF THE SPANISH ECONOMY

2.1 Overview of the Spanish Economy, 1960-1991

The history of the Spanish economy from 1960 to the present can be easily divided into three different periods, which are illustrated by Figure 2.1. Starting after a recession in 1959, the economy experienced substantial and sustained growth through 1974. GDP growth during this period was consistently between 4 and 8 percent, with an annual average of 6.8 percent from 1960 through 1974 (Table 2.1). The average rate of growth for per capita real income was 6.1 percent. This growth was the result of various economic reforms. The most important of these reforms, a greater opening to international trade, allowed Spain to share in the general prosperity of the world economy. With the world recession of 1975, brought about in part by the first oil shock, Spain started into a period of prolonged stagnation. Annual GDP growth averaged only 1.5 percent from 1975 through 1985, and there was no growth in income per capita. It was not until 1987 that GDP growth was again to climb above 4 percent. This slow growth is due to many factors, including sluggish growth in the rest of Europe, the high price of oil, structural rigidities embedded in the economy, and the political turmoil brought about by the death of General Franco, the head of state for over 35 years.

In 1986, Spain joined the European Community, and the economy began to bustle. For the years 1986 through 1991, GDP growth averaged 4.1 percent; real per capita income growth was even higher, at 5.1 percent. An acceleration in investment for capital goods, non-residential construction and housing paced this growth. The investment boom was

Figure 2.1: Real Gross Domestic Product, 1960-91
(Annual percentage change)

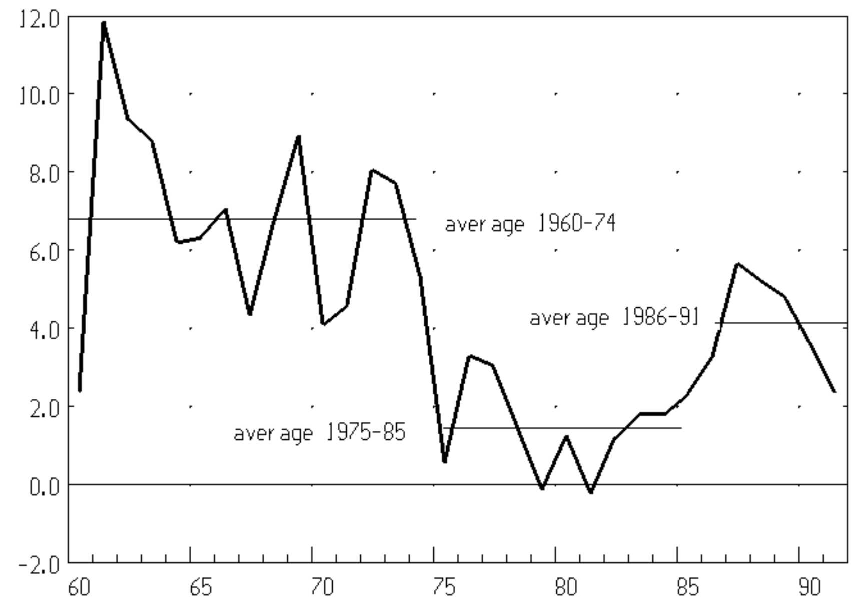


Figure 2.2: Current Account Balance as a Percentage of GDP, 1960-91
(Current prices)

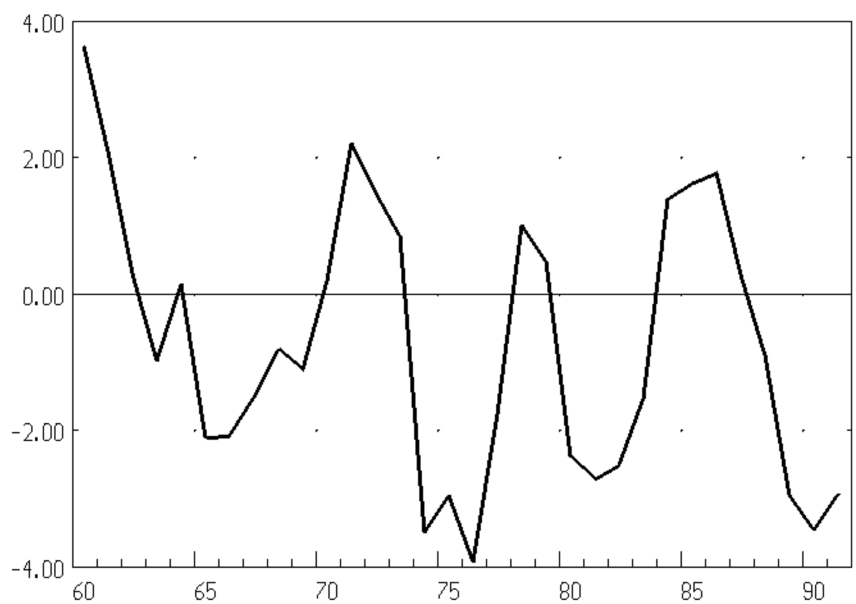


Table 2.1: Real Gross Domestic Product and Components, Other Economic Indicators, 1960-1991 (percentage change unless otherwise noted).

Yr.	GDP	Priv. Cons.	Govt. Cons.	Fix. Inv.	Tot. Exp.	Tot. Imp.	Infl. %(a)	Unemp. %	C.A. (b)	PCap Y(c)
60	2.4	-3.3	3.5	8.7	67.5	5.4	0.8	N/A	3.6	0.8
61	11.8	10.8	5.3	17.5	7.8	39.9	1.6	N/A	2.1	12.2
62	9.3	8.5	6.5	10.8	12.4	33.9	5.4	N/A	0.3	8.7
63	8.8	10.6	8.9	10.7	3.1	22.7	8.4	N/A	-1.0	8.4
64	6.2	4.9	1.8	19.4	26.2	13.7	6.1	1.5	0.1	4.8
65	6.3	6.6	3.4	16.7	6.6	32.7	9.9	1.5	-2.1	5.0
66	7.0	6.9	1.7	12.7	15.2	19.0	7.2	0.9	-2.1	6.4
67	4.3	6.1	2.4	4.2	-4.6	-3.2	5.8	1.0	-1.5	5.2
68	6.8	6.2	2.1	8.8	18.7	8.5	4.9	1.0	-0.8	5.0
69	8.9	6.8	4.1	11.9	15.4	15.6	3.2	0.9	-1.1	9.2
70	4.1	4.6	5.7	2.0	17.9	7.4	6.3	1.0	0.2	3.1
71	4.6	5.1	4.3	-3.0	14.2	0.7	7.8	1.5	2.2	4.1
72	8.0	8.3	5.2	14.2	13.4	24.3	7.6	2.1	1.5	8.6
73	7.7	7.8	6.4	13.0	10.0	16.7	11.4	2.3	0.8	8.0
74	5.3	5.1	9.3	6.2	-1.0	8.0	17.8	2.6	-3.5	2.3
75	0.5	1.8	5.2	-4.5	-0.4	-0.9	15.5	3.8	-2.9	-0.3
76	3.3	5.6	6.9	-0.8	5.0	9.8	16.5	4.9	-3.9	1.7
77	3.0	1.5	3.9	-0.9	12.1	-5.5	23.7	5.5	-1.7	1.1
78	1.4	0.9	5.4	-2.7	10.7	-1.0	19.0	7.3	1.0	1.6
79	-0.1	1.3	4.2	-4.4	5.6	11.4	16.5	9.2	0.5	-1.1
80	1.2	0.6	4.2	0.7	2.3	3.3	16.5	11.5	-2.4	-2.2
81	-0.2	-0.6	1.9	-3.3	8.4	-4.2	14.3	14.4	-2.7	-4.7
82	1.2	0.2	4.9	0.5	4.8	3.9	14.5	16.2	-2.5	-0.2
83	1.8	0.3	3.9	-2.5	10.1	-0.6	12.3	17.7	-1.5	0.0
84	1.8	-0.4	2.9	-5.8	11.7	-1.0	11.0	20.6	1.4	1.1
85	2.3	2.4	4.6	4.1	2.7	6.2	8.2	21.9	1.6	2.7
86	3.2	4.1	5.8	10.1	1.6	14.8	8.7	21.4	1.7	6.1
87	5.6	5.8	8.9	14.0	6.3	20.1	5.7	20.6	0.2	6.4
88	5.2	4.8	4.0	14.0	5.1	14.4	5.1	19.5	-0.9	5.9
89	4.8	5.6	8.3	13.8	3.0	17.2	6.6	17.3	-2.9	5.3
90	3.6	3.7	4.2	6.9	3.2	7.8	6.4	16.2	-3.4	4.1
91	2.4	3.0	4.4	1.6	8.4	9.4	6.3	18.6	-2.9	2.6
Annual Averages:										
60-74	6.8	6.3	4.7	10.3	14.9	16.4	6.9	1.1	-0.1	6.1
75-85	1.5	1.2	4.4	-1.8	6.6	1.9	15.3	12.1	-1.2	0.0
86-91	4.1	4.5	5.9	10.1	4.6	12.4	6.5	19.0	-1.4	5.1

Sources: Banco España (1991a), Instituto Nacional de Estadística (various), Corrales and Taguas (1989), Baiges et al. (1987).

(a) Inflation expressed as percentage change in the consumption deflator.
(b) Current Account expressed as percentage of GDP, in current prices.
(c) Net natl. income, divided by cons. deflator, divided by population.

partly the result of an increase in foreign investment as transnational firms aspired to profit from the growing internal market and establish a foothold in the European market.

Since 1986, imports have exploded, but export growth has been disappointing, and a large trade deficit has evolved. Reasons for this outcome include a higher demand growth rate in Spain relative to its EC partners, higher inflation and wage growth, reduction of Spanish trade barriers, and a steady appreciation of the peseta since EC membership. Also, foreign investors in Spanish production facilities normally import foreign capital equipment. Accordingly, the substantial inflow of direct foreign investment since 1985 stimulated a direct flow of imports.

Throughout the modern history of Spain, the trade balance was the major constraint on the economy. A major stabilization plan was instigated in 1959 as a result of a foreign exchange crisis brought about by chronic trade deficits. During the growth years of the sixties, periodic trade imbalances induced restrictive policies by the government. Large deficits and inflation caused by the oil price shocks of the 1970s repressed growth for a long period. The resulting "stop-and-go" characteristic of the current account can be seen clearly in Figure 2.2. Therefore, the present deficit produces uneasiness surrounding the future of the economy.

The Years of Prosperity: 1960-1974

A high rate of GDP growth from 1960 through 1974 is only part of the story. A large structural shift from agriculture towards services also characterized this period. Table 2.2 illustrates the magnitude of this shift. In 1960, the proportion of the GDP arising from agriculture was 22.3 percent, while industry and services accounted for 28.7 and 43.5 percent, respectively. By 1975, agriculture produced only 9.5 percent of GDP,

Table 2.2: Sectoral Proportion of GDP and Employment, 1960-1989.

	1960	1965	1970	1975	1980	1985	1990
Value added percentage of current price GDP (a)							
Agriculture	22.3	15.5	10.7	9.6	7.1	6.3	4.6
Industry	28.7	33.0	32.9	32.3	30.2	30.5	25.6
Construction	5.5	7.6	9.1	9.6	8.4	6.5	9.0
Services	43.5	41.6	45.2	46.6	52.5	54.8	54.6
Import Taxes	--	2.3	2.1	1.9	1.8	2.0	0.7
Value Added Tax	--	--	--	--	--	--	5.5
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percentage of total employment							
Agriculture	40.5	35.7	30.5	23.4	18.8	18.2	11.8
Industry	23.5	23.5	24.8	26.9	27.2	24.5	23.7
Construction	6.7	8.5	9.5	9.6	9.0	7.3	9.7
Services	29.2	31.0	33.8	38.6	44.9	50.0	54.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Instituto Nacional de Estadística (1988), Banco de España (1991b), Corrales and Taguas (1989), Dehesa et al. (1988).

(a) All figures GDP market prices (including taxes and subsidies) except 1960 which is GDP at factor cost (excluding taxes and subsidies.

while industry's share had climbed to 32.3 percent, and the service share to 46.6 percent. The agricultural share of total employment fell from 40 to 23 percent. These jobs were compensated by employment expansion in each of the other three sectors, with services absorbing the most, increasing its share from 29 to 39 percent. This combination of rapid growth and structural change allowed Spain to close the gap between itself and the rest of the industrial world.

The foundations for the development of the Spanish economy in the 1960's were laid in the previous decade. The industrialization of the economy had begun in earnest in the 1950's under the import substitution policies of the Franco regime (Dehesa et al. 1988). This philosophy was adopted because of a suspicion of free markets held by the government leaders and because of the political isolation of Spain following World War II.[1] Economic policies of this era included price controls, especially on food products, and government intervention in capital markets to channel investment to favored sectors. An elaborate system of import licenses, quotas, tariffs, and foreign exchange controls favored industrial development. This industrial bias induced massive migration of at least one million people from rural to urban areas. The result was "a growing urban and monetary economy endowed with an intermediate level of technology and appropriate and flexible human capital" (Dehesa et al. 1988, p. 10).

Nevertheless, the import-substitution-driven economy ran out of momentum by the late 1950's, when the economy sustained huge trade-balance deficits. These deficits were driven by an ever increasing need for imported intermediate and capital goods to feed the growing domestic industries. Also, the anti-agricultural bias, an over-valued exchange rate, and protection for domestic industry discouraged exports. By 1959, Spain had run out of foreign exchange and could not import the foodstuffs, let alone the intermediate and capital goods, on which it had come to depend. This fact, coupled with inflationary financing of public sector debt (see below), spurred high rates of inflation (an average of 8.5 percent from 1954 to 1959). Faced with this crisis, the government, in cooperation with the International Monetary Fund and Organization for Economic Cooperation and Development, adopted the Stabilization Plan of 1959 (Plan Nacional de Estabilización Económica). This plan was composed of three elements (Fuentes Quintana 1989):

1) Liberalization of the Foreign Sector. The peseta was devalued and a uniform foreign exchange rate system introduced. A rapid liberalization of import license/quota and tariff systems reduced the industrial bias and protectionist

[1] It is well known that Spain had always held to a mercantilist philosophy throughout its history. The economic policies of the early Franco regime were not a deviation from this tradition.

nature of the previous system. A new foreign investment law encouraged inflows of capital.

2) Balancing of the government budget and a halting of subsidies to public enterprises. Taxes and prices for publicly provided goods increased. Because government debt was financed by securities that were immediately monetized by the central bank, the reduction of the government deficit reduced inflationary money creation.

3) Limitation of liquidity expansion in the private sector. The ceiling on interest rates was raised, and a limitation was placed on the expansion of private credit.

The immediate impact of the Plan was an improvement in the balance of payments and a severe recession. Within a few years, the new policies had the desired effect of alleviating the problems of unsustainable trade deficits and inflation. More important, however, was that the trade liberalization elements of the stabilization plan produced the opportunity for Spain to share in the general world-wide economic boom during the 1960's. International prosperity attracted foreign direct investment, tourism and other exports receipts. It also stimulated a large emigration of labor to other parts of Europe which kept unemployment low while increasing transfers from abroad. Though there was some occasional backsliding toward protectionism, Spain never returned to its long tradition of autarchy.

Returning to Table 2.1, we see the pattern of real economic growth through the 1960-74 period. The rapid real GDP growth on an average annual basis, 6.8 percent, was accompanied by a substantial inflation rate (6.9 percent, high compared to the international standards of the time) and very low unemployment (1.1 percent). While government spending grew at a modest pace of 4.7 percent, the public sector was a net lender to the economy, mainly because of a surplus in social security. The economy displayed very high growth rates of fixed investment (10.3 percent) and exports (14.9 percent, including tourism). The 16.4 percent increase in imports was offset by transfers from Spanish workers abroad to produce a balanced current account, on average. Obviously, the high growth rates of foreign trade represent a significant change in the degree of openness of the Spanish economy. The proportion of current price imports to GDP increased from 7.5 percent in 1960 to 19.2 percent by 1974, the export proportion from 10.3 to 14.4 percent.

Nevertheless, other factors prevented a more thorough transformation of the economy (Dehesa et al. 1988). In 1964, a new round of subsidies, tax exemptions and special financial privileges, reduced the momentum created by the 1959 reforms. A poor taxation system impeded complete and fair collection of income and property taxes, leading to a shortage of public goods and infrastructure investment. The efficiency of the labor market was hampered by regulations stipulating the duration of labor contracts, restricting dismissals and mandating levels of severance pay. Trade unions were illegal and there was no right to strike. Reforms in this area would have run counter to the philosophy of the Franco regime, which emphasized a paternalistic system of job security in exchange for worker discipline and low wages (Toharia 1988, p.120). Remnants of this system still impede labor mobility and economic growth today.

As evident in the stabilization plan outlined above, the government still exercised tight control in the financial system, imposing interest rate ceilings and barriers to entry for new lenders. The low, and often negative, rates of real interest insured that credit rationing was the rule. Since a large proportion of financial resources were channelled to preferred recipients through compulsory investment rules, the most economically deserving investment projects lost out to the dubious projects of the well-connected. Exchange controls remained substantial and tended to isolate the Spanish capital market from the rest of the world. Politically powerful bankers resisted any suggestion of reform of this system. As we have seen, inflationary pressures were strong during the period. When the combination of inflation and trade imbalances periodically appeared, the government authorities introduced demand cutting measures, usually through ad hoc capital constraints, to stabilize the situation. Such restrictive measures were significant in 1967, 1971 and 1975.

From 1960 to 1974, the economy was opened to world trade and displayed rapid growth of production, income and investment. However, much remained controlled and regulated. These structural and institutional rigidities proved disastrous when the first oil shock and world recession occurred in 1975.

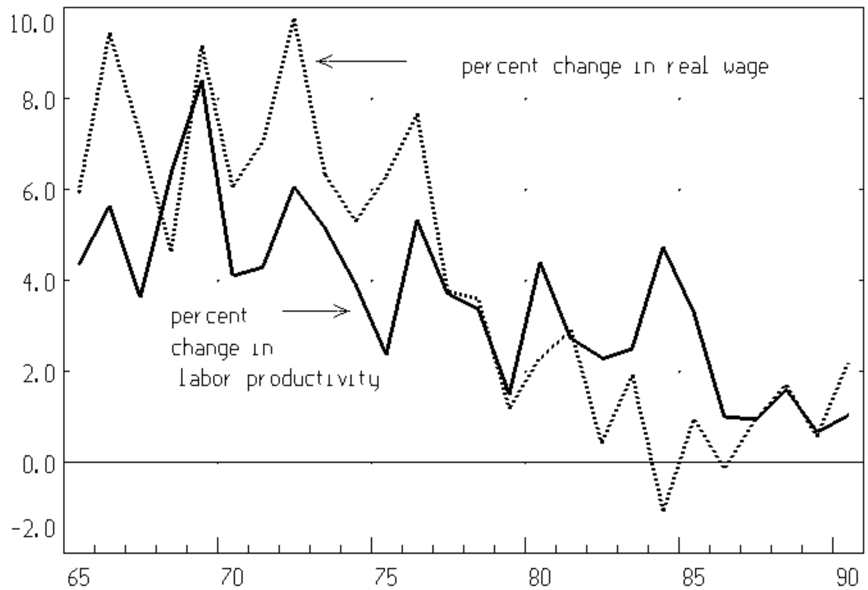
Economic Crisis: 1975-1985

By 1973, imported oil accounted for 68.3 percent of Spain's energy consumption (Salmon 1991, p.6). In that year, large increases in the international price of oil stopped the Spanish economic juggernaut in the water. The balance of payments turned sharply negative and domestic inflation increased dramatically. By 1975, economic growth fizzled out. Structural and institutional rigidities, especially those of the labor market, prevented the economy from responding with any flexibility to the oil price shock. Moreover, the path and duration of economic crisis in Spain was profoundly influenced by the political turmoil associated with the death of General Franco in 1975. At that time, Spain embarked on a perilous transition to democracy. Economic problems often took a backseat to political ones.

Political problems and social demands overwhelmed the first governments of the political transition. Social peace was partly bought by a permissive monetary policy and huge rises in monetary wages (política permisiva, Toharia 1988, p. 123). Because of the tight labor market, real wage increases had exceeded labor productivity increases for years (Figure 2.3). Until 1975 the differential had been accommodated by a redistribution of income between wages and profits (Figure 2.4). From 1975 through 1979, however, the permissive monetary policy allowed firms to avoid the redistributive trend by immediately passing wage increases into prices. Meanwhile, continued restrictions on interest rates led to negative real interest rates. Companies increased borrowing, stoking the fires of inflation. This inflation, which peaked at 23.7 percent in 1977, only postponed the problems of the Spanish economy. Finally, unemployment, previously very low, increased rapidly, reaching 5.5 percent of labor force by 1977. As we shall see, later adjustments aimed at squeezing inflation out of the economy proved even more damaging to employment.

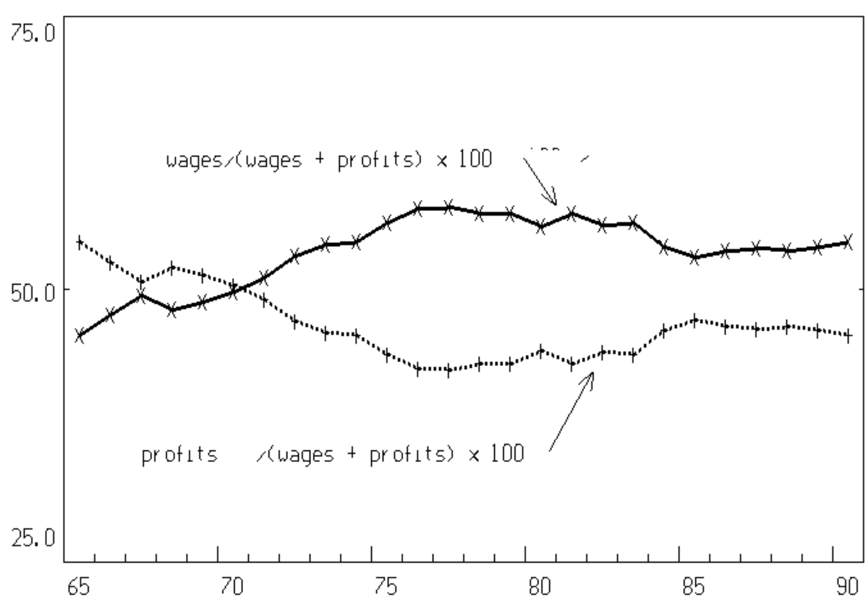
Following the first democratic elections of 1977, the various political parties agreed to initiate measures which would begin the difficult process of economic adjustment. These policies were formalized by the Moncloa Pacts (Los Pactos de la Moncloa). As in 1959, the reform policies contained in this document stressed restrictive monetary and fiscal policies. For the first time, however, Spain's leaders also agreed to begin reforming the labor market. In 1977, virtually all industrial wages were 100 percent indexed with inflation. The most important short-run impact of the pacts was made by changing the wage indexation from actual inflation to a target (or expected) inflation rate set by the government. Also, the government agreed to decrease social security tax rates. These two provisions helped to break the inflationary spiral. As shown in Figure 2.3, by 1979 the increase in real wages fell below productivity growth. For the longer term, the Moncloa pacts contained provisions for shorter duration and less costly types of temporary job contracts, and for easier and less costly dismissals. Finally, the government accepted the responsibility to administer a restructuring program (reconversión industrial) aimed at reducing excess capacity and employment in several large industrial sectors (Fuentes Quintana 1989, p. 40-41).

Figure 2.3: Real Wages and Labor Productivity, 1965-90. (a)
(Annual percentage change)



(a) Real wages defined as gross nominal wages (including social security paid by employer) deflated by GDP deflator, divided by employment. Labor productivity defined as real GDP divided by employment.

Figure 2.4: Shares of Wages and Profits in Value Added at Factor Cost, 1965-90.
(Percent)



The stated aim of the government's industrial conversion policy was to adapt Spanish industry to the changing international economic environment and increase its competiveness. Government intervention was felt to be necessary to promote a more orderly and less costly restructuring than one that might occur from market forces alone. In practice, the policies cushioned industries from the full impact of the industrial crisis. These measures took various forms, including: the promotion of mergers, nationalization or new regulation of monopoly firms, subsidies and debt writeoffs, and government sanctioning of layoffs and factory shutdowns with training and benefit assistance to the unemployed workers. The reconversion was especially important for the metals, shipbuilding, electrical, textiles, and motor vehicle industries.[2]

From the Moncloa pacts through 1985, an improving political climate allowed for better economic policy. Money supply growth and inflation gradually abated and the current account was in surplus by 1984. However, GDP growth was slow (below 2 percent) and fixed capital investment experienced negative growth in eight of the years from 1975 through 1984 (Table 2.1). Restrictive demand policies and restructuring took an enormous toll on employment. Figure 2.5 illustrates the magnitude of the job destruction. Between 1974 and 1985, employment was reduced by 2.2 million positions; the unemployment rate increased from 2.6 percent to a peak of 21.9 percent in the same period. By 1991, it was still hovering at 16 percent, and remains the major problem of the Spanish economy today.[3]

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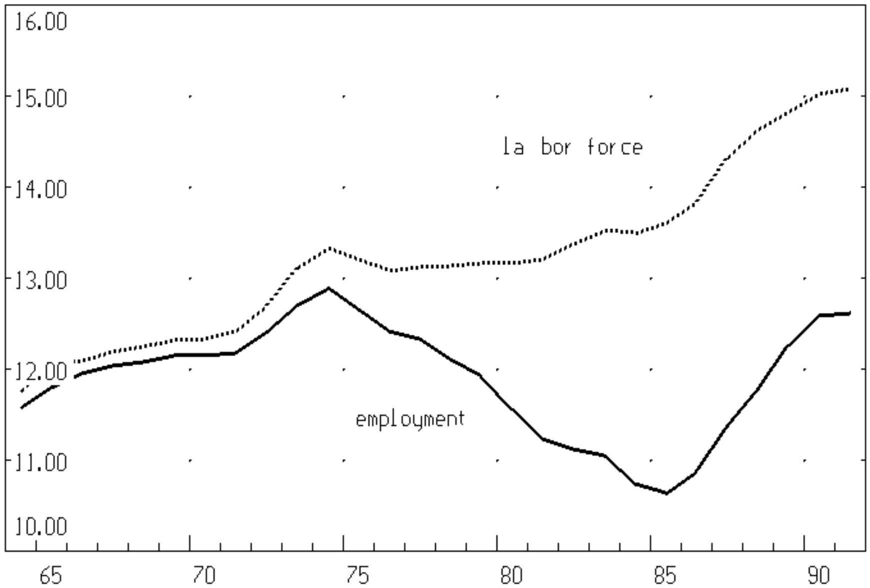
[2] For detailed descriptions of the reconversion programs, see Salmon (1991, 112-145).

[3] The actual unemployment rate remains disputed. Spain has a substantial underground economy. The proportion of underground to documented activity probably increased during the crisis. Moreover, expansion of unemployment compensation eligibility induced entry into the labor force of unemployed persons who would not otherwise be there. Therefore, it is possible that official employment figures increasingly underestimate the number of workers employed. However, a measure of the "real" unemployment, say, five percent below the official rate, would still place it among the highest in the EC.

Figure 2.5: Employment and the Labor Force, 1964-91.
(Millions of persons)



EC Integration and Economic Boom: 1986-1990

Economic membership in the European Community (EC) influenced the Spanish economy significantly. Growth began at a rapid pace starting in mid-1985, just before Spain joined the EC. From 1986 through 1990, Spain experienced the most rapid expansion of the Community, averaging 4.5 percent GDP growth and 4.8 percent private consumption growth. While the growth of Spanish exports was steady, that of its imports was much stronger, throwing the current account into a fat deficit. This constraint, however, has been softened by the large flow of foreign direct investment. Indeed, a large portion of the increased imports can be directly attributed to the capital inflow, as foreign investors have imported great quantities of durable equipment (see Section 1.2 and Chapter 6).

The most striking characteristic of this boom was the vigorous expansion of investment. From 1986 through 1990, investment in machinery and transportation equipment increased at 15.3 percent, residential construction 5.6 percent, and non-residential construction 15.0

percent. Since fixed investment stagnated significantly during the crisis, the renewed growth represents a needed rebuilding of capital stock, but it also signals a healthy confidence in the economy by both domestic and foreign agents. It also suggests a recognition by Spanish producers, whether foreign or domestic, of the need to accumulate the most modern and productive technology available in order to compete in the European single market which starts in 1993. Furthermore, helped by EC structural transfer funds and spurred by the 1992 Olympics in Barcelona and the 1992 World Exposition in Seville, government investment in infrastructure increased substantially. It is hard to drive a car anywhere in Spain without encountering construction-related delays. We shall examine investment behavior in detail in Chapter 5.

Since the explosion of foreign direct investment played an important role in the investment boom, it deserves further explanation. Table 2.3 displays the total and direct net foreign investment flows into Spain for the period of 1982 through 1990. By 1990, both figures are almost ten times greater than in 1982. There are several plausible reasons for this gush of foreign capital, including (Martín 1990a, p.216; Larre and Torres 1991):

1) the reduction of uncertainty surrounding future economic regulation due to Spain's integration in the EC;

2) the possibility of gaining a foothold in the EC market within a country with low relative labor costs;

3) the promise of plentiful profits from a domestic market growing faster than the EC average;

3) the greater availability and reduction in costs of imported inputs, due to trade liberalization, which raises the rate of return of capital;

4) the exploitation of Spanish government incentives to foreign investors, especially for activities in certain high technology sectors or regions of interest.

Table 2.3: Total and Direct Net Foreign Investment into Spain, 1982-90.
(Billions of pesetas)

Year	Total Net Inflow	% change	Direct Net Inflow	% change
1982	198.8	--	111.4	--
1983	243.7	22.5	121.5	9.1
1984	322.1	32.2	156.4	28.5
1985	412.9	28.2	164.2	5.2
1986	716.8	73.6	284.2	73.1
1987	996.5	39.0	321.5	13.1
1988	1063.5	6.7	521.1	62.1
1989	1730.1	62.8	667.3	28.1
1990	1845.5	6.7	1073.1	60.8

Source: Banco de España, Boletín Estadístico (various years).

A very large proportion of the foreign investment has been directed toward industrial sectors with rapid demand growth, such as pharmaceutical, automobiles, computers, electronics and food processing (Ministerio de Industria y Energía 1990; Buiges et al. 1990, p.7). Now, foreign transnational firms dominate several industries. For example, the motor vehicle industry expanded to become a leading sector of Spanish industrial development; Spain is now the sixth largest producer of motor vehicles in the world. The industry, however, is completely owned by foreign producers. Moreover, this same set of industries contributes disproportionately to exports. Again taking the auto industry as an example, in 1989 five of the leading ten exporters, including the top four, are companies of this industry (El Pais 1991, p.392). The situation is much the same in chemicals, computer, electronics, and, increasingly, food processing.

The bad news from the current expansion is an accumulation of foreign debt to finance the current account, an excruciatingly slow fall in the unemployment rate, and a steady increase in inflationary pressures with accompanying high interest rates. (Consumer prices rose 5.4 percent in 1987 to 6.4 percent in 1990, Table 2.1). A recent increase in real wages above labor productivity growth, after several years of slower growth, has hindered the competiveness of the economy (see Figure 2.3). Also, entry in the European Monetary System (EMS) in June of 1989, coupled with a restrictive monetary policy and foreign capital inflow, resulted in a steep appreciation of the peseta to the top of the 6 percent band with the German Mark. This did not help the current account deficit, which reached a record 15.7 billion dollars in 1990.

Prospects for the Modern Spanish Economy

The modern Spanish economy was born in a period of autarchy in the 1950's. It experienced expansion during the "economic miracle" of the 1960's and contraction during the "economic crisis" of the late 1970's and early 1980's. During all this time, the government took an active role in directing the development of the economy, among other things, protecting it from international competition, allocating investment funds to preferred sectors, and retaining majority holdings of firms in several key sectors. As Spanish firms enter the 1990's they face several challenges. Most importantly will be the emergence, in 1993, of the European single market. This program contemplates the removal of all remaining barriers to goods, service, capital and labor movements among the EC countries.[4] Also pending is a substantial reduction of tariffs and non-tariff trade barriers with third countries as Spain approaches harmonization with the Common External Tariffs (CET) of the EC. Table 2.4 shows that remaining trade liberalization is still quite significant. Competition will also increase in service markets. As already apparent, domestic industries and institutions will be buffeted by these changes.

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[4] Chapter 8 covers the EC single market program in detail. For an overview of specific provisions and implications of "*Europe without borders*" see Cecchini et al. (1988) and Hufbauer (1990).

Table 2.4: Program of Trade Liberalization Under Spain's EC Membership, 1986-93.

A. Industrial products:

1. Gradual tariff rate reduction process from the base rate (approximately 14%) to zero in the case of other EC countries, and from the base rate to the (lower) Common External Tariff rate (CET approximately 4-5%).

2. The time-table for the above tariff reduction is as follows:

	% reduction
March 1st	1986....... 10
January 1st	1987....... 12.5
"	1988....... 15
"	1989....... 15
"	1990....... 12.5
"	1991....... 12.5
"	1992....... 12.5
"	1993....... 10
Total	 100

3. Most quantitative restrictions between Spain and the EC can be maintained only until 1-1-1990. In fact, Spain got rid of many quantitative restrictions in 1986.

B. Agricultural products:

1. Products originating in any EC country have preference (relative to products originating in non-EC countries) in other EC countries.

2. Common Agricultural Policy accepted as of 1986.

3. Gradual tariff rate reduction for agricultural products to be completed by January 1, 1993. The time-table for fruits, vegetables, and vegetables fats extends to January 1, 1996.

Source: Viñals (1989).

At the same time, the European single market produces opportunities previously unavailable in an inward-looking economy. Unrestricted access to the huge European market will enable Spanish producers to capitalize on economies of scale, adapt new production techniques, and reach new customers. Liberalization of capital flows provides Spanish firms the possibility of tapping new sources of finance and opens new channels for investment. While this period is not unlike the early 1960's where there was a great opening towards the international economy, firms cannot depend on the state to support them through hard times. The government is now committed to reducing its interference in microeconomic affairs, and at any rate, its hands are tied by the regulations promulgated by the EC.

In this respect, it is important to note that government ownership of firms continues to be significant. Several public sector holding companies or agencies still dominate several key sectors, including: (1) Instituto Nacional de Hidrocarburos (INH) in petroleum refining; (2) Instituto Nacional de Industria (INI) in mining, metals, electricity, shipbuilding and aircraft; (3) Corporación Bancaria de España (CBE) in financial services; (4) Dirección General del Patrimonio del Estado (DGPE) in tobacco products, retail services, shipping and other light manufacturing; (5) RENFE in railways; and (6) Dirección General de Correos y Telecommuncaciones in postal and telecommunication services. While some limited privatizations have occurred under a general rationalization of these entities, the present government is not especially committed to widespread privatization. Because of budgetary considerations, however, government authorities are committed to a substantial reduction of subsidies to government firms (see below). In the end, the future course of government influence of the economy through its ownership in these companies will be played out in the wider arena of EC debates over the appropriate role of public sector ownership.

Especially critical will be European Commission and Court rulings over subsides and public procurement contracts for state-owned industries. While current proposals stipulate that national governments must treat public sector firms on an equal basis with any other EC firm, is not clear whether this will occur in practice (The Economist 1991c, pp.16-18).

The current preoccupation of Spanish economic policy makers and observers (including ordinary citizens) is to increase competiveness vis-a-vis the rest of the European Community. Many Spaniards feel that with the arrival of a single European market in 1993, the external imbalance will become unsustainable and another deep retraction will be required. Since EC trade barriers to many Spanish products were minimal before 1986, integration had little immediate payoff in increased exports. In the long run, a competiveness strategy must encompass a resource shift toward sectors where Spain holds a comparative advantage, the exploitation of scale economies, the development of new products, a greater application of modern technology and a penetration of new markets. In the shorter run, however, a reduction of production costs must play a role. While Spain possesses a significant labor cost advantage relative to EC countries, the differential has eroded recently. One part of a competiveness strategy, therefore, is to keep wage increases in line with productivity growth.

Another, complementary, objective is "monetary" or "nominal convergence" with the rest of the EC in preparation for Economic and Monetary Union (EMU - which includes, among other items, a common currency) sometime in the late 1990’s. Under agreements made in the recent Maastricht summit, EMU will start in 1997 if a majority of the current EC members meet the five "convergence criteria" required to join. If a majority is not ready by 1997, the EMU will be started in 1999 including the members meeting the criteria, whether they are a majority or not. The convergence criteria are (The Economist 1991a):

1) A country’s **inflation rate** should be no more than 1.5 percent above the average of the three EC countries with the lowest inflation rates.

2) Long-term **interest rates** should be no more than two percentage points higher than the average of the lowest three.

3) The **government budget deficit** must be less than three percent of GDP.

4) The **public debt** must be less than 60 percent of GDP.

5) The **national currency** must not have been devalued within the last two years within the 2.25 percent narrow band of the exchange rate mechanism (ERM).

As one might guess, in early 1992 the Spanish economy fails to meet four out of five of the criteria. Its inflation and interest rates were above the EC average, the budget deficit was 4.4 percent of GDP and the peseta is contained in the wide 6 percent band of the ERM. However, as illustrated by Table 2.5 Spain is not alone. Only two countries of the twelve, France and Luxembourg, would have qualified at the end of 1991. Moreover, Spain satisfies the criterion which could prove the most difficult one for many nations: Spanish public debt is only 46 percent of GDP. The primary objective targeted by Spanish policy makers is to bring down the rate of inflation. Low interest rates and exchange rate stability should follow.

With this objective in mind, the monetary authorities instituted restrictive policies in mid-1989 which continued through 1990. It was hoped that these policies would bring down inflation and domestic demand, and, perhaps, encourage potential exporters to focus on international markets. The measures did dampen the growth of domestic demand in 1990, especially for residential construction and durables consumption. Their effect on inflation, however, was less successful. The consequent high interest rates and appreciating peseta sustained the foreign capital inflow, especially for government and corporate bonds (Fuentes Quintana 1991). Many firms, now with greater access to international bond markets were

Table 2.5: European Community Indicators of Monetary Convergence, Year End 1991. (Underlined figures meet convergence criteria as outlined in text.)

Country	Inflation rate % December, 1991	Long-term govt. bonds % December, 1991	Budget deficit % of GDP, 1991 est	Public debt % of GDP, 1991 est	Currency stability satisfied?
France	2.5	8.8	-1.5	47	yes
Luxembourg	2.4	8.1	2.0	7	yes
United Kingdom	3.7	9.7	-1.9	44	no
Denmark	1.8	8.8	-1.7	67	yes
Germany	4.1	8.1	-3.6	46	yes
Belgium	2.8	8.9	-6.4	129	yes
Ireland	3.5	9.3	-4.1	103	yes
Holland	4.8	8.6	-4.4	78	yes
Italy	6.2	14.1	5.4	101	yes
Spain	5.5	11.7	-3.9	46	no
Portugal	9.8	14.1	-5.4	65	no
Greece	17.6	20.8	-17.9	96	no

Source: Economist (December 14, 1991, p.30).

able to sustain their investment purchases by borrowing abroad. The problem was compounded by the fact that most controls on capital outflows were still in place. (Substantial deregulation of capital outflows occurred in early 1991.) Therefore, growth in imports remained strong at 8.1 percent (down, however, from the 17 percent growth of 1989). This episode illustrates the realities faced by government policy makers in the new world of liberated capital markets, freer trade and pegged exchange rates.

In the battle against inflation, the government has placed a high priority on the restraint of wage growth. From late 1990 through the first half of 1991, the national government attempted to conclude a Competitive Pact (Pacto de Competitividad) between itself, the trade unions and employer organizations. The objective of this pact was to have each party agree to play its part in restraining inflation. Most important, it would have attempted to restrain the increase in monetary wages so that real wages would have increased in line with productivity growth. However, in July of 1991 the trade unions withdrew from the negotiations. As a result, real wages continued to outrace productivity growth, especially in the non-tradeable sectors such as services.

The ultimate economic goal of Spaniards is to reach the living standards, however they may be defined, of their northern neighbors. To accomplish this "real convergence" it is clear that one element is paramount. To reach the goal, productivity of the *labor force* must grow faster in Spain than in its richer trading partners. High productivity growth will boost real income and help bridle the inflation which undermines the country’s competitiveness. While we will have much more to say on productivity in Chapter 4, some observations can be made here.

In both the application of modern technology and the availability of infrastructure, Spain clearly lags behind the rest of the EC. In recent years, however, the high level of investment narrowed the gap. This is one step on the road to higher productivity growth. Because of recent slow economic growth and budgetary problems, the government recently scaled back investment plans for the next several years. The updated plan calls for a steady level of public investment at five percent of GDP. This figure still produce a historically high level of public investment. Prospects for private capital formation are more difficult to judge, but a reasonable estimate would be for steady but slower growth than the 11.7 percent annual average of 1986-89.

While investment increases the productivity of the employed labor force, Spain must also take measures to increase the utilization of its considerable under and unemployed labor resources. An important step is to increase further the flexibility of the labor market. To American eyes, Spanish labor market regulations appear strange indeed. Regulations stipulate that each employee must be covered by a government sanctioned contract. Most of the current contracts are of indefinite (read permanent) duration. Termination of indefinite contracts by employers are complicated and costly and, in any event, normally involve very high levels of severance pay. Such regulations increase the bargaining power of employees. Moreover, sectoral wage bargaining is highly centralized, affording little leeway for troubled firms or for firms located in regions with high unemployment to strike their own deals with labor (Viñals 1989). Nominal wage growth, therefore, has consistently kept up with inflation, discouraging employment growth in the face high unemployment. The government's high reliance on wage taxes for financing growing social security requirements also pushes up labor costs.

Over the years, the high fixed costs of hiring and firing, and, especially in the 1970's, the high rate of growth in real wages, stimulated an over-investment in labor saving capital goods. In several industries the capital intensity of production processes is excessive given the relative capital to labor endowments of the economy (Malo de Molina 1990). There is also ample evidence that the high level of unemployment is further impeding labor mobility (Viñals 1989). Among Spanish workers there remains a reluctance towards moving away from their family, who offer security in times of unemployment. Labor mobility has also been reduced by housing problems in high growth areas where labor demand is most vigorous.

A more important reform has been taken place in labor market regulation. Every year, the proportion of workers covered by fixed-term contracts increases. The existence of these contracts has opened the door for part-time work and employment training programs. However, little progress has been made in reducing firing costs. The market is still quite rigid, preventing a greater adsorption of the unemployed labor.

The disappointing performance of the economy in 1991 (2.4 percent GDP growth and 6.3 percent consumer inflation, see Table 2.1) raised fears as to whether Spain would reach the monetary convergence criteria by 1997. This prompted the government to propose a package of new budgetary and labor market reforms in early 1992. This "*Plan de Convergencia*" is quite controversial since it contemplates the reduction of unemployment benefits and the new effort to reform labor contract laws. The program also gives a general outline of fiscal plans through 1996, projecting a public deficit of one percent of GDP by 1996. Among other measures to reduce spending, subsidies to publically owned enterprises will be reduced and the government health system will be reformed. As of this writing (April 1992), it is not clear whether the plan will pass the Spanish legislature. There is no question that the plan can contribute to a better long-run performance of the economy. However, the Spanish economy faces another, more challenging, problem which is not addressed by the convergence plan.

Perhaps the greatest constraint facing the Spanish economy is the shortage and unequal distribution of human capital. While industrial and professional positions are filled with highly skilled workers, there remains a large unskilled segment of the workforce either unemployed or in low productivity jobs. This dualism has resulted in inflationary pressure and hindered job creation in the sectors experiencing the highest rates of growth, especially professional services and high technology manufacturing. The education system is either unable or unwilling to provide a solution to this problem. Engineering and technical programs in Spain require up to six years of study and are highly competitive. In 1987-88, Spanish universities produced only 3,431 engineers, out of 58,812 students enrolled in engineering programs. Technical schools graduated only 6,166 of the 78,690 students enrolled (Instituto Nacional de Estadística, 1991a). In contrast, Taiwan, a country with two thirds of the population of Spain, graduates 37,000 engineers and 136,000 technicians per year (The Economist 1991b, p.18). It is difficult to escape the conclusion that the entrance requirements for these professions have been designed, at least partly, to exclude competition. Alas, reform in this area, as in any country, is difficult because such reform challenges powerful interest groups (see Olson 1982). A more important example is found in general education. Most affluent Spaniards send their children to private schools. Therefore, proposals to increase government support to public schools are not widely supported and the education provided by them is mediocre. However, in the long run, productivity growth depends critically on an ever increasing quality and more uniform distribution of human capital.

The pace of change throughout the past 30 years has left some startling contrasts. Modern electronic factories exist with cottage textile plants of the underground economy. Modern cosmopolitan cities stand apart from a "population desert" in almost abandoned rural villages of the interior that have few modern conveniences. The income distribution, never very equitable in Spain, is characterized by a growing affluence among urban professionals, and, on the other end of the scale, the poverty of the urban unemployed and rural farmers. In the middle is an urban majority trying to cope with swiftly increasing rents, property prices, and taxes. Of course, this description fits many countries. But in 1992, Spain faces the opportunity to revitalize its economy, reduce social rigidities and close the gap between itself and its neighbors. The tradeoff facing Spain is to maximize the long run benefits of the adjustments while minimizing their short run costs.

2.2 A Sectoral Description of the Spanish Economy

Since the empirical model outlined in this work is a sectoral description of the Spanish economy, on many occasions I will refer to characteristics or conditions in individual industries. Therefore, it is appropriate at the outset to give a general portrait of the different industries of the Spanish economy. More detailed and specific descriptions can be found in Salmon (1991). Table 2.6 displays value added and employment shares for each of the 43 sectors of the MIDE model for 1980 and 1987 (the last year of data availability for detailed sectoral value added). Table 2.7 exhibits sectoral shares of total exports, the export share of production, the sectoral shares of imports, the share of imports in domestic demand, and the current price net exports for each MIDE sector which participates in international trade. These figures are for 1987.

Sector 1: Agriculture, Forestry and Fishing

Despite the decline in its share of economic activity, the Agriculture, forestry and fishery industries continue to play an important role in the economy. As displayed in Table 2.6, the sector comprised 5.5 percent of value added and 15 percent of employment in 1987. Of the total 1987 employment of 1.7 million persons, 1.6 worked in agriculture and forestry, and the remaining .1 in fishing (Instituto Nacional Estadística 1990b). The industry is also important in external trade, constituting 7.34 percent of total exports (11.76 percent of output) and 5.14 of imports (9.21 percent of domestic demand) in 1987. In that year, the industry also displayed a trade surplus of 90 billion pesetas, the first year of surplus since at least 1970. Major exports are fresh fruit and vegetables, table olives, and cereals. Imports include feed grains (especially maize), fresh fish, and live animals. Intermediate sales to the food processing industries (sectors 15-19, including tobacco) account for almost

Table 2.6: Percentage Shares of Value Added and Employment for the Production Sectors of the MIDE Model, 1980 and 1987.

Sector	Value Added (a) 1980	Value Added (a) 1987	Employment 1980	Employment 1987
Agriculture, forest. & fish.	7.06	5.45	19.21	15.04
Energy	4.44	5.95	1.28	1.19
2. Coal & radioactive material	0.45	0.35	0.42	0.39
3. Coke	0.05	0.13	0.02	0.01
4. Petrol. extract. & refining	1.91	2.41	0.13	0.11
5. Elect., gas & water utilit.	2.03	3.06	0.71	0.68
Manufacturing	25.76	24.48	25.69	22.98
6. Metal mining & processing	1.78	1.25	0.84	0.67
7. Nonmetallic minerals & prod.	2.14	1.75	2.03	1.59
8. Chemicals	2.28	2.18	1.48	1.29
9. Metal products	2.47	1.91	2.82	2.66
10. Industrial & agric. mach.	1.25	1.04	1.07	0.92
11. Off. mach, computers, instr.	0.18	0.63	0.19	0.25
12. Electric & electronic equip.	1.74	1.70	1.52	1.35
13. Motor vehicles & engines	1.84	2.06	1.36	1.38
14. Other transport equipment	0.83	0.79	1.01	0.76
15. Meat & other animal products	0.80	0.94	0.43	0.47
16. Dairy products	0.41	0.42	0.23	0.26
17. Other food products	1.88	2.00	2.03	1.97
18. Beverages	1.08	1.16	0.62	0.61
19. Tobacco products	0.44	0.63	0.10	0.10
20. Textiles & apparel	2.36	1.76	3.80	3.32
21. Leather products, shoes	0.55	0.59	1.10	0.91
22. Wood & wood products	1.21	0.88	2.16	1.91
23. Paper & publishing	1.27	1.45	1.39	1.31
24. Rubber & plastic products	0.98	1.09	0.97	0.87
25. Other manufactured products	0.27	0.25	0.55	0.39
Construction	8.44	7.39	8.99	8.15
Private services	41.40	43.37	32.30	46.89
27. Repairs & reconstruction	1.71	1.81	1.88	2.05
28. Wholesale & retail trade	12.44	13.14	13.38	14.46
29. Restaurants, cafes & hotels	4.07	6.78	3.94	5.09
30. Interior transport	2.56	2.68	3.71	3.63
31. Maritime & air transport	0.80	0.93	0.54	0.43
32. Transport related services	0.91	0.91	0.65	0.55
33. Communications	1.50	1.59	0.86	0.98
34. Banking & insurance	5.91	6.55	2.26	2.39
Imputed prod. of banking (b)	-3.52	-6.13	--	--
35. Business services	4.02	4.84	1.22	2.41
36. Commerc. & resid. rents	7.31	5.91	0.03	0.01
37. Private education & research	0.78	0.63	1.00	1.04
38. Private health services	1.00	1.05	0.90	0.88
39. Recreat., pers. & oth. serv.	1.91	2.68	1.93	2.35
Public and domestic services	11.11	11.72	12.53	16.36
40. Public administration	6.29	6.24	5.13	6.99
41. Public education services	1.99	2.47	2.37	3.32
42. Public health services	2.01	2.32	1.75	2.43
43. Dom. & oth. nonmarket serv.	0.82	0.69	3.28	3.62

Sources: Instituto Nacional de Estadística (1988, 1990b, 1991a), Author's compilations.

(a) Percent share of GDP, does not sum to 100 because of import taxes, which were 1.79 and 1.64 percent of GDP in 1980 and 87 respectively.
(b) For explanation of this term, see Chapter 4.

Table 2.7: Foreign Trade Indicators for
Production Sectors of the MIDE Model, 1987. (a)

Sector	Exp/ Tot Exp (%)	Exp/ Output (%)	Imp/ Tot Imp (%)	Imp/ Dom Dem (%)(b)	Net Exp (bil. ptas.)
Agricult., forest. & fish.	7.34	11.76	5.14	9.21	90.3
Energy	9.08	15.02	25.82	35.25	-673.6
2. Coal & radioact. mat.	0.04	1.00	1.02	23.12	-39.4
3. Coke	0.01	1.46	0.04	4.48	-2.0
4. Petrol. ext. & refining	8.87	26.19	24.68	51.70	-641.3
5. Elect., gas & water	0.16	0.76	0.08	0.40	9.1
Manufacturing	45.64	14.50	59.70	19.40	-1455.5
6. Metal mining, proc.	5.36	16.95	6.25	20.53	-79.9
7. Nonmet. min. & prod.	2.25	13.32	1.51	10.08	35.2
8. Chemicals	4.88	18.25	8.18	28.86	-332.8
9. Metal products	2.17	10.53	2.97	14.84	-44.3
10. Indust. & agric. mach.	3.97	32.24	6.90	47.32	-336.7
11. Off. mach. & computers	1.20	15.92	5.40	47.97	-282.2
12. Elect. material	1.94	10.64	6.56	30.43	-334.1
13. Motor vehicles	6.32	22.05	6.42	23.73	-15.6
14. Other transp. equip.	0.89	10.14	0.60	7.66	1.4
15. Meat & oth animal prod.	0.20	1.05	1.13	6.24	-71.9
16. Dairy products	0.12	1.68	0.43	6.27	-26.5
17. Other food products	4.10	10.99	3.31	9.76	30.4
18. Beverages	0.71	6.05	0.66	6.09	3.0
19. Tobacco products	0.03	0.69	0.34	9.24	-32.2
20. Textiles and apparel	2.39	12.53	2.69	14.89	-51.9
21. Leather products, shoes	2.73	41.14	0.59	14.10	138.3
22. Wood and wood products	0.96	9.74	1.06	11.51	-2.9
23. Paper and publishing	2.19	14.29	2.57	17.51	-25.2
24. Rubber & plastic prod.	2.70	24.43	1.46	15.98	15.1
25. Oth. manufactured prod.	0.53	17.25	0.67	22.27	-12.7
Private services	16.15	5.09	6.19	2.18	458.3
28. Wholesale and retail	3.83	5.36	0.88	1.38	190.1
30. Interior transport	1.07	4.33	0.01	0.03	72.6
31. Marit. & air transport	6.16	66.15	0.69	19.15	301.7
32. Transport related serv.	1.78	30.31	1.53	28.88	-15.8
33. Communications	0.40	4.13	0.16	1.85	9.3
34. Banking and insurance	1.34	3.51	0.70	2.01	19.3
35. Business services	1.37	5.08	2.10	8.19	-119.7
39. Recreation, oth. serv.	0.20	1.70	0.12	1.17	0.8
Tourism	21.79	--	3.15	--	1579.5

Sources: Instituto Nacional de Estadística (1988, 1991a), Dirección General de Aduanas, *Estadística del Comercio Exterior de España*, Fundación Tomillo, Author's compilations.

(a) Exports are defined as in the input-output table. Therefore, margins of wholesale/retail trade, transportation and insurance on merchandise are allocated to these sectors, accounting for the relatively high shares accorded to these industries. On the other hand, imports of merchandise are cif (cost insurance and freight) and therefore the merchandise imports include the margins.

(b) Domestic demand is defined as output minus exports plus imports.

60 percent of the domestic demand for agricultural and fishery goods. Taken together, food processing is the largest manufacturing industry in the country. Therefore, developments in the agricultural and fishery sector are critical for another 5 to 6 percent of GDP. Most of rest of the demand is split between private consumption (20 percent) and intermediate sales to other sectors such as wood products and restaurants (9 percent).

In general, Spanish agricultural productivity is low in relation to other European community countries. This is the result of many factors, including: (1) a difficult physical environment in much of central Spain, (2) a relatively low level of capital application, (3) the persistence of outdated production techniques, (4) an aging and undereducated workforce, (5) a distorted farm size structure, and (6) a legacy of often arbitrary government regulation (Salmon 1991, pp.48-59). However, for several products, such as vegetables and citrus fruits, there are modern production centers thriving along the coasts of Spain. Moreover, a recent expansion of irrigation has lifted the productivity of parts of central Spain. Nevertheless, declines in the level of employment, if not value added, will continue for the indefinite future.

Spanish agricultural production now represents about 12 percent of that of the EC. The sector has been, and will continue to be, profoundly influenced by Spain's integration into the EC. First, a rapidly increasing proportion of agricultural trade has been with the EC. The share of agriculture imports from the EC increased from 9 percent in 1980 to 29 percent in 1987 (Fierros 1990, p.72). In 1980, agricultural exports to the EC were already quite high, accounting for 82.6 percent of the total exports of the sector. In 1987, this proportion was almost 87 percent. Spanish farmers will remain dependent on the EC for exports as the remaining trade barriers come down.

Second, the adoption of the EC Common Agriculture Policy (CAP) prompted substantial changes in the regulatory environment. Before the CAP, the state tended to control markets through agricultural marketing agencies or price controls. Import controls were also widely used. These forms of intervention were more rigid than the CAP. However, taken in total, the breadth of the state intervention was less than under the CAP (Reig 1989, p.159). Now an elaborate system of price supports and export subsidies applies to most agricultural production. Overall, membership in the CAP should boost the fortunes of producers of fruit and vegetables, cotton, rice, sunflowers, olives, and grapes for wine. On the other side of the ledger, producers of dairy products, animals and cereals (besides rice) will suffer declining domestic market shares (Reig 1989, pp.167-173).

Sectors 2-5: Energy

As evident in Table 2.7, a crucial aspect of the Spanish economy is its reliance on imports, especially of crude petroleum, to satisfy its domestic energy requirements. This dependence was a major cause of economic problems in the 1970's and early 1980's and remains a latent threat today. Natural gas imports, already large, will continue to grow as domestic users discover the utility of this energy source. Domestic energy production centers around a largely public-sector domestic coal industry, nuclear and hydroelectric power. Each of these sources faces problems: low quality coal reserves, strong political opposition to nuclear power stations, and variable precipitation affecting hydroelectric production. Oil and natural gas production is negligible.

Coal production expanded rapidly in the late 1970's and early 1980's as the government encouraged substitution of coal for oil. Since 1985, production decreased as import competition, a lower oil price, substitution of electricity for coke in the metal industries and environmental considerations have made domestic coal less attractive. The cost of domestic coal is high because of low quality coal, geologically difficult conditions, small scale production and labor unrest (Salmon 1991, p.87). This industry will experience a continued decline in the coming years.

Oil refining is split between the public-sector Repsol Group (60 percent of capacity), Cepsa (24 percent; Salmon 1991, 92), Petromed, a subsidiary of British Petroleum, (10 percent) and ERT (6 percent). This present structure is the result of considerable restructuring and consolidation throughout the 1980's. Exports of refined products is significant, comprising 8.87 percent of total exports and 26.19 percent of total production for 1987 (Table 2.7). An expansion of exports began in the mid 1980's when domestic refiners found themselves with excess capacity as domestic consumption leveled off. As other European nations cut refining capacity (The EC-12 cut refining capacity by 36 percent in the mid 1980's, Spain by only 14 percent; Salmon 1991, p.97), Spanish refiners filled the void.

Before entry into the EC, the marketing of petroleum products was concentrated in the publically owned domestic monopoly Campsa. However, EC competition policy obliged Spain to reorganize Campsa in 1984. It is now jointly owned by each of the above refiners, with shares divided by refining capacity. The government, therefore, still controls the industry through Repsol. It also sets maximum and minimum prices throughout each stage of the process, from the crude oil input price, to the price at the gasoline pump (although there are plans to deregulate some retail prices). EC competition policy has also required the elimination of barriers to foreign oil companies in the marketing of products. While Campsa will retain the monopoly over distribution of any oil products made in Spain, foreign firms are allowed to market imported products. British Petroleum, Agip, Texaco and Mobil have entered the competition so far. This competition will affect both the refining and marketing segments of the industry.

A large number of regionally based private utilities supply electricity. However, the state holding company ENDESA (Empresa Nacional de Electricidad) owns a share in several of these companies. Financial problems originating from over-expansion in capacity plagued the industry in the early 1980's, leading to some consolidation in the middle of the decade. In technical terms, the largest transformation of the industry was a shift away from fuel oil generating plants to coal (25.5 percent in 1988; Salmon 1991, p.103), nuclear (17.8 percent) and hydroelectric (46.0 percent) generating plants. Oil and gas fired capacity made up only 12.7 percent of the total in 1988. Aside from opening the door to some foreign investment, EC integration will probably have little impact in this sector.

Sectors 6-25: Manufacturing

Several characteristics of Spanish manufacturers are relevant in order to project the future of Spanish industry (Salmon 1991, 112-115; Martín 1990a). In general, Spanish industries display lower productivity in relation to their counterparts in other EC members, Japan and the US. Since they have been highly protected over the years, Spanish industrial firms are primarily orientated to the domestic market. In several cases, such as cement, glass and agricultural chemicals, there is a very high degree of concentration where firms enjoy virtual monopoly power. In other areas such as mining, steel, aluminum, shipbuilding and aircraft, public-sector firms dominate the market. This situation has led to a lack of innovation and inflated costs of production. On the other hand, the more competitive industries (clothing, shoes, parts of the food sector, wood and plastic products) are characterized by small firm and plant size. This small size has limited the ability of firms to obtain long-term finance, frustrated the exploitation of scale economies and restricted opportunities to diversify into exports. Therefore, the lack of competition in concentrated industries and the lack of finance for smaller firms has led to the use of technology which is older and often obsolete compared to that of potential international competitors. Furthermore, because of labor market regulation and the high costs of firing, overstaffing is common in Spanish industry. This characteristic is especially common in industries owned by the central and regional governments where profitability often takes a backseat to other social objectives.

Secondly, the industrial structure of Spanish industry is weighted toward traditional industry. Table 2.6 shows that in 1987 a full third manufacturing value added was produced by the food, textiles, clothing, shoes and wood products industries (Sectors 15-22). Metal mining and processing, Non-metallic mineral products and Chemicals account for another 20 percent (sectors 6, 7 and 8). These sectors experienced only medium to low demand growth the past several years and will continue to do so. Evidence does exist that Spanish industry holds a comparative advantage in generally labor intensive sectors such as clothing, footwear, and toys within the EC (Martín 1990a). However, these sectors are subject to strong competition from South-East Asian and Eastern European countries. In the long-run, this competition could undermine Spanish export penetration into the northern EC countries. This suggests a strategy for the application of non-cost competiveness measures such as the specialization of up-market product ranges and strong brand name marketing.

Third, in industries characterized by higher technology and a more rapid growth of demand, Spain clearly has problems. In machinery sectors, Table 2.7 shows that the recent investment boom has induced a strong flow of imports (sectors 10-12). Moreover, the share of machinery imports from the EC has increased substantially since 1985 due to the reduction of trade barriers (Fierros, 1990). Industries displaying promising performance (automobiles, computers and domestic electrical appliances) are dominated by foreign firms applying foreign technology. Reduction of import dependence in these high demand growth sectors will occur, if ever, after several years of a sustained effort in adopting foreign technology and implementing domestic research and development programs. Eventually, formation of human capital in foreign owned enterprises may result in a greater presence of domestically owned and operated firms in these industries.

With these points in mind, I will now make some observations concerning manufacturing industries of the Spanish economy. Figures 2.6 through 2.20 display the output (q), domestic demand (dd), import (imp) and export (exp) for each of the manufacturing sectors of the economy for the years 1970 through 1989. Data for outputs, exports and imports come form the MIDE model data base, while domestic demand is defined as output minus exports plus imports. A common pattern of most of the sectors is rapid growth both in demand and output through the 1960's and early 70's, anemic or negative growth through the crisis of 1975 through 1985. Since 1985 the fortunes of the industries are mixed.

In the Metallic mining and base metals processing industry (Figure 2.6), rapid demand contributed to an overbuilding of capacity in the early 1970's. Actual demand, however, fell short of the planners' projections. The industry was one of the first to be subjected to capacity reduction and mass layoffs under a reconversion program. Nevertheless, output remained steady as the government subsidized exports (sometimes called "dumping") in order cushion the effects of readjustments. While this sector is competitive within the EC, it is subject to strong competition from the NIC's of Southeast Asia and Brazil. Moreover, since world demand growth for metal products will continue to be weak, the prospects for this sector cannot be optimistic. Production and exports have been down from 1985 levels through 1990.

The fortunes of Nonmetallic minerals and products (Figure 2.7) follows closely with its major consumer, the construction industry. Stagnation in construction for most of the crisis years led to a sharp decline in domestic demand. Producers were able to buffer the effect on production by, again, increasing exports. As construction investment has revived, however, potential exports have been diverted to domestic demand and imports have risen.

In both the Chemical (Figure 2.8) and Metal products industries (Figure 2.9), production has not been able to keep up with the revived domestic demand and imports have increased strongly. As in other sectors, exports have stagnated with the increase of domestic demand. Even higher demand elasticities for imports is evident in the capital equipment sectors (Figures 2.10 to 2.12). This phenomena is not only evident in recent years, but also in the early 70s (see especially Figure 2.10). In both periods, investment booms encouraged a flood of imports. Underdeveloped industries (in the cases of Industrial machinery and Computers and precision instruments) and the desire of investing firms to obtain modern foreign-made technology accounts for this trend. In Sector 10, Industrial and agricultural machinery (Figure 2.10), agricultural machinery makes up most of the relatively high level of exports. The rapid expansion of Sector 11, Office machines, computers and precision instruments (Figure 2.11), is mainly due to the opening of an IBM plant in the Valencia area. Several other computer makers have also been active in Spain.

Figure 2.6: Sector 6 Metal mining and metals processing, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

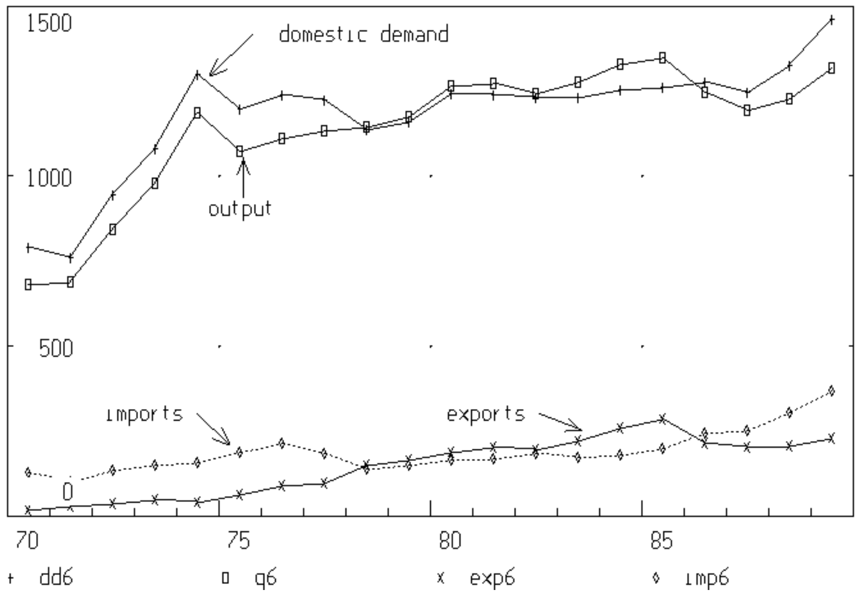


Figure 2.7: Sector 7 Nonmetallic minerals and products, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

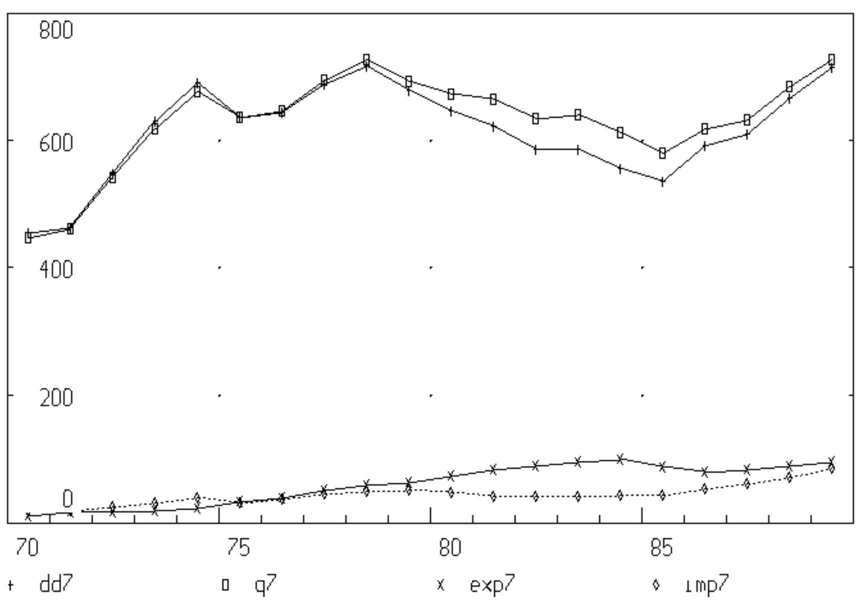


Figure 2.8: Sector 8 Chemicals, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

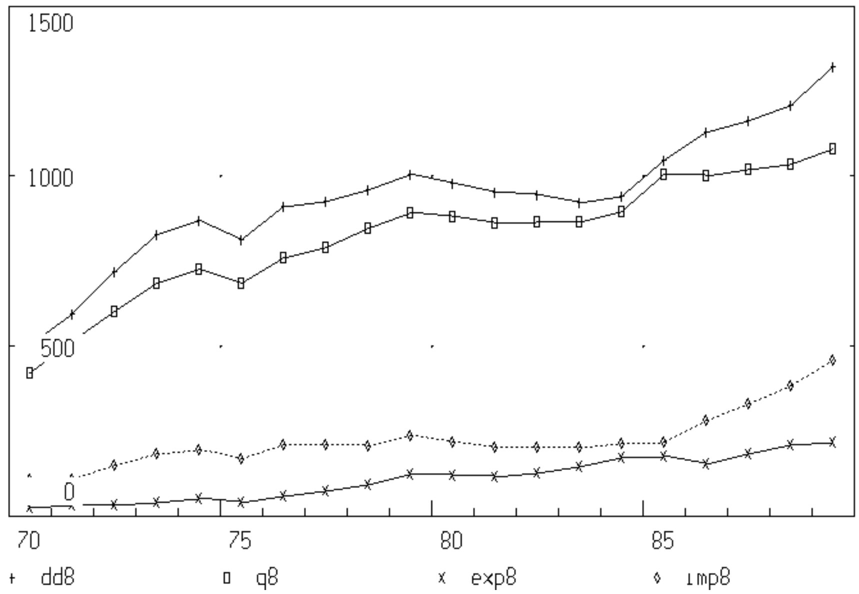


Figure 2.9: Sector 9 Metal products, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

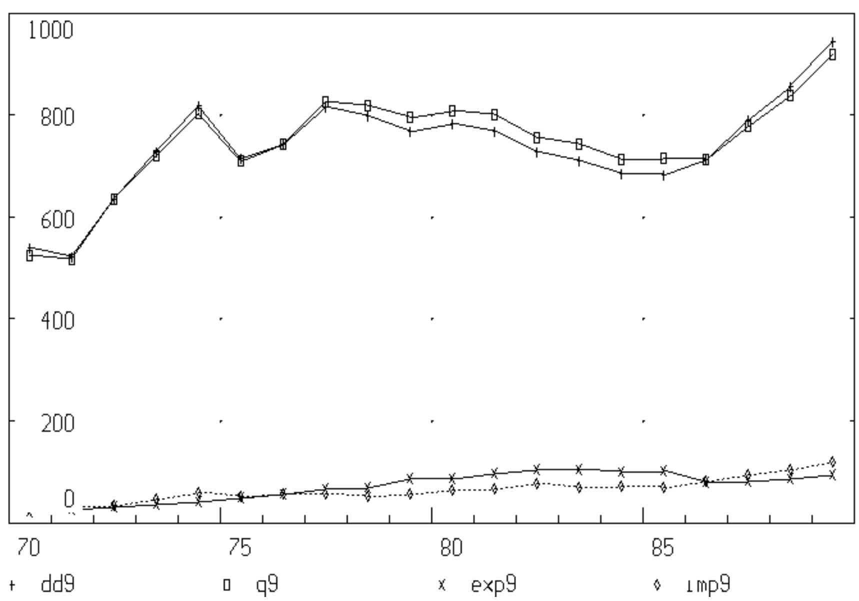


Figure 2.10: Sector 10 Industrial and agricultural machinery, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

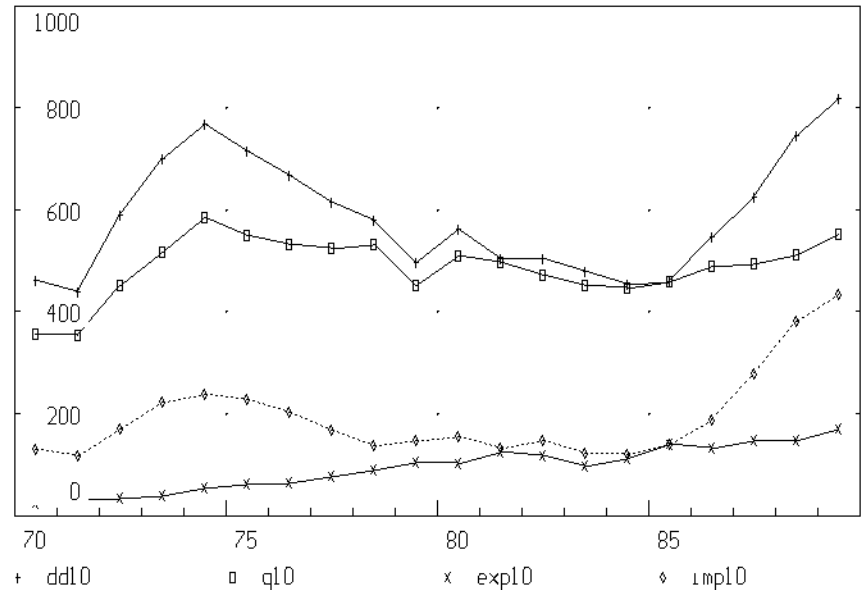


Figure 2.11: Sector 11 Office machines, computers and instruments, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

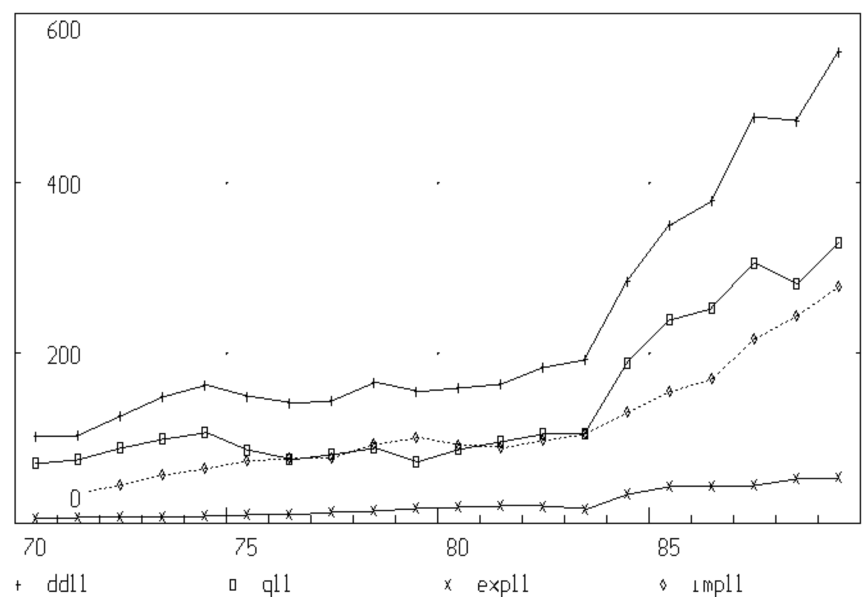
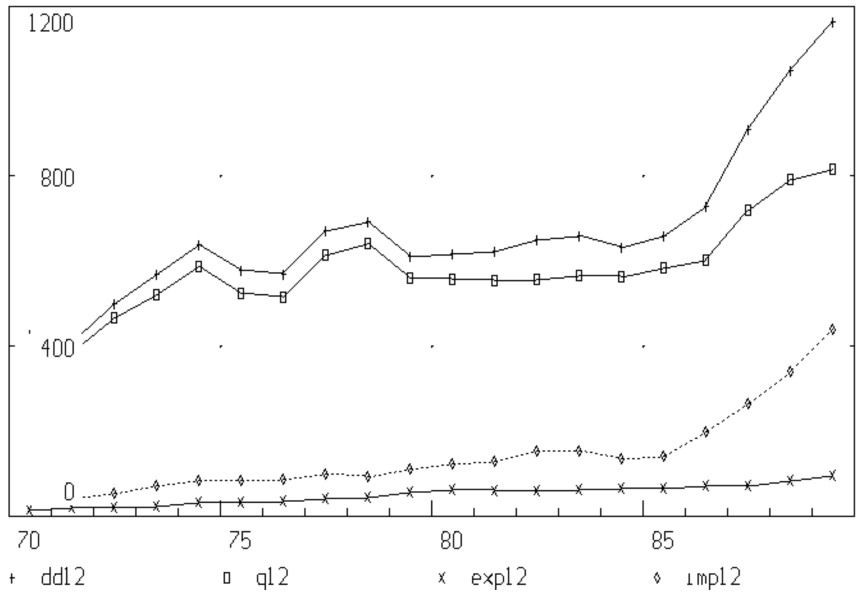


Figure 2.12: Sector 12 Electric and electronic equipment and material, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)



Domestic demand for, and production of, motor vehicles has been particularly vigorous since 1983 (Figure 2.13). Registrations of new motor vehicles virtually doubled from 746 thousand in 1985 to 1.4 million in 1988 (Ministerio de Transporte, Turismo y Comunicaciones 1989). While this demand growth produced a slight trade deficit in the industry for the years 1987 through 1989, reduced domestic demand starting in 1990 has probably restored the industry's traditional trade surplus. At any rate, recent capacity expansion has provided a modern, competitive motor vehicle industry. As we have noted, however, this industry is dominated by foreign producers.

The Other transportation equipment sector (Figure 1.13) experienced significant restructuring during the seventies. Most of the loss of capacity and employment was in the shipbuilding industry which lost sales because of a general slackening in world demand and to competitors such as South Korea and Japan. Recently, the shipbuilding industry has been

Figure 2.13: Sector 13 Motor vehicles and engines, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

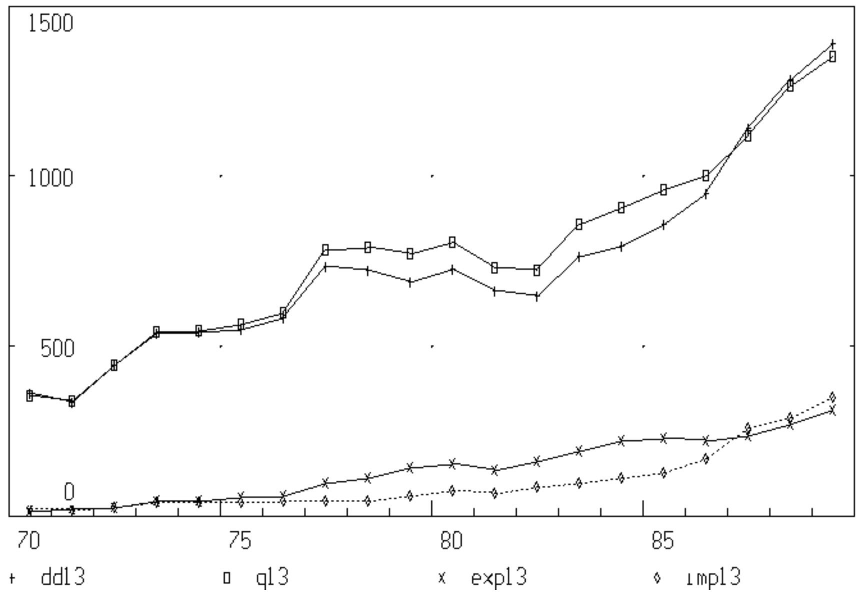


Figure 2.14: Sector 14 Other transportation equipment, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas)

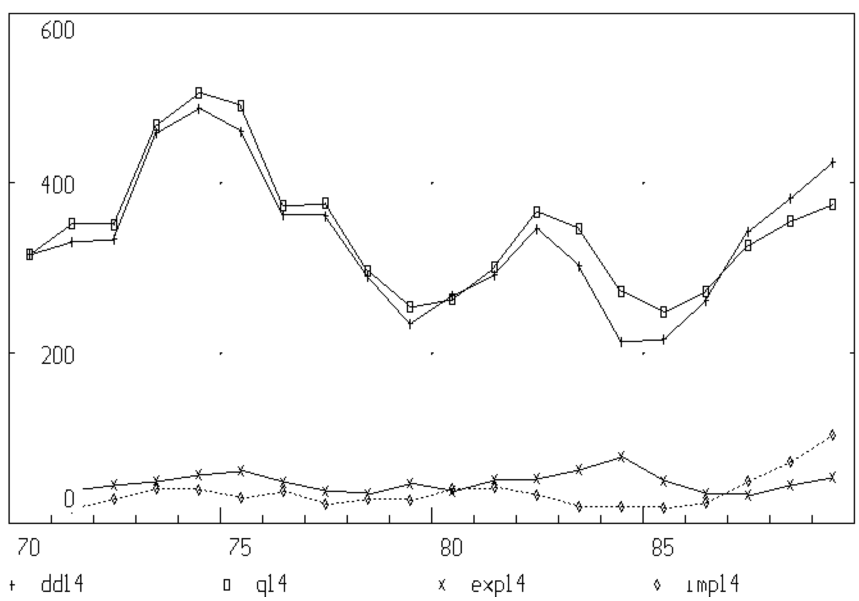
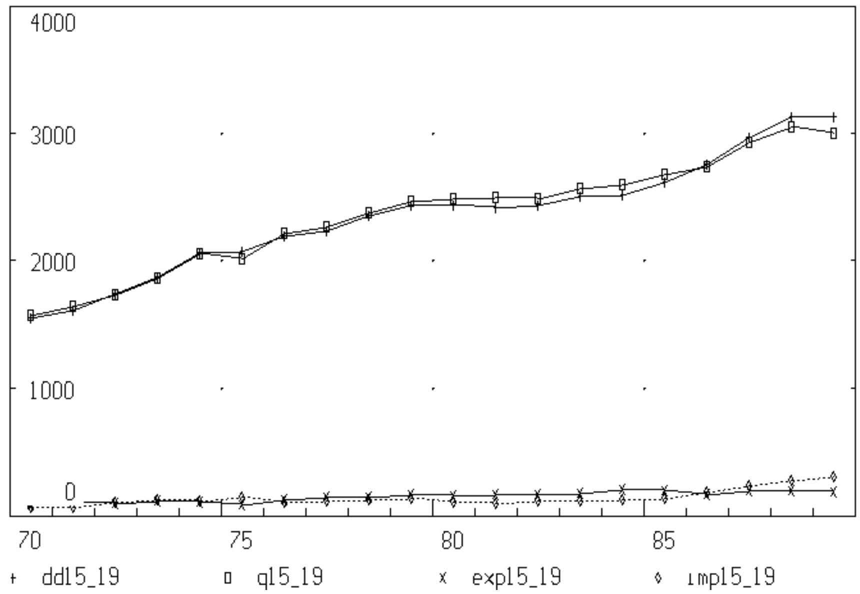


Figure 2.15: Sectors 15-19 Food, beverages and tobacco products, 1970-89.
Domestic Demand, Output, Imports and Exports.
Billions of 1980 pesetas.



revived by new demand in the leisure boating market. The public-sector aeronautical firm, CASA, is part of the Airbus consortium and has enjoyed steadily increased production since 1985. Public procurement contracts have kept manufacturers of railroad equipment working, but it is unclear whether they can withstand other European competition when bidding for such contracts must be open to all EC firms.

Figure 2.15 displays aggregated data for the Food processing industries (Sectors 15 through 19: Meat products, Milk products, Other food products, Beverages and Tobacco products). The graph, however, is not very useful in pointing out several important features of this huge industry. First, the steady expansion in domestic demand is not so much a reflection of an increase in the volume of food and drink demanded by Spaniards, but a shift toward more processed foods, which contain a higher value added component. Moreover, through time, more food sales are brought under the statistical net as the proportion of informal sales of food products decreases with the urbanization of the society. Secondly, since the ratios of imports to domestic demand and exports to production are so low, the graph obscures important changes regarding foreign trade in the sectors. Since 1986, import penetration increased notably in all the sectors, with the exception of Tobacco products. We shall have more to say about this in Chapter 5. On the other hand, while exports of wine, and some dairy and meat products have increased, exports of food products as a whole have decreased.

Figure 2.16 displays Textiles, clothing, leather products and footwear industries. Domestic production in these sectors have been highly protected over the years. The sector required major restructuring to adapt to the decrease in domestic demand during the crisis. The strong export component of production is evident in the graph. However, exports, particularly of footwear, were adversely effected by the depreciation of the dollar starting in late 1985. Integration with the EC has also opened the industry to strong competition from Italy, Portugal and Greece, as evidenced by the recent surge in imports.

The Wood and wood products industry (Figure 2.17) suffered a prolonged recession due to a sustained decline in construction and furniture consumption starting in 1980. Recently, demand has revived. Paper products and publishing - the input-output aggregation in this sector is unfortunate - (Figure 2.18) did not face a reduction in demand and is presently enjoying healthy growth. Much the same can be said for Plastic and rubber products and Other manufactured products (Figure 2.19). These sectors also enjoy buoyant exports (toys are important), but also have experienced an increasing level of import penetration.

Figure 2.16: Sector 20-21 Textiles, clothing, leather products and footwear, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas.)

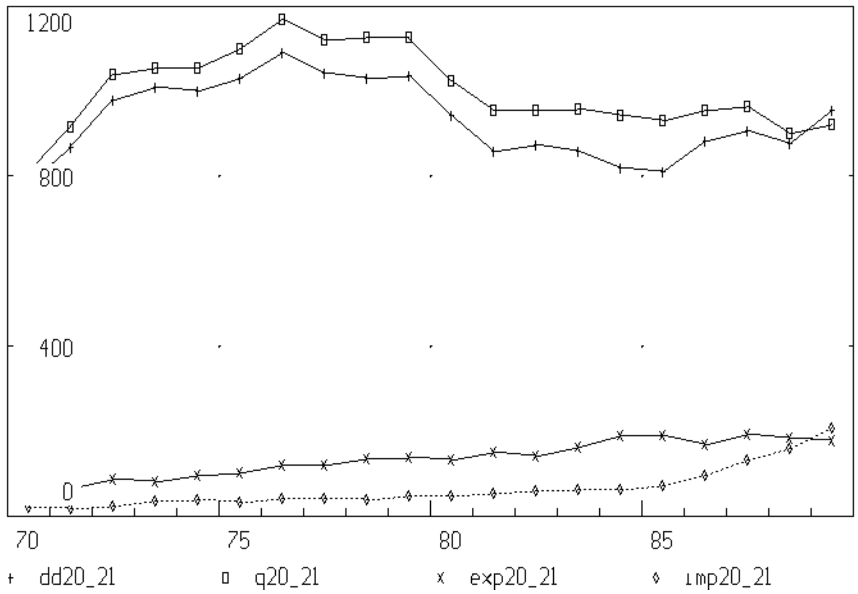


Figure 2.17: Sector 22 Wood, wood products and furniture, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas.)

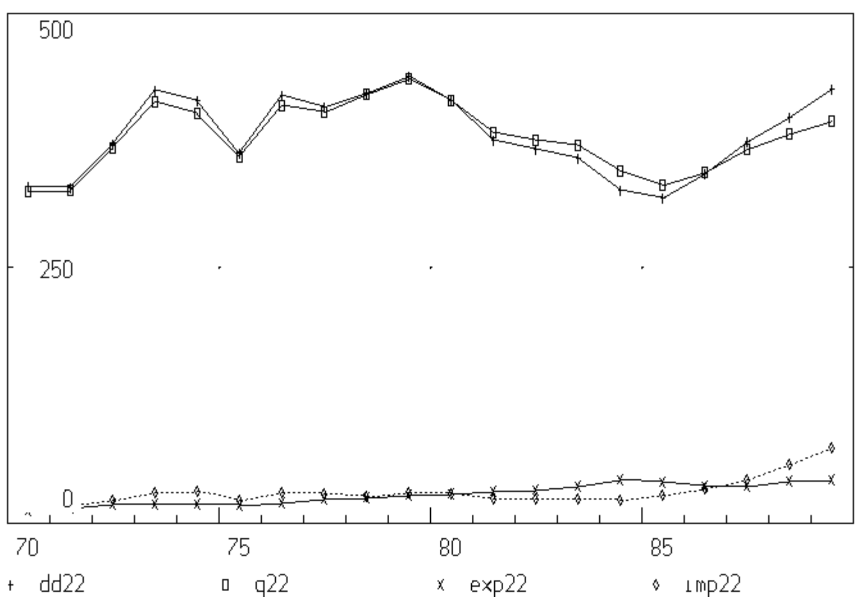


Figure 2.18: Sector 23 Paper, paper products and publishing, 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas.)

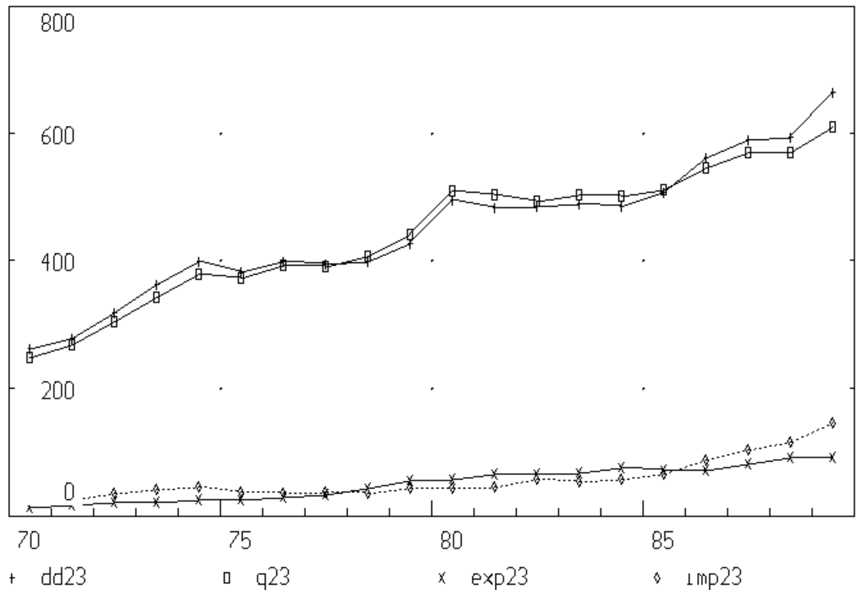


Figure 2.19: Sector 24-25 Plastic and rubber products,
Other manufactured products 1970-89.
Domestic Demand, Output, Imports and Exports.
(Billions of 1980 pesetas.)

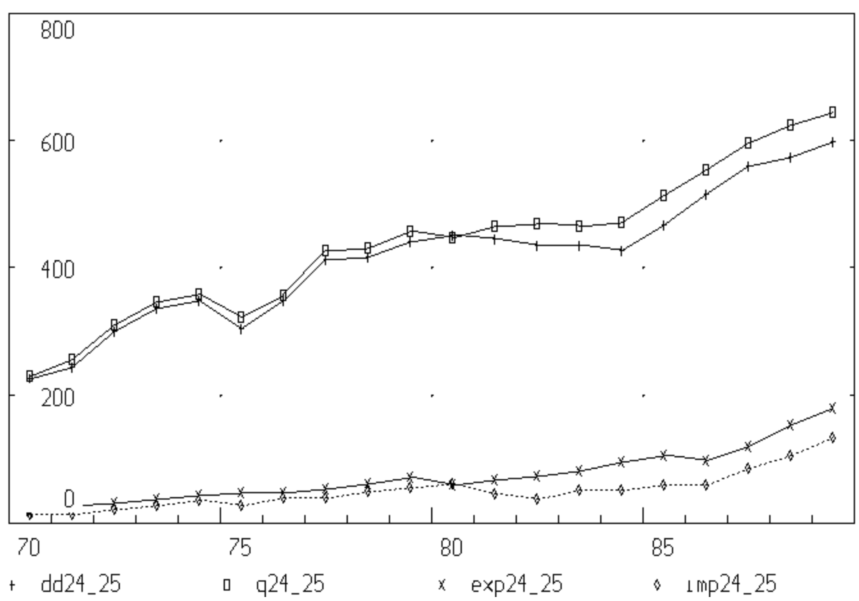
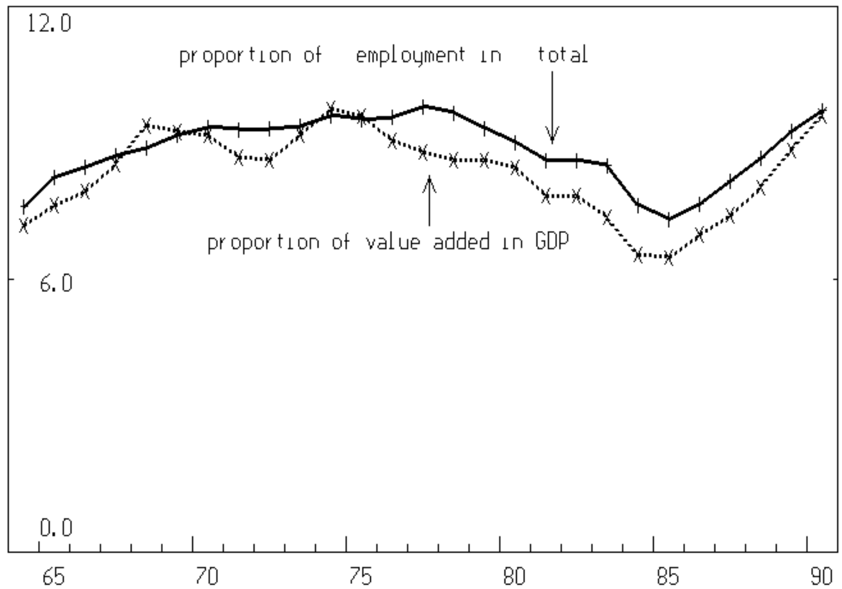


Figure 2.20: Sector 26 Construction, 1965-90.
Proportions of value added in GDP and employment in total employment.
(Percent)



Sector 26: Construction

The industrialization of Spain generated a huge volume of work for the construction industry. In addition to the job of urbanizing new industrial areas, the provision of infrastructure for the tourist boom occupied the industry. Over the past thirty years, the construction industry has been one of the largest sectors of the Spanish economy. Figure 2.20 shows the proportion of GDP and employment contributed by the industry from 1964 through 1990. After rapid growth through the mid-70s, the sector experienced a prolonged recession throughout the 1975-85 economic crisis. Because of the investment boom of the late 1980's, however, the shares in value added and employment returned to 9.58 percent and 9.7 percent, respectively, by 1990. The construction boom will continue throughout the early 1990's, fueled by an enormous demand of public works. These projects include those associated with the 1992 Olympic games in Barcelona, the World Exposition in Seville in the same year, and the construction of high speed rail links with the rest of Europe. In addition, while the recent growth of residential housing construction (5.6 percent between 1986-1989) will probably not continue, activity will remain at a very high level. EC integration will open the construction industry to competition from other European firms, especially for public works projects, reducing construction prices. In the longer term, it will force a reorganization and consolidation of a domestic industry made up of many relatively small companies by European standards (Salmon 1991, p.163).

Sectors 27-39: Private Sector Services

As in any mature economy, the service sector of Spain claims the largest share of value added and employment. Table 2.6 shows that in 1987 the combined value added and employment shares for market and nonmarket (mostly government) services are 55 and 63 percent, respectively. However, little research exists on the service industries (sometimes called the tertiary sector) of Spain. One reason for this is the lack of available data covering these sectors. No published production or price indices exist for services. For agriculture, energy and manufacturing, you can count tons of wheat, tons of coal, or number of machines produced in order to construct such indices. The production of services cannot be similarly counted. Moreover, the nature and quality of services changes drastically through time. For example, computerized banking services, such as twenty-four hour banking machines and debit cards, have increased the accuracy and convenience of banking services. However, if output is measured by the amount of transactions the total value of those services is understated. Moreover, the variety of services provided by these industries consistently expands, and it is difficult to quantify the impact of new services on a historic output series. Nevertheless, for building an econometrically estimated multisectoral model such as MIDE, it is important to obtain indicators of service output and prices through time. Therefore, from the beginning of the MIDE project, a special effort has been made in constructing these series (see Appendix). The result is the most comprehensive data bank on the service industries of Spain in existence.

The greatest potential impacts of European economic integration lie within the service industries. The small size of national markets has resulted in a dearth of competition for these "nontradeable" services. Governments felt that it was necessary to regulate such industries. Often, intervention consisted of absolute barriers to entry for potential foreign competitors and the erection of monopolies, usually of the public sector variety. This was especially true in Spain. Now, the EC Commission is pushing ahead with plans for integrating and promoting competition in the transport, communications, finance and business service markets. Moreover, beginning in 1993, the mobility of professionals will be guided by the "mutual recognition" principle. Under this principle, any professional licensed to practice in one EC member state must be permitted to practice in all the states. While several practical obstacles to this ideal must be overcome, it opens the possibility of German engineers, British lawyers or French doctors setting up business in Spain.

The implications for the Spanish economy of increased competition in services will be dramatic. Since EC integration in 1986, agricultural and manufacturing industries have been subject to increasing competition from imports. Up to this point, however, competition in services has been minimal. This situation is reflected in Table 2.8 which displays the inflation rate of consumption indices for various good and services. Since 1986, the increase in the price of services has been consistently larger than the general consumption index and usually quite larger than the price increases for the categories of food, energy and other manufactured goods. While there may be many reasons for this dual inflation, the lack of

Table 2.8: Inflation Rate for Consumption Price Indices for Type of Products, 1985-90. (percent)

Year	General (100%)	Food (33%)	Energy (7%)	Oth. mfg. (26%)	Serv. (34%)
1985	8.82	9.52	4.42	9.90	8.13
1986	8.79	10.64	-6.30	9.85	9.13
1987	5.25	5.03	-3.92	6.26	6.25
1988	4.84	3.70	-0.63	4.87	6.82
1989	6.79	7.67	2.55	3.99	8.67
1990	6.69	6.51	8.26	4.26	8.57

Note: Figures in parentheses are weight in general index.
Source: Instituto Nacional Estadístico, *Indices de Precios de Consumo*.

competition for providing services plays a large role in the explanation. Not only will competition in services reduce general inflationary pressures, the quality of the services provided will surely improve.

The first specific service sector of note is retail and wholesale trade (Sector 28), the largest single sector of the MIDE model with a 13 percent share of value added and 14 percent share of employment as of 1987 (Table 2.6). The output of this sector consists of the margins it charges for distribution activities. (In other words, its value added plus the cost of energy, transportation, office supplies, etc.; but not the costs of goods sold.) The employment share is significantly higher than in other EC countries (Salmon 1990, 161), reflecting the nature and relative inefficiency of the industry. Recently, the industry has been undergoing rapid change. A dual structure of traditional shops and street markets coexisting with a modern sector of supermarkets, hypermarkets (variety stores) and shopping centers characterizes the retail system. As consumer patterns (an increasing demand for more services, such as more convenient hours) and work behavior (married women are increasing labor force participation very rapidly) change, the traditional sector is losing out to the modern stores. Accompanying this is increasing concentration, a greater foreign penetration, and the increasing use of modern technologies in both retailing and wholesaling (Casares et al. 1990). These transformations are resulting in a more efficient distribution industry.

Spaniards do most of their socializing in bars, cafes and restaurants. Therefore, Spain has a large, very competitive restaurant sector (Sector 29). The importance of this sector, which also includes hotels, is also linked with the tourist industry, which we will cover in detail below. For now, we should note that the sector is not included in Table 2.7 which presents foreign trade statistics. This is because private consumption in the input-output table is *interior* consumption and, therefore, it includes the purchases of tourists made inside the country. These purchases are not considered exports in the *structure of the input-output table.* Nevertheless, the sector is very important in generating exports of tourist services.

Transportation services (Sectors 30-32) are the lubricants of economic activity. Their most important roles are intra-urban mass transit (subways, busses and intra-urban railroads) and the facilitation of trade and business exchanges between different regions and nations (airlines, trucking, inter-regional railroads, and maritime transport). Every other sector of the economy purchases transportation services. Agriculture, mining, construction, and the food industries are particularly dependent on transport. It is also important to the tourist trade. But throughout Europe, and especially in Spain, lack of competition results in a sticky lubricant. The transport sector is subjected to substantial regulation which is justified in order to avoid monopoly pricing and negative externalities (e.g., traffic congestion) or for reason of safety. Regulation of capacity and prices exist for all types of transportation. In urban mass transportation, railways and airlines, the government owns monopolies providing the services. In Spain, the small size of the market, lack of competition and poor infrastructure has led to a very inefficient and costly transportation system even by European standards.

EC integration will have direct influences for highway freight, airline and maritime transportation industries as barriers to foreign entry to the domestic market will be removed. More pressure from trucking companies will force nationalized railroads to cut cost to hold market share. All customs stations will be removed at EC borders, resulting in a gain in efficiency for highway and airline transportation. One estimate of the savings of eliminating border controls is $10 billion annually (Cecchini et al. 1988, Table 9.2). Finally, EC structural funds have afforded Spain the opportunity to make improvements in roads, railways, subways and airports, all badly needed and overdue. While some Spanish private and public transportation firms will be harmed and may even disappear with integration, consumers of transportation services will benefit immensely. For an overview of the future of transportation policy in the EC see Swann (1988).

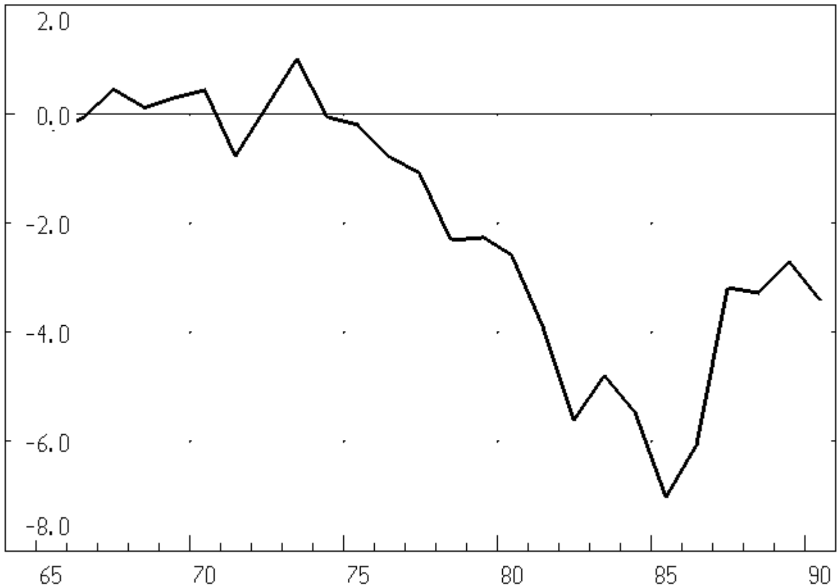
Postal services and telecommunications comprise the Communications sector (Sector 33). Demand growth in the industry has averaged almost 10 percent since 1985, the bulk of the growth in telecommunications services. The high rate of growth will certainly continue as telecommunications services have become an integral part of the modern economy. This sector is dominated by the two government monopolies: Dirección General de Correos in postal services and Telefónica in telecommunications. It does not appear that these monopolies will experience any substantial competition in their traditional services for the foreseeable future. However, the possibility exists for competition in new "enhanced" telecommunications services such as credit card and airline reservation networks (Cowhey 1990).

The banking system (most of Sector 35) of Spain consists of state banks (recently consolidated into the Corporación Bancaria de España (CBE), now the largest single banking entity in Spain), commercial banks and savings banks. The commercial sector, while being fairly concentrated, contains several small and inefficient banks by international standards (Viñals 1989). The private banks have extensive and dense branch networks that add to fixed costs. However, collectively Spanish banks were the most profitable in the world in 1990 (Economist 1991c, 79). This profitability is the result of wide interest rate margins as a result of market power, and, until recently, government regulation which sheltered the industry from both domestic and foreign competition. Moreover, Spanish banks possess large holdings in other sectors of the economy which allowed them to share in the profits generated during the recent economic boom. However, profit margins will surely sink with financial deregulation and more competition among domestic banks and from foreign entrants. There exists much scope for cost cutting and consolidation within in the industry, in order to become more competitive in the expanding international market. Moreover, the banking sector's ties to the rest of the economy leave it vulnerable to crises which may occur in individual industries.

Sectors 40-42: Public Sector Services

In the MIDE model, public consumption is grouped into three categories, each one comprising an individual production sector: Public Administration (Sector 40 - including central, regional and local governments), Education services (Sector 41) and Health services (Sector 42). Each of these consumption categories has grown faster than the economy as a whole since the establishment of a democratic government in the mid-1970s. Three main factors account for this growth (Viñals 1989, 163):

Figure 2.21: Combined government deficit as percentage of the GDP, 1965-90.



1) Economic crisis increased unemployment and social security transfer payments, as well as subsidies.

2) Education, health and other social services, neglected under the Franco regime, expanded rapidly under the democratic government.

3) Demands for political decentralization led to a considerable transfer of spending authority to regional governments. This often caused a duplication of spending.

Since this growth was accompanied by economic stagnation and, therefore, declining tax receipts, the combined government deficit rose dramatically through the early and mid-80's. Recent reforms in tax collection and cuts in the growth of spending have reduced the substantially deficit as a percentage of GDP since 1986 (Figure 2.21).

Despite this improvement, several problems plague Spain's fiscal system. First of all, the extent of income tax fraud is notorious, with the official estimate of under-reporting at 45 percent of the tax base (Viñals 1989, p.164). In theory, the Value Added Tax (VAT), introduced in 1986, should be less susceptible to fraud since expenditures are often easier to trace than incomes. In fact, the extent of VAT fraud is also large, and, apparently, increasing (OECD 1991, p.101). These problems have created an over-reliance on social security taxes for financing government expenditures. In 1985, Spain collected 39.4 percent of its tax revenue in wage taxes, while the EC average burden was 29.7 percent (Viñals 1989, 164). High wage taxes increase the relative price of labor, which reduces international competiveness and aggravates the unemployment problem. Several commentators have called for cuts in the social security tax rates to be replaced by increases in the VAT rates.

Another entrenched institutional problem of the fiscal system is the method for distributing spending and taxing power through the various levels of government (Bel i Queralt 1991). Local and regional governments account for a little over 30 percent of total government expenditures. With the exception of the Basque territories, however, they collect little tax revenue. Most of their financial requirements are met by transfers from the central government. They also have the authority, within limits, to borrow in order to meet deficits. Therefore, local politicians determine much of the allocation and amount of government spending, but are not accountable to the voters for the level of tax rates. This incentive problem is gradually being corrected by a decentralization of taxing authority.

Tourism

Tourism is Spain's most important export industry. In 1990, 52 million foreign residents provided $18.6 billion of foreign exchange. The tourism trade surplus was over $14 billion (Banco de España, 1991b). Moreover, tourism's backward linkages provide a propulsive force for the rest of the economy, especially for the construction, transport, food, restaurant and hotels sectors.

Figure 2.22: Gross Tourism Receipts and Payments, 1960-90.
(Billions of 1980 pesetas.)

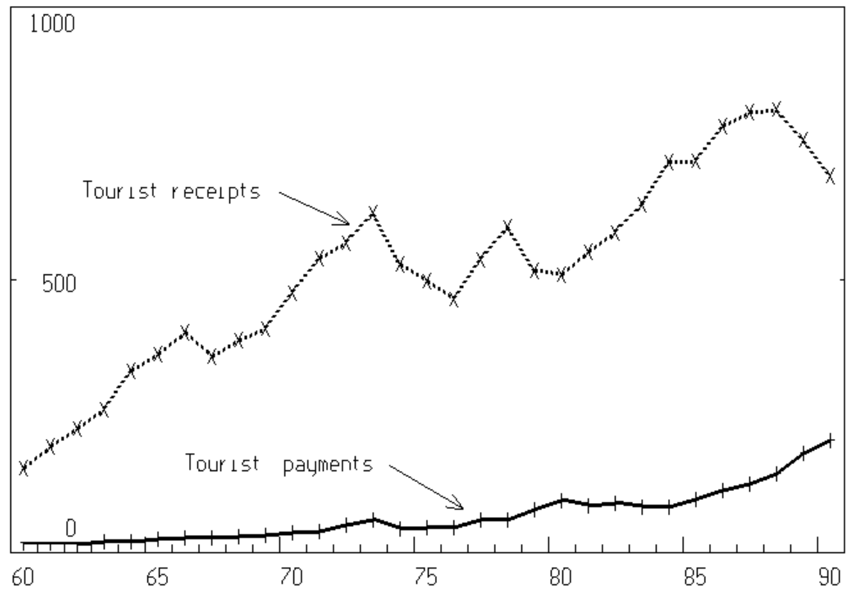


Figure 2.22 displays real gross receipts from non-resident visitors. Devaluation of the peseta, the opening to foreign investment initiated by the Stabilization act of 1959, and increases in disposable income in northwest Europe stimulated rapid growth throughout the 1960's. Foreign visitors were attracted by the low cost of guaranteed sun and beautiful beaches. The burgeoning tourist industry engulfed regional economies along the coasts, transforming small fishing villages into international tourist playgrounds. Unfortunately, the Spanish planning system was unprepared to handle the sudden tide of development. Disorderly growth of tourist facilities was not accompanied by sufficient infrastructure investment. The resulting wild land speculation, congestion and other problems would later turn investors and tourists away.

With the onset of world recession in 1974, the tourist boom faltered and the receipts fell sharply until 1977. After a brief recovery, income faltered again in the latter part of the decade. Real gross receipts did not reach the 1973 level again until 1983. This period of decline prompted restructuring in the industry, included the formation of large hotel groups and a reduction of labor intensity. After healthy growth through most of the 80's, income again started falling in 1989, catching the industry by surprise. A number of factors contributed to this fall: (1) slower income growth in northwestern Europe (especially Britain), (2) exceptionally good weather in northwestern Europe, (3) a strong peseta and domestic inflation. The Spanish industry is concerned that changing consumer tastes, a deterioration in the image of Spanish tourism, and more competitive destinations such as Northern Africa, Turkey and Eastern Europe may spell long-term decline for the sector. Furthermore, an enormous proportion of tourism in Spain is based on the mass package holiday market where competition is high and value added margins are low. As repeat tourists become more sophisticated, the demand for these type of holidays will decline.

In confronting these problems, the industry, aided by government, has embarked on strategies to promote new areas and new forms of tourism in Spain. One strategy is to promote the cultural and natural treasures of Spain located in the country's interior. "Up-market" tourism facilities such as luxury hotels, golf courses and exhibition centers are also being emphasized. These measures may also help reduce the seasonality of the industry. Regional governments have taken a more active role in improving the existing coastal facilities by providing better planning and infrastructure.

Tourism is an important ingredient in the Spanish economy. But as real labor costs accompany real incomes in their convergence with the rest of the EC, Spain may lose much of its comparative advantage. Undoubtedly, there is still a strong future for the industry, especially if it can successfully adapt to changing realities. Nevertheless, as Spain becomes a more diversified, modern and richer nation, it will not be able to depend as much on its traditional engine of growth.

CHAPTER 3:

EMPIRICAL ECONOMIC MODELS OF THE SPANISH ECONOMY

The following chapters describe a macroeconomic, dynamic, multisectoral model of the Spanish economy (MIDE). MIDE is a disaggregated, comprehensive simulation and forecasting model. It combines input-output structure with extensive use of regression analysis to describe the behavioral characteristics of the economy. When appropriate, the description will compare and contrast the MIDE model with approaches used by other existing models of the Spanish economy. Therefore, this chapter presents a brief survey of some of these models. A recent edition of *Situación*, a journal published by the Banco Bilbao Vizcaya (1990), contained articles describing several empirical models of the Spanish economy, including MIDE. The following discussion will take advantage of this survey by borrowing from these articles.

Empirical economic models provide a bridge between the realm of pure theory and the real economic world. While built on the foundation of economic theory, empirical models can make this theory relevant, or show it to be irrelevant, by attaching real-world places and numbers to the theories. One advantage of these models is that they force an analyst to make his assumptions about how the economy operates explicit at each stage of the analysis. The user can then trace the implications of this particular set of assumptions. Furthermore, empirical models provide quantitative results for which we can judge the relative significance of the different assumptions. Often, indirect effects of economic developments or policy which may be neglected by theory are found to be important when quantitatively modeled. For these reasons, economists use empirical models to evaluate their thinking about the workings of an economy.

There are several different types of empirical economic models, each type designed to fill different needs. In this survey of Spanish empirical models, I shall concentrate on macroeconomic, structural models. The term "macroeconomic" refers to models which depict the economy as a whole, not just a certain industry, market or institution. Typically, they consist of an econometrically estimated, multi-equation simulation system for a set of endogenous variables underlying the right hand side of the Gross domestic product identity:

$$GDP = C + G + V + X - M$$

In this equation C represents private consumption, G is government consumption, V is investment, X is exports and M is imports. The scope and detail of relations between the variables varies widely among models. The term "structural" implies that the design of the model is influenced by economic theory. To be more specific, the model builder arranges the behavioral equations and identities of the model in a causal framework that reflects a theoretical model of the economy.

3.1 Macroeconometric Models

The first type of model considered can be termed the classical econometric-macroeconomic, or "macroeconometric", models. These models rely heavily on regression analysis for determining final demand aggregates, but make little or no use of input-output tables. Consequently, they normally have little industry detail and no accounting for intermediate consumption. For example, the sales of steel to the automotive industry, which is not a part of GDP, is ignored. Therefore, classic macroeconometric models cannot assess industry level impacts of changes in final demands and also have trouble considering changes in indirect tax rate changes or commodity price shocks.

These models are usually used in government and academic circles to assess macroeconomic results of macroeconomic policies or shocks. Most forecasters use such models. There are three well known models of such type in Spain: (1) the Wharton-UAM (Universidad Autónoma de Madrid) built and maintained by the Centro de Predicción Económico (CEPREDE) in Madrid, an economic consulting firm; (2) the MOdelo de Investigación y Simulación de la Economía ESpañola (MOISEES), built by a team in the General Directorate for Planning of the Ministry of Economics; and (3) two integrated models, INCOYMOD and HISPANIA/PC built by the Economic Studies Service of the Banco Bilbao Vizcaya.

The Wharton-UAM (henceforth referred to as UAM) model is the oldest and most elaborate macroeconometric model of the Spanish economy. The model provides four to five year forecasts and historical simulations for subscribers of CEPREDE’s services. It is based on annual data. Construction of the first version of the model began at the Universidad Autónoma de Madrid in 1978 by the Centro de Predicción L.R. Klein. Formal collaboration between the its builders and Wharton Econometric Forecasting Associates (WEFA) was initialized in 1980 (Fernandez and Pulido 1990). The model is now part of project LINK, an inter-connected set of country models headquartered at the University of Pennsylvania. The LINK system provides all the international variables of the UAM. The model is fairly disaggregated, providing, for example, estimations for nine different product prices, eight different types of exports and imports and three different types of investment. While there is no input-output accounting or intermediate consumption on the production side, the model uses fixed input-output coefficients to measure the impacts of intermediate product prices on the final product deflators. This type of price determination allows the model to assess the impacts of commodity price fluctuations or indirect tax rate changes on the final prices. Many aggregate macro-models lack this feature.

The MOISEES model was developed to appraise the long-term effects of fiscal policy measures and to help in the elaboration of the macroeconomic and budgetary projections of the Ministry of Economics (López Blanco and Taguas 1990). Developed only in the past five years, MOISEES is a relatively small model, highly aggregated and based on annual data. Nevertheless, it has two interesting and distinguishing features. First, because of its roles in simulating the impacts of fiscal policy and planning the government's budgets, MOISEES endogenizes government receipts and outflows to a large extent. Especially important are the effects of changes in aggregate income on non-discretionary transfer payments and tax receipts.

Second, MOISEES is characterized by its builders as a disequilibrium model (Dirección General de Planificación 1990). Prices are assumed to be sticky and non-price rationing can occur. In the short run, the capital-to-labor ratio is assumed fixed. The output equation summarizing this state of affairs is:

$$Y = min(YD, YP, YLS)$$

where Y is output, YD is demand, YP is the maximum output given existing capital stock, and YLS is the maximum output given a fully employed labor force. If the demand constraint holds (YD is the minimum), the economy is in a Keynesian regime. If a fully employed capital stock prevents equilibrium between supply and demand (YP is the minimum) the economy is said to be in a classical regime. Finally, if the restriction is due to the unavailability of labor at the going wage rate, the economy is in a repressed inflation regime. In this case, a rise in prices would reduce demand, transferring it into a different regime, but prices are prevented from rising for some reason.

At any given time, there will firms in the economy in each regime. To determine total output, a CES aggregator function of the three regimes (based on the work of Lambert 1987) is used to determine these proportions through time. This function is:

$$Y = (YD^{-\rho} + YP^{-\rho} + YS^{-\rho})^{-\frac{1}{\rho}}$$

where ρ is an index of the structural friction or uncertainty about demand, capacity and labor supply. In practice, it depends on a matrix of variances and covariances of the historical deviations of actual output from the output supposed by each of the regimes. Since in the forecast period, this parameter cannot be determined, it becomes the central assumption of the model user. Econometrically estimated functions for labor and capital productivity determine potential supply (YP and YS); behavioral equations for consumption, government spending, investment (which feeds back into capital stock), imports and exports determine potential demand (YD). Rationing of demand or supply occurs in the foreign trade sector, where the import and export identities are inequalities. Space does not allow us to elaborate more fully here, details can be found in Dirección General de Planificación (1990).

The Spanish National Statistics Institute does not produce quarterly figures for national account data such as GDP, consumption and foreign trade. Consequently, all the models of the Spanish economy are based on annual data. Moreover, since the annual accounts appear with a three to four month lag, it is difficult for the annual models to integrate the latest information into their predictions. This situation makes it difficult for government and business leaders to access short run economic conditions. The Economic Studies Service at the Banco Bilbao Vizcaya (Servicio de Estudios de BBV) has attempted to remedy this situation by building INCOYMOD (INdicadores COYuntura MODelo). This model consists of behavioral equations which project national accounts aggregates employing annualized figures for indicators published monthly or quarterly. The indicators used include industrial production and price indices and employment (Alcaide and Martínez Aguado, 1990). Since the indicators are available much sooner, INCOYMOD produces estimates for the current year national accounts based on actual data. For example, by plugging the annualized indicators for the first two quarters of a year into the equations, the model produces estimates for the GDP, private consumption and foreign trade for the current year in July. Users of the information can then get a feel for the actual economic conditions represented by the national accounts. The studies service of BBV also has a small annual macro model of the Spanish economy called HISPANIA/PC. Outputs of INCOYMOD are used to update the medium run predictions of the HISPANIA in a timely fashion.

3.2 Classic Input-Output Models

Classic input-output models are structured around the input-output tables and its production or price identities (which will be defined in Chapter 4), but make little or no use of regression-based behavioral equations. The advantage of these models is that the data requirements are minimal, consisting of one input-output table. The disaggregation of classic input-output models is limited by the disaggregation of the published input-output table. Since these models account for intermediate exchanges, they are useful for assessing industry level impacts for changes in final demand, indirect tax rates or commodity price shocks. However, projections are normally made by specifying final demands (consumption, investment, exports and imports) exogenously. Intermediate consumption, prices and income are determined with strict identities. Consequently, there is no integration between final demand and prices or income and no guarantee that there will be economic consistency among, for example, consumption, prices and income. Moreover, attempts to build "dynamic" input-output models by endogenizing investment based on the capital equipment "requirements" for future output often leads to severe instability problems (Steenge 1990; Almon 1966). Therefore, classic input-output models are of limited use for forecasting.

Abadía et al. (1981) constructed the first Spanish model in this category. Their 13 sector model was designed to investigate and project the patterns of production, capital formation, employment and income distribution. The model contains only real variables, there are no prices or nominal quantities. Consumption and exports are specified exogenously. Investment is dependent on future capital requirements and imports depend on the static import requirements implied by the base input-output table. The classic input-output equation, based on constant intermediate demand coefficients, computes production. The model is closed by specifying a balance of trade constraint. Abadía et al. used the model to project possible growth paths for the Spanish economy from 1975-1985 under different exogenous assumptions for consumption growth. The exercises were useful for describing the potential for growth given the initial capital stock and external trade positions of the economy. The model also provided sectoral breakdowns of production, employment and income distribution for each of the scenarios. However, there is no attempt to generate the relative and general price movements of the economy.

On the flip side of the coin is IINDIO (modelo de simulación de la Imposición INDirecta con técnicas Input-Output). This 17 sector model provides the detailed accounting for price formation in the economy. IINDIO was used by Lasheras et al. (1989) to examine the price effects of the change of Spanish indirect tax regime in 1986. Previous to EC entry, the Spanish indirect tax regime was a cascade tax which fell on all sales, including intermediate consumption. With EC integration, this system was replaced by a value-added tax (VAT). Under the VAT, the producer's tax liability is the difference between the tax charged on his sales and that paid on his purchases of intermediate goods and services.

Unlike the old tax, therefore, indirect taxes paid on intermediate inputs are refunded. In this way, taxes are collected at each stage of production according to the value added. However, there are exceptions. Sales of several sectors, such as health and education, are exempt form the VAT. Since these sectors have no tax liability, they have no way of obtaining a refund for taxes paid on intermediate purchases. Price and government tax revenue implications of initiating or changing this system must be examined in an input-output framework since the tax falls directly on some intermediate input purchases.[1] The IINDIO approach was successful in demonstrating the first round impacts of the tax regime change. However, since there was no price feedback to final and intermediate demands, indirect effects of tax changes cannot be estimated. Tax revenue results are especially problematic under such a limitation.

These two classic input-output models illustrate the utility of constructing empirical models which include explicit accounting for intermediate demand and inputs. One model describes the real side of the economy; the other is dedicated to investigation of price formation. Both models are limited by their inability to integrate the effects of demand and supply on prices, or vice-versa. Such integration is the object of the following two types of models.

3.3 Computable General Equilibrium Models

Computable general equilibrium models (CGE) are disaggregated representations of the economy which use input-output structure for the production side of the economy. Data

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[1] The issues involved here are complicated and will be dealt with in more detail in Chapter 4. For an excellent discussion of the European system of value added taxes and its implications for modeling see Bardazzi et al. (1991).

requirements are larger than those for classic input-output models since income distributions to the various sectors of households, government and firms are also considered. However, the data set used in model construction is usually limited to one year. CGE models also include sectoral-level production functions and disaggregated demand functions for consumption, imports, investment, etc. They combine input-output structure and behavioral functions. Normally, however, behavioral parameters are not estimated with regression analysis as in econometric models but are deduced from the single year's set of data or specified exogenously. In the determination of prices, CGE models assume flexible prices which move to clear all the markets simultaneously (although some CGE models will assume some sticky prices, such as in the labor market). The models are used to describe differences between two equilibrium positions, rather than on a dynamic time path of an economy. As John Whalley, a pioneer in CGE modeling, notes, that the models

> are not forecasting tools built to give an accurate picture of the future time path of actual economies, but are instead a form of theory with numbers which generates insights rather than precise forecasts (Whalley 1986, p.3).

In other words, CGE models are used to estimate different static equilibriums under Walrasian general equilibrium theory.

One CGE model has been constructed for the Spanish economy by Kehoe, et al. (1988). It is based on a social accounting matrix (SAM) constructed from the 1980 input-output table and national accounts and contains twelve production sectors. It differs from other CGE models in that it allows for excess supply in the labor market (i.e. unemployment) via an inflexible wage rate. The model was used to assess the effects of the 1986 tax reform. The approach could be said to be superior to the IINDIO model because of price feedback effects on final demand. The model has also been used to assess the impacts of the various economic changes implied by Spanish integration in the European single market (Polo and

Sancho 1989). The results of various market union measures, which we will examine in Chapter 8, are presented as single figures which summarize the deviation of the base run of the absence of integration. Since the model is static, there is no definition of the time frame for which the impacts may occur. Moreover, without a dynamic time path, fluctuations in economic activity which could occur in the meantime cannot be described. To attain this type of information, another type of model must be utilized.

3.4 Macroeconomic Multisectoral Models

A final type of model can be described as macroeconomic, dynamic and multisectoral. This type of model combines all the features of the above models. They are macroeconomic, since the depict the behavior of the economy as a whole and produce projections for GDP and its components. They are multisectoral and include input-output accounting which shows intermediate consumption. They integrate intermediate input prices with sectoral price formation. In contrast to classic input-output models, however, macroeconomic multisectoral models connect the production and price sides of the economy through behavioral equations for final demand which depend on prices and output, and functions for income which depend on production, employment and other variables. Furthermore, unlike CGE models, they are dynamic, that is, they produce projections of a time path of the economy rather than differences between "equilibrium" positions. Therefore, macroeconomic multisectoral models are more suited for forecasting.

An important feature of a macroeconomic multisectoral is the *bottom-up* technique. In this approach, the model works like the actual economy in that the macroeconomic aggregates are built up from detailed projections at the industry or product level, rather than being estimated and distributed between sectors.[2] For example, total capital investment, total imports and total wage income are not projected directly but are computed as the sum of their parts: investment by specific industries or goods, imports by production branch, and labor compensation by industry. The bottom-up technique gives the model the ability to describe how changes in one industry, such as increasing productivity or changing input-output coefficients, affect other, related sectors and the general economy. Also, parameters in the behavioral equations differ between products or industries, reflecting differences in consumer preferences, price elasticities in foreign trade, and industrial structure. Finally, the detailed level of disaggregation permits the modeling of prices by industry, allowing one to explore the causes of relative price changes, and their effects on industry output, structure, and employment.

In 1981, the European Commission sponsored the HERMES (Harmonized European Research Macrosectoral Energy System) project for building and linking a collection of macroeconomic, multisectoral models for the EC countries. The specification for each of the models is homogeneous, based on the document "European Project for a Multinational Macrosectoral Model" by d'Alcantara and Italianer (1982). A significant study developed from the entire HERMES system is Catinat and Italianer (1988). This study provided the quantitative macroeconomic impacts of the European single market presented in the now famous Cecchini report (Cecchini et al. 1988) sponsored by the EC Commission. Unfortunately, a Spanish representative of the project was not finished in time for the project. Consequently, the various studies concerning European integration have very little

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[2] This is in contrast to another type of multisectoral model which allocates macroeconomic model results to sectors through the use of an input-output table. In this *top-down* type of model, there is little of no behavioral modeling at the sectoral level. Since no such model exists for Spain, the type is not discussed here.

to say concerning the Spanish economy (see, for example, Catinat et al. 1988). However, the HERMES-ESPAÑA model is presently being built and operated by a team at the aforementioned Centro de Predicción L.R. Klein at the Universidad Autónoma de Madrid. A survey of the model is found in Dones Tacero et al. (1990).

HERMES-ESPAÑA contains nine production sectors, fourteen consumption categories and five sets of bilateral trade equations. It also includes an energy block to provide a detailed treatment of eight different types of energy products. The major feature of the model is the use of sectoral CES (Constant Elasticity of Substitution) production functions to determine demands for capital, employment and energy. The model is quite complicated, and it is beyond the scope of this chapter to explain it in detail. Instead, since HERMES-ESPAÑA is the Spanish model most similar to the model presented here, a brief comparison of its characteristics to those of the MIDE model can be made.

Two distinctions can be identified. First, while taking similar approaches to modeling the economy, the MIDE model contains substantially higher degrees of disaggregation (43 production sectors, 43 categories of consumption and 11 types of investment). The advantages of higher disaggregation are those normally cited in the literature: a richer depiction of the structure of the economy and more accurate description of economic behavior. More important, highly disaggregated forecasting models are much more useful to a business planner because they provide specific information concerning the customer, supplier, and the own industries of a business. Second, the Spanish implementors of Hermes were given no room for adapting its structures or equation specifications to Spain. In building the MIDE model, however, I had virtually unrestricted scope for adapting the model structure and equation forms to the situation existing in the Spanish economy.

On the other hand, the greater the disaggregation of the model, the greater is the complexity of the model and the greater are the limitations of published data. Also, it is generally true that the smaller a sector, the more difficult it is to prepare behavioral equations for the variables of that sector. This is because individual sectoral peculiarities become more important as the sector modelled becomes smaller. This characteristic, however, while making life miserable for the modeler, is precisely a point in favor for greater disaggregation. Nevertheless, data limitations and sectoral peculiarities often lead to *ad hoc* specifications in a highly disaggregated model. The trade off is that while these specifications may not be as grounded in economic theory as we desire, they are grounded firmly in reality.

CHAPTER 4:

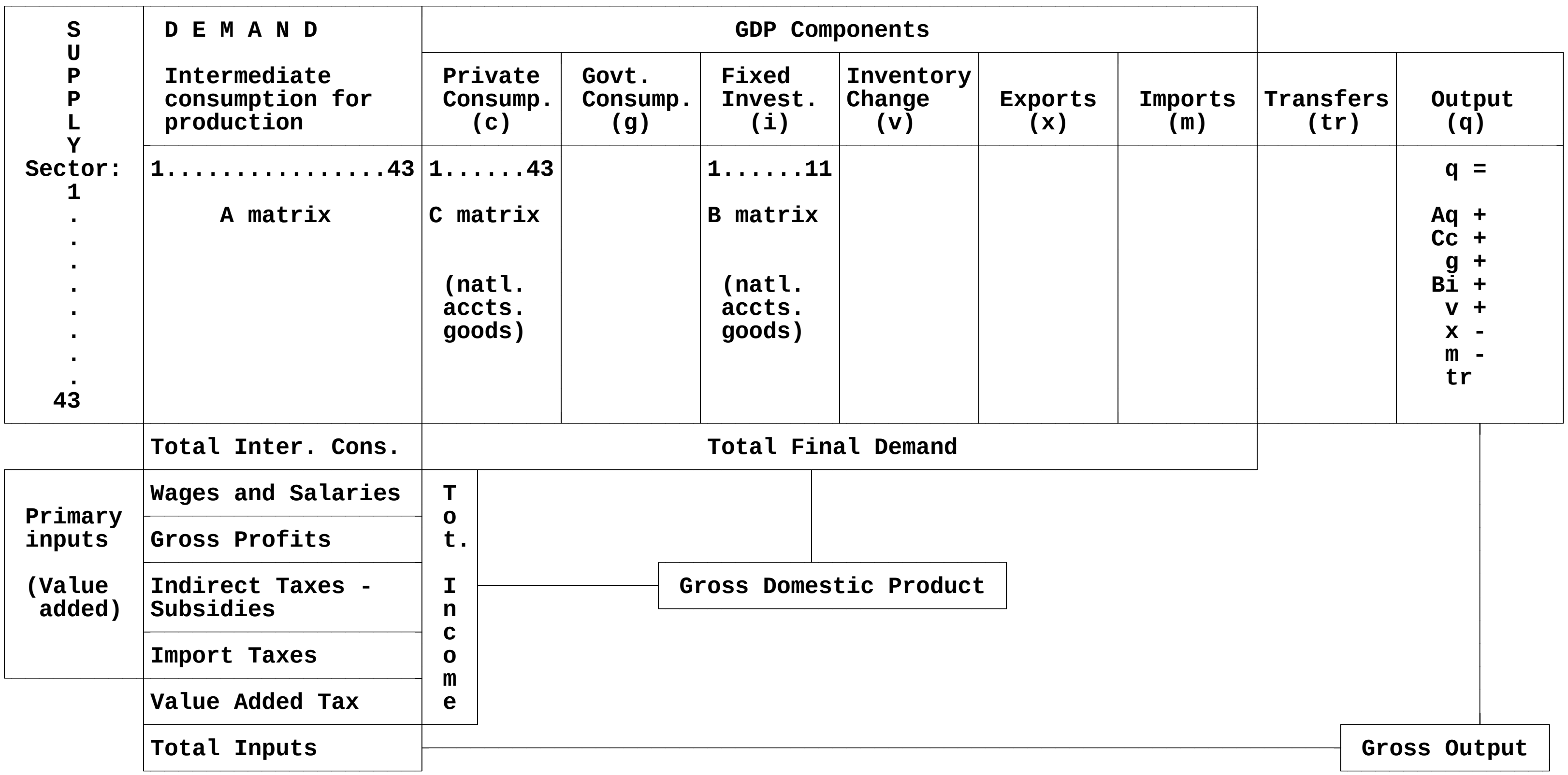
GENERAL EQUILIBRIUM FRAMEWORK OF THE MIDE MODEL

The foundation of the MIDE model is a 43 sector input-output table embedded in the structure of the Spanish national accounts. The data base of the model has been compiled using the 1980 input-output table and the national accounts published by the Instituto Nacional de Estadística (INE), and various other sources. It contains annual time series for sectoral level and macroeconomic variables covering the years 1964 through 1989 (up to 1991 for many variables). The Appendix contains an enumeration of sector and commodity categories of the model and describes the construction of the data base in detail.

Figure 4.1 illustrates the input-output structure of MIDE. In the table, the quantities across each row represent the sales of each sector to the different sources of demand. The top left section of Figure 4.1 is the intermediate demand matrix. This matrix lists the sales of the product in row *i* to the industries in column *j* ($q_{i,j}$). These intermediate inputs are not included in Gross Domestic Product (GDP), but nevertheless make up part of the total demand of the row sectors. To the right of the intermediate matrix appear the final demand ($f_{i,k}$) categories which comprise GDP. The final demand components of MIDE are private consumption, government consumption, investment, change in inventory, exports, and imports. Imports enter as negative quantities. Each row of the table is summed to give total demand of the product sector (q_i).

Quantities listed down the column for each of the production branches in the A matrix are the payments to the factors of production. Below the intermediate demand matrix is the value added, or income, paid to the primary factors of labor and capital and to the

Figure 4.1:
Input-Output Accounting Framework for the MIDE Model



government. Three types of taxes are computed in the model. Indirect production taxes minus subsidies, import taxes, and value added taxes. This income is aggregated to GDP. The total inputs to each sector, both intermediate and primary, are added down the column to equal to the output of that sector. A matrix of intermediate demand coefficients, the A matrix, is constructed with the equation:

$$a_{i,j} = q_{i,j} / q_j ,$$

where $q_{i,j}$ is the intermediate input flow of product i to industry j, and q_j is the output of industry j.

The input-output table published by Instituto Nacional de Estadística is a *product-to-activity* table. It reflects the way the data was collected. Survey data on consumption of different products is collected from individual establishments, or, in some cases, parts of establishments. Each establishment (or in the words of the Standard European Accounts, "homogenous output unit") is classified under an activity which best reflects its principle product. The establishment is then assigned to the column of the input-output table corresponding to the *activity*. The establishment’s consumption of different types of *products* is then entered in the appropriate product rows of the activity column. The final table is the imputed aggregation of each cell entry from the survey data. The column sum for each activity appears under the heading of *effective production*. Since it is the sum of inputs, this total represents the gross production from the units of production.

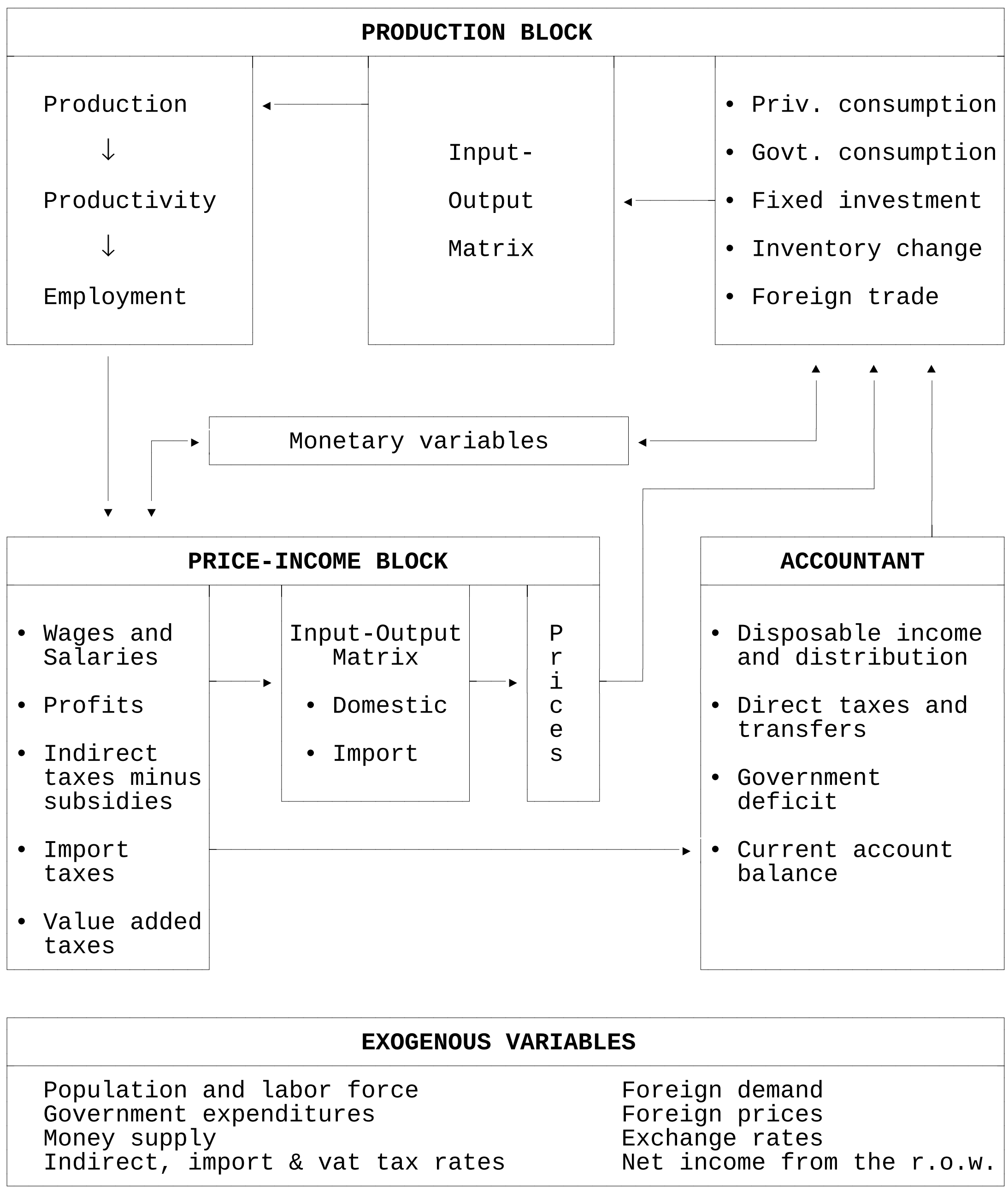
While an activity is classified under its primary product, it is possible that it also produces by-products or secondary products which belong in a different classification. Therefore, the effective production of an activity can contain the output of products which are classified under different product category in the rows of the input-output table. Since the row sums of the input-output table represent demands by products, there are discrepancies in the corresponding row and column sums of the table. To reconcile these inconsistencies, the table is published with a row of *transfers* added to the bottom of the table. These transfers sum across the row to zero. A transfer entry in a column represents the output produced by another industry which is classified as a product of that column classification, less the by-products or secondary products produced by that column industry. The transfers are added to effective production to yield *distributed production* for each activity, which is equal to the row demand for each corresponding product.

This method introduces certain problems. Ideally, the MIDE model should contain a *product-to-product* table. In such a table, the A matrix flows reflect the purchases of intermediate products for the manufacture of products, rather than for the outputs of activities. The row of transfers disappears. Unfortunately, there is no information on the manufacture of secondary and by-products by activity to transform the 1980 published table. Moreover, the national accounts data on value added and effective production are always published for activities, not for product categories. For these reasons, I have elected to simply balance the table by converting the transfers into a final demand column, entering negatively, as shown in Figure 4.1. Therefore, the output solutions in the MIDE model are activity-level effective production and can be directly compared with the data in the national accounts. Since there is no information on the magnitude of the transfers in any other year except 1980, they are projected in each year as the constant 1980 proportion of effective production and scaled to sum to zero. While this solution is not ideal, the magnitude of the transfers is small. If there were significant problems introduced by this scheme, they would show up in the solutions for output in the historical simulations of the model. I have not encountered such problems.

From this input-output accounting system, a detailed annual simulation model is built using econometric techniques. MIDE consists of three inter-related submodels: the *production block*, the *price-income block*, and the *accountant*. The production block determines constant-price sectoral final demands, intermediate consumption, outputs, labor productivity and employment. The price-income block computes nominal wages, profits, net taxes and price indices for each industry. The accountant transforms the sum of sectoral income into national income and other aggregates with the use of macroeconomic identities and behavioral equations. It then distributes this income to households, corporations and government. The model is closed by specifying relationships between the variables of the production, price-income and accountant blocks. For example, private consumption is dependent on the prices and income generated by the price-income block, and sectoral wages are dependent on productivity and employment.

The model uses an iterative solution process, which is displayed in Figure 4.2. In any given year, MIDE begins in the production block at the upper right hand corner of Figure 4.2 and proceeds counter-clockwise. On the first iteration for a given year, the model estimates the variables exogenous to the production block such as prices and income (usually the last period quantities adjusted by a growth factor). These quantities are used to compute first estimates for the endogenous variables for final demand. The model continues through the loop, computing each of the interdependent quantities of output, productivity, employment, value added, prices and income. On subsequent iterations of the full model in the same year, the computed estimates determined by the rest of the model are used throughout. The model iterates through this loop until the convergence criteria is met. Each of these blocks is discussed in more detail below, providing a outline of the interrelation between the model’s variables. In the interest of simplicity, details on the functional forms and econometric results have been left for the following chapters.

Figure 4.2:
Solution process of the MIDE Model



4.1 The Production Block

The MIDE model is Keynesian in the sense that the sectoral demands for goods and services determine the production level. The production block begins by specifying Government consumption exogenously for three different rows, which correspond to the classification of the government production sectors of the input-output matrix, Public administration, Health care, and Education. Intermediate consumption by the government is allocated to the branches of activity via the input-output coefficients of the government sectors.

Private consumption is the next order of business. A two-staged process determines: 1) the allocation of private income between consumption and savings, and 2) the allocation of consumption between 43 categories of goods and services. Additionally, imports and exports of tourism are computed as an intermediate step in this portion of the model. In the first stage, a behavioral equation computes aggregate National private consumption. This approach is perhaps an exception to the *bottom-up* technique used in the rest of the model. However, the assumption that consumers decide how to divide their income between savings and consumption and then decide on which products to consume is not far from reality. At any rate, the consumption-savings decision is difficult to model on a disaggregated level. Since consumption comprises 60 to 70 percent of GDP in any one year, it is the most important quantity in the model. A single-equation representation of aggregate consumption simplifies the interpretation of the entire model.

Aggregate consumption in the MIDE model depends on household disposable income, a measure of wealth, the unemployment rate and the interest rate. Real disposable income enters the equation with a distributed lag, indicating that increases in income do not translate immediately into a equal increase in consumption, but are partly absorbed by savings (the permanent income effect). Inflation affects consumption negatively through the real wealth term. Since it tends to devalue their stock of wealth, high inflation motivates consumers to increase savings in order to maintain their asset stock.

After aggregate national consumption is computed, behavioral equations calculate Interior consumption by nonresidents and Exterior consumption by residents. The former is added and the latter subtracted from national consumption to yield total Private interior consumption. Then, this total is distributed among 43 categories of goods with a nonlinear econometric system of per capita consumption functions. Demand for each good depends on per capita real aggregate interior consumption expenditures, the one period difference in real per capita aggregate expenditures, a time trend to reflect changing tastes or demographics, its own price, and the prices of all the other goods. Since the commodities do not correspond with the production branches, the projections from these equations are converted to private interior consumption expenditures by industry via a share or bridge matrix.

Most multi-sectoral models contain investment equations by purchasing sector based on neoclassical production functions where investment is derived from the demand for capital as a factor of production. Unfortunately, sufficient data on capital stocks and investment purchases by sector do not exist for the Spanish economy. Therefore, the MIDE model uses a specification found more often in macroeconomic models, an accelerator equation which estimates demand for capital by product (industrial machinery, office machinery, motor vehicles, non-residential construction, etc.).

The traditional accelerator model of investment distinguishes between net investment and replacement investment. Positive (negative) net investment in a period is defined as the portion of gross investment above (below) the amount required to replace the depreciation of the capital stock in the period. An accelerator function treats net investment as dependent on the lagged changes in output of the purchasers of the capital. Adding a replacement investment term converts the equation into a gross investment function. The equations in MIDE also contain the ratio of the price index for the capital goods over the price of the purchaser's output and the current and lagged ratio of M2 to nominal GDP as explanatory variables.

The construction of weighted indices for the changes in output and the producer prices of the purchasing sectors requires some knowledge of the purchasers of each type of equipment. For this information, I have used a series of capital flow matrices, covering the years 1980 through 1983, constructed by Antón and Escribano (1988). These matrices show the flows of investment sales of the type of good to the purchasers, classified according to the 40 non-government sectors of the 1980 IO table.[1] Gross investment in fixed capital is estimated in this way for nine categories of equipment purchases and non-residential construction. Residential construction is estimated as a function of disposable income, the consumption of housing, and the ratio of M2 to nominal GDP. A share matrix distributes investment goods margins to the service sectors such as retail trade and transportation.

Inventory investment is a small but volatile component of final demand. For some industries, such as agriculture and petroleum, it can be important. Inventory change for each of the manufacturing industries is predicted as a partial adjustment to a desired stock. The stock depends on the level of output.

Foreign trade in the MIDE model is linked to other, similar models through the

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[1] This information is precisely what is required to construct conventional, neoclassical investment demand equations by purchaser. However, since this study includes only 4 observations, the data is still inadequate for this purpose. I await further releases of similar data.

INFORUM international trade model (Nyhus 1991). Countries included in this system include the U.S., Japan, and major European economies. Through this system, sectoral exports and imports of the Spanish economy respond to sectoral level demand and price variables projected by models of its trading partners. For example, Spanish merchandise exports for 25 industries are computed by nonlinear functions which relate exports to the foreign demand and the ratio of Spanish prices to the foreign prices of that sector. The domestic production deflators are used to project the export prices for the forecast period. Both the foreign demands and competing exporters prices come from the INFORUM international system. The foreign demands are computed by weighting the sectoral imports of each trading partner by its sectoral share of Spanish exports for 1987. The international prices are the sectoral production prices of the competing countries weighted by the participation of each country's exports in the world market, adjusted by exchange rates.

Transportation and wholesale trade exports consist mostly of margins earned in shipping and marketing merchandise exports. Therefore, exports for these sectors depend on the level of merchandise exports. Exports of communications, finance, business and other services depend on the general level of demand in other European nations as projected by the INFORUM models. To complete the export accounting, the Interior consumption by non-residents is added to the merchandise and service exports.

Imports are measured to include the cost of insurance and freight, but not to include customs duties. Imports for each of the 33 importing branches are projected by nonlinear equations using internal demand and the import purchaser price to domestic price ratio as explanatory variables. For the forecast, import prices at the border are moved with the sectoral production prices of the supplying countries, weighted by the shares of each country in supplying that commodity to Spain in a base year, and adjusted by exchange rates. The production prices of the trade partners also come from the INFORUM international system of linked models. Purchaser prices are computed by adding the ad-valorem import taxes to the border prices. Finally, to determine aggregate imports, Exterior consumption by residents is added to the sum of the sectoral projections.

Once the final demands are determined they are added to construct the vector, **f**, of total final demand for each of the production branches. The formation of **f** is done by the matrix equation:

$$\mathbf{f} = \mathbf{Cc} + \mathbf{g} + \mathbf{Bi} + \mathbf{v} + \mathbf{x} - \mathbf{m} - \mathbf{t}$$

where:	**C**	=	the 43x43 consumption bridge matrix,
	c	=	the 43x1 vector of private interior consumption by commodity,
	g	=	the 43x1 government consumption vector,
	B	=	the 43x11 investment bridge matrix,
	i	=	the 11x1 gross investment vector,
	v	=	the 43x1 inventory change vector,
	x	=	the 43x1 export vector,
	m	=	the 43x1 import vector,
	t	=	the 43x1 transfer vector.

Sectoral output is then computed by use of the Leontief equation:

$$\mathbf{q} = \mathbf{Aq} + \mathbf{f}$$

where:	**q**	=	vector of constant price sectoral outputs,
	A	=	intermediate demand matrix, where each coefficient, a_{ij}, of the matrix gives the total constant-price amount of good *i* needed to produce a unit of good *j*,
	f	=	vector of constant price final demands.

Since several demand components (i.e. investment, exports, imports, inventories and transfers) depend on output or domestic demand, they must be computed simultaneously with output. Therefore, a Seidel iterative loop exists within the production block so that the solutions for these quantities are consistent.

The technical coefficients of the A matrix, while exogenous to the model, vary over time *across-the-row* along logistical curves estimated with historical data for output and final demand. This feature is somewhat unique to INFORUM type models. Most multi-sectoral models assume fixed coefficients, at least in a majority of sectors. But rather than being a luxury, this coefficient change is necessary to assure the accounting consistency among final demands, intermediate use and output. For the estimation of these logistic curves, I compute historical intermediate demands for each sector, di_{it} by subtracting the actual final demands from output. Then an alternative series of intermediate demands is elaborated under the assumption that there had been no changes in the technical coefficients. This quantity, called cci_{it} for "constant coefficient indicator" is defined as

$$cci_{i,t} = \sum_j a_{i,j,80} \times q_{j,t}$$

where: $q_{j,t}$ = historical output for activity j in year t, and

$a_{i,j,80}$ = the base year (1980) coefficients.

The changing pattern of inputs to each activity is estimated by comparing the actual intermediate demand and the constant coefficient intermediate demand with the ratio:

$$r_{i,t} = \frac{di_{i,t}}{cci_{i,t}}$$

A logistic curve, estimated as a function of time, projects this ratio into the future. In the model, the coefficients of each row, i, change in proportion to $r_{i,t}$. A detailed explanation of this work is found in Diaz (1990).

Frequently, the projections of individual coefficients using this general method are unsatisfactory given other available information. In such cases, this information is used to modify the across-the-row coefficient projections. One example of such a modification is for the Coal and lignite industry. After the petroleum price shocks of the 1970s, Spanish government policy strongly encouraged the substitution of coal for oil by controlling coal prices and subsidizing conversion to coal of large energy users such as power plants, metal furnaces, ceramic and cement plants (Salmon 1991, p.89). Therefore, intermediate demand for coal expanded rapidly and this is clearly illustrated by the computed intermediate demand ratio ($r_{i,t}$). The projection of this ratio indicates a continuation of this trend. Since 1985, however, demand has stagnated as a lower oil price, substitution of electricity for coke in the metal industries, and environmental considerations have made coal less attractive. Moreover, the cost of domestic coal is high because of low quality coal, geologically difficult conditions, small scale production and labor unrest. The industry, therefore, is expected to experience a decline in the coming years. In line with this expectation, the projection its intermediate coefficients shows a slight decline throughout the forecast horizon.

After the level of production in each branch is determined, labor productivity and employment per sector is projected. The sectoral productivity variables, defined as output per hour of labor time, are estimated using regression equations which include exogenous exponential changes over time and cyclical output fluctuations as independent variables. Sectoral employment in total hours is related to output by dividing output by productivity. A second equation for each sector estimates the work year, in total hours per employee, as a function of time and the change in output. This quantity is divided by the hours of worked to determine the employment in persons for each sector. For the government administrative sector, productivity and employment are exogenous. The model computes total unemployment as the difference between the exogenous labor supply and aggregated employment.

These variables become important factors in other parts of the model. Labor productivity and employment play key roles in determining the underlying industrial structure and the growth potential of the economy as a whole. As we shall see below, they are important inputs for determining the levels of wages and prices. If labor productivity in a certain sector increases at a rate high enough to decrease the unit labor costs in that sector, the relative price of its product will fall and demand for the product will increase. Moreover, total employment (via the unemployment rate) enters into the aggregate wage index equation. In this equation, productivity growth decreases wage pressure because it reduces labor requirements. This reduction in inflationary pressures increases real income and aggregate demand, encouraging faster growth in the economy as a whole. Therefore, as in the actual economy, productivity growth and its effect on employment play a key role for determining real economic growth in the model.

Table 4.1 summarizes the discussion of the product block. It shows influences included in the behavioral equations and identities used for the determination of each product block variable.

Table 4.1: Components and Influences of the Production Block

Variable	No. eqs.	Influences
Government consumption	3	Exogenous
National private consumption	1	Real wealth Real disposable income Unemployment rate Change in the nominal interest rate
Interior consumption by foreign residents	1	GNPs Germany and the UK ER adjusted relative consumption price of Spain to Germany and the UK
Exterior consumption by residents	1	Real disposable income ER adjusted relative consumption price of Spain to Germany and UK
Private interior consumption by type of commodity	43	Total interior consumption Change in interior consumption Time Relative prices Interest rates
Investment in equipment and non-residential structures by type of investment good	10	Change in purchasing sector outputs Relative prices of investment goods Equipment depreciation Ratio of M2 to nominal GDP
Residential construction	1	Disposable income Consumption of housing Ratio of M2 to nominal GDP
Inventory investment	25	Sectoral output
Merchandise Exports (fob)	25	Foreign demand by sector Domestic/foreign sector prices Exchange rates Changes in domestic demand
Service Exports	8	Merchandise exports General demand in Europe

Table 4.1 : Components and influences of the Production Block (cont.)

Variable	No. eqs.	Influences
Imports (cif)	33	Domestic demand by sector Foreign/domestic sector prices Exchange rates
Output	43	Intermediate demand + final demand
Labor productivity	42	Time Output cycles by sector
Average employee work year	42	Time Change in output
Employment	43	Sectoral labor productivity Length of work year Sectoral outputs Exogenous (government)

4.2 The Price-Income Block

As the name implies, this part of MIDE determines the value added (income) in each sector, and from these calculates the sectoral price indices. There are four components of value added per sector: total labor compensation (including social security contributions paid by the employer), gross profits,[2] net indirect taxes on production (indirect taxes minus subsidies) and import taxes. The sectoral collection of value added taxes are also determined at this stage. These variables are analogous to final demand in

[2] Gross profits in the Standard European Accounts input-output table are capital income before deductions for capital consumption, net interest and business transfer payments. It therefore differs from the conventional definition of economic profits. At the sectoral level, the Spanish national accounts, and therefore the MIDE model, do not provide a separate accounting for these components. For simplicity, throughout this paper the term gross profits, or simply profits, refers to capital income before the deductions.

the production block of the model in that they are determined in the initial stage of the price-income block and are then used for the computation of prices.

Since wages tend to move uniformly across the economy, MIDE contains an aggregate wage function. In this behavioral equation, the percentage change in total labor compensation per employed worker is determined by a two-year moving average of consumer inflation and the difference between the actual unemployment rate and a measure of the natural unemployment rate (the rate at which wage inflation neither accelerates of decelerates - the NAIRU). Consistent with a hypothesis of "hysteresis," the natural rate of unemployment is defined as the lagged four-year moving average of the unemployment rate. There is much evidence from the recent history of the Spanish economy to support the proposition that the non-inflation accelerating rate of unemployment follows the actual unemployment rate. The implication of this hysteresis is that as the natural rate catches up to the actual rate of unemployment, the deflationary (inflationary) impact of a given gap between the two rates will disappear. The aggregate wage equation of the MIDE model does not directly determine wage growth or total employment income. Rather, the aggregate wage index is the primary explanatory variable in each of the sectoral wage equations. Sectoral wage levels also depend on sectoral productivity.

The second component of industry value added in the MIDE model is capital income. A large portion of capital income is net profits, which tends to be cyclically volatile. It also includes more stable items such as capital consumption, net interest payments by business, business transfer payments, and rental income (including the imputed rent from owner-occupied dwellings). The dependent variable of the sectoral profit equations is the ratio of gross capital income to wage income. In contrast to labor compensation, movements of capital income are not uniform across branches of activity. Moreover, the factors affecting profits vary across industries. There are, however, factors which should be important in every sector.

Profits are sensitive to demand changes and normally exhibit strongly pro-cyclical behavior. Therefore, the percentage change in output is included in each of the profit equations. Another explanatory factor significant in each sector is the real unit wage cost. When the wage per unit of output increases, the producer is often reluctant to pass the full amount of this increase into unit price increases. Instead, and for a time, he absorbs part of the increase by decreasing profit margins. Therefore, higher unit wage costs lead to lower profits in the short run. For industries open to substantial international competition, the price of competing imports is an important determinant of profits for domestic industries. Equations for these sectors, which include almost all of the manufacturing industries, include the ratio of import prices to the real unit wage cost index. (In these equations, the unit wage cost does not enter again as a separate variable.)

Net indirect production taxes by sector are computed using an exogenous rate on current-price sectoral output. The model calculates import taxes using the exogenous import ad-valorem tax rates multiplied by nominal imports. These rates are projected using historical trends and known information. The estimation of value added taxes requires a rather special treatment.

A macroeconomic, multisectoral model is an ideal tool to analyze the price and government revenue impacts of value added tax (VAT) rate changes. Such models not only compute the direct price impacts of the VAT, but also simulate the indirect effects on demand caused by the price impacts. VAT rates vary across products. Generally, necessary goods carry reduced rates, while luxuries bear augmented rates. More important, the incidence of the tax varies according to the type of transaction. To understand the modeling consequences of this fact, the working mechanism of the VAT requires explanation.[3]

All producers charge the VAT on the buyers of his goods or services, applying the applicable tax rate on the value of sales. A producer's tax liability is the difference between the tax collected on his final sales and the VAT paid on purchases of intermediate inputs and investment goods. In this way, the VAT paid at any stage of production is levied on the value added at that stage of production. No tax is applied to exports. Even though exporters do not collect VAT, they are still entitled to a full refund of the VAT paid on the intermediate products embodied in the exports. Tax collection comes to an end with the final consumer of a product. Since he does not collect VAT on a resale of the product, the final consumer has no way to deduct the VAT paid on his purchases and thus is the ultimate payer of the tax. In this pure version, the tax is consistent with the textbook view of the VAT as a tax on final consumption. However, various tax rules prevent some firms from deducting the entire amount of VAT paid on their inputs. In such cases, part of the current price intermediate purchases the VAT also becomes a tax on intermediate consumption.

An important incidence of nondeductible VAT occurs for firms and government agencies providing goods and services exempted from the VAT. Like the final consumer, these firms have no way to recover the VAT paid on intermediate purchases. The most important exemptions in the EC countries concern insurance, financial, health,

[3] This section borrows heavily from Bardozzi, et al. (1991). This paper provides a much more comprehensive discussion of the treatment of the Value Added Tax in a macroeconomic-multisectoral model of a European economy (Italy).

education and government services. The VAT also falls on intermediate purchases where rules limit the deduction of VAT paid on particular goods. These rules exist for fuels, passenger cars, restaurants and transportation services. Deduction on purchases of these goods is limited to prevent final consumption from being camouflaged as intermediate purchase or for revenue reasons.

The "impurities" in the VAT system introduced by exemptions and special rules are quite important and, as we shall see below, have a non-trivial impact on sectoral price formation. For now, we note that the MIDE model determines the sectoral VAT yield by multiplying exogenous VAT rates by the value of each transaction of the input-output table:

$$VAT_i = \sum_j t_{i,j} P_i a_{i,j} Q_j + t_{i,c} P_i C_i + t_{i,v} P_i V_i$$

where: VAT_i = the total VAT yield from producers of product i,

$a_{i,j}$ = the input-output coefficient for the amount of product i required for the production of one unit of product j,

$t_{i,j}$ = the effective tax rate on sales of product i to sector j,

P_i = the price index of sector i,

Q_j = output of sector j,

$t_{i,c}$ = tax rate on consumption of product i,

C_i = real private consumption of product i,

$t_{i,v}$ = tax rate on investment purchases of product i, and

V_i = real investment purchases of product i.

The tax rates $t_{i,j}$ and $t_{i,v}$ are non-zero for transactions where some of the VAT is nondeductible. The model's effective tax rates were determined by reconciling the rates and locations of the VAT mandated by the tax law with the sectoral current-price tax yields provided for 1986 and 1987 in the national accounts. The effective tax rates can be easily revised to assess the impacts of changes in the rates or the incidence of the VAT.

Wages, gross profits, net indirect production taxes and import taxes are summed to give total value added per industry. This quantity is transformed into the value added by unit of output by dividing it by the corresponding constant-price output computed in the production block. Sectoral producer prices are then calculated by use of the identity:

$$P_j = \sum_i d_{i,j} P_i (1 + t_{i,j}) + \sum_i m_{i,j} PM_i \ (1 + t_{i,j}) + v_j$$

where:

P_j	=	the domestic production prices of product *j*,
$d_{i,j}$	=	the input-output coefficient for row *i* and column *j* for domestically produced inputs,
$t_{i,j}$	=	the effective VAT rate on sales of product *i* to sector *j*,
$m_{i,j}$	=	the input-output coefficient or row *i* and column *j* for imported inputs,
PM_i	=	the price index of imports, inclusive of taxes, for product *i*,
v_j	=	the value added per unit of output in sector *j*.

Note that $d_{i,j} + m_{i,j} = a_{i,j}$, where $a_{i,j}$ is the total input-output coefficient. The division of the total coefficient between its domestic and import components depends on the ratio of the selling sector's imports to its output plus imports. This proportion will vary through time. If imports increase faster than output, then the share of the $m_{i,j}$'s will increase. Specifically:

$$m_{i,j,t} = \frac{m_{i,t}}{(q_{i,t} + m_{i,t})} \times a_{i,j,t}$$

where: $m_{i,t}$ = the imports of sector i at time t, and

$q_{i,t}$ = the output of sector i.

The price identity states that the producer's price is a weighted average of all intermediate input purchase prices, each of which is a weighted average of the domestic and import prices, plus a component for the amount of primary factor compensation per unit of output. This approach to price modeling is not based on a producer's objective function. Rather, the solution is interpreted from an economic point of view that the producer chooses a profit margin over unit costs. Changes in this "mark up" occur as modeled in the profit equations.

The prices are also determined with a Seidel iterative process. Since sectoral profits and taxes depend on the prices resulting from the above equation, another iterative loop is required in the price-income block. Once this system converges and the producer price vector is generated, MIDE determines a purchaser price for each sector as a mixture of foreign and domestic prices, with the proportions being determined by the shares of domestic and imported goods in interior consumption. This vector of mixed prices, $\mathbf{p_{mix}}$, is used to calculate private consumption and investment prices. For example, the prices of private consumption goods are computed through the consumption bridge matrix:

$$PC_j = \sum_i c_{i,j} PMX_i (1 + t_{i,c})$$

where: PC_j = the purchaser price of consumption good j,

$c_{i,j}$ = the consumption bridge matrix coefficient for production sector i and consumption good j,

PMX_i = the domestic-imported mixed price for production sector i, and

$t_{i,c}$ = the effective VAT rate on sales of product i to private consumption.

A summary of the components and influences of the price-income block is given by Table 4.2. As a prelude to the explanation of the accountant, Table 4.3 displays the macroeconomic identities of the production and price-income blocks. These identities comprise the connection between the sectoral level variables of the input-output accounts and the national account construction of GDP. In addition to the sum of sectoral value added, a final quantity is required to compute nominal GDP in the price-income block, the *Imputed production of banking services*. In the Standard European Accounts system, the difference between the interest received and the interest paid by the banking sector is considered as an intermediate goods purchase from the banking sector and not part of value added or GDP. In the input-output table, however, the specific purchasing industries are not identified in the banking row, so this amount ends up spread across gross profits for each industry. In order that sectoral value added sums to GDP, the total, termed Imputed production of banking services is deducted from the profits of the banking sector. Rather than attempting to model the banking profits net of this deduction, I compute it separately. A behavioral equation using lagged values of nominal interest rates and the real GDP as explanatory variables calculates the quantity. GDP represents the volume of the lending business and nominal interest rates reflect the profitability of that business.

Table 4.2: Components and Influences of Price-Income Block

Variable	No. eqs.	Influences
Aggregate labor compensation index index (wages per employee)	1	Lagged and current inflation Unemployment rate Natural rate of unemployment
Sectoral labor compensation index index (wages per employee)	43	Aggregate compensation index Sectoral productivity
Sectoral capital income		
Private sector (profit markup over labor cost)	40	Change in sectoral output Real labor costs per unit of output Import prices
Government sectors	3	Nominal sectoral output
Indirect business taxes minus subsidies	40	Nominal sectoral output Exogenous tax rates
Taxes on imports	33	Nominal imports Exogenous tax rates
Value added taxes	40	Nominal sales to intermediate and final demand Exogenous tax rates
Imputed production of banking services	1	Gross domestic product Lagged interest rates

Table 4.3: GDP Identities of the MIDE Model.

Production Block (Constant prices)

+	kcpn		Private national consumption
		kcpi	Private interior consumption (43)
		(kcftnr)	Private interior consumption by nonresidents (1)
		kcfer	Private consumption in the r.o.w. by residents (1)
+	kcp*		Government consumption (3)
+	kfbcf		Gross fixed capital formation
		kimo	Investment in machinery and other products (7)
		kimt	Investment in transport equipment (2)
		kiir	Residential construction (1)
		kioc	Nonresidential construction (1)
+	kve		Inventory change (25)
+	kx		Exports of goods, services, and nonresident consumption
		kxbs	Exports of goods, fob (25)
		kxs	Exports of services (8)
		kcftnr	Private interior consumption by non-residents
-	km		Imports of goods, services and resident consum. in r.o.w.
		kmb	Imports of goods, cif (25)
		kms	Imports of services (8)
		kcfer	Private consumption in the r.o.w. by residents
=	kpib		Gross domestic product

Price-Income Block (Current prices)

+	ra	Wages and salaries (43)
+	ebe	Gross profits (43)
+	tp_sub	Indirect taxes on production, net of subsidies (40)
+	tm	Import taxes (33)
+	iva	Value added taxes
-	pisb	Imputed production of the banking services (1)
=	pib	Gross domestic product
dpib = pib/kpib		GDP deflator

Notes: The variable names included in this and following tables are adapted from the Spanish titles. For example, pib stands for *Producto interior bruto* and fbcf stands for *Formación bruta de capital fijo*. A "k" preceding the variable name indicates the variable is in constant prices. Numbers in parentheses indicate the extent of disaggregation for the respective variable. An "*" denotes exogenous.

4.3 The Accountant

The role of the accountant is to determine the total disposable income of the nation from the nominal GDP, and distribute this income to households, corporations and government. The four major identities are displayed in Table 4.4. Several important macroeconomic quantities must be modelled at this stage, other variables are assumed exogenously. Table 4.5 identifies, and lists the influences on, each of the endogenous variables.[4]

The first identity is for the determination of Net national disposable income from Gross domestic product. To determine this quantity, we must model Capital consumption, deduct it from GDP, and add several exogenous international income flows. The second identity computes the Net household disposable income. This computation requires the modeling of net interest and dividend income, the calculation of several taxes from exogenously specified tax rates on gross income, and various exogenous transfer payments. The household disposable income then feeds back into the product block as an input into the determination of aggregate consumption. Household savings is then computed as the difference between income and consumption. The last two identities shown in Table 4.4 are for the Government surplus (deficit) and the Balance on the current account. These quantities are necessary for interest payments and interest rate equations. More importantly, as we shall see below, the current account balance becomes an important variable for judging the overall performance of the model.

[4] The accounting identities, and much of the data used for them, come from the work of Corrales and Taguas (1989). Several ideas for modeling the quantities were borrowed from the MOISEES model constructed at the Ministerio de Economía y Hacienda as described in Dirección General de Planificación (1990).

Table 4.4: Macroeconomic Identities of the Accountant.
(current prices)

1) Net national disposable income

+	pib	Gross domestic product
-	ccf	Total fixed capital consumption
	ccfe	Corporate fixed capital consumption
	ccff	Household fixed capital consumption
	ccfap	Government fixed capital consumption
+	subntrm (a)	Subsidies net of taxes received from the r.o.w.
+	ranrm	Net wages and salaries from the r.o.w.
+	rpnrm (b)	Net proprietor and corporate income from the r.o.w.
+	trnrm (c)	Other net current transfers from the r.o.w.
=	rnnd	Net national disposable income

2) Net household disposable income and savings

+	ebef	Gross proprietor profits
-	ccff	Household fixed capital consumption
+	ras	Wages and salaries
+	ranrm	Net wages and salaries from the r.o.w.
-	csf	Social security taxes paid from wages and salaries
+	rpnf	Net interest and dividend received by households
+	trnf (c)	Net other current transfers received by households
-	tdf	Direct taxes paid by households
+	ps (c)	Social security benefits paid by government
+	ops (c)	Other benefits paid by businesses
=	rndf	Household net disposable income
	/pcpn	Consumption deflator
=	krndf	Real household net disposable income
	-kcpn	Private national consumption in current prices
=	ksnf	Real net household savings

(a) - Variable completely exogenous to the model.
(b) - Variable is exogenous to the model, but dependent on exchange rates, which are also exogenous.
(c) - Variable exogenous in real terms, but nominal quantity is dependent on an appropriate endogenous deflator.

Table 4.4: Macroeconomic identities of the Accountant (continued).
(current prices)

3) Government deficit

+	tp_sub	Indirect taxes on production net of subsidies
+	iva	Value added taxes
+	tm	Import taxes
+	csap	Social security taxes received by the government
+	td	Direct taxes received by government
	tdf	Direct taxes paid by households
	tde	Direct taxes paid by corporations
+	intap	Net interest received by government
+	tynap (c)	Net other transfers and income received by government
-	ps (c)	Social security benefits paid by government
+	cin (c)	Current international cooperation
+	subntrm (a)	Subsidies net taxes received from the r.o.w.
=	rndap	Net disposable income of government
-	cp (c)	Government consumption
-	iap (c)	Government investment
+	ccfap	Government fixed capital consumption
-	ant (a)	Net asset purchases
+	trkap (c)	Net capital transfers to the government
+	tk	Taxes on capital
=	confap	Government surplus (deficit)

4) Balance of Payments - Current Account

+	x	Exports of goods, services, and nonresident consumption
-	m	Imports of goods, services, and resident cons. in the r.o.w.
+	ranrm	Net wages and salaries from the r.o.w.
+	rpnrm (b)	Net proprietor and corporate income from the r.o.w.
+	trnrm (c)	Net current transfers from the r.o.w.
+	subntrm (a)	Subsidies net of taxes received from the r.o.w.
=	socrm	Current account surplus (deficit)
+	trkrm (c)	Net capital transfers from the r.o.w.
=	confn	Net financing surplus (deficit)

Table 4.5: Influences on Endogenous Macroeconomic Variables of the Accountant.

Variable	Influences
Gross proprietor profits (ebef)	Total private sector gross profits (ebe)
Gross government profits (ebeap)	Equal to sum of public sector gross profits
Gross corporate profits (ebee)	ebee = ebe - ebef - ebeap
Total fixed capital consumption (ccf)	Depreciation computed for invest. eqs. inflated by invest. price
Household fixed capital cons. (ccff)	Total fixed capital consumption
Govt. fixed capital cons. (ccfap)	Equal to govt. gross profits (national account identity)
Corporate fixed capital cons. (ccfe)	ccfe = ccf - ccff - ccfap
Net wages & salaries from r.o.w. (ranrm)	Unemployment rate Exchange rate
Net interest & dividends received by households (rpnf)	Dist. lag on corporate after-tax net profits Dist. lag on real interest rate Dummy variable for financial deregulation
Direct taxes paid by households (tdf)	Taxable household income Unemployment rate
Direct taxes paid by corporations (tde)	Net corporate profits
Direct taxes received by government (td)	td = tdf + tde
Soc. sec. taxes rec. by the govt. (csap)	Total wages and salaries Exogenous tax rate
Pension contrib. rec. by corporations (cse)	Exogenous
Social security taxes & pension payments from wages and salaries (csf)	csf = csap + cse

Table 4.5: Influences on Endogenous Macroeconomic Variables of the Accountant (cont.)

Variable	Influences
Net interest paid by government (intap)	Accumulated govt. deficit times effective interest rate at time of deficit Distributed lag on interest rates
Taxes on capital (tk)	Current period nominal investment
Long-term interest rate (rlp)	M2 to nominal GDP ratio, current and one lagged period Weighted average of current and past inflation Current account deficit as percentage of nominal GDP Dummy variable for deregulation of capital markets

Due to the absence of homogenous historical interest rate series, the present version of MIDE contains only one interest rate variable. This variable is the long-term rate paid on the government debt. It was extended back from 1978 using the information provided by Baiges, et al. (1987). This rate is important in equations for consumption and income flows. The explanatory variables used in the behavior equation which projects the interest rate are shown in Table 4.5. The major influence in the equation is the level of the money supply relative to the nominal GDP. The level of the current account deficit relative to the GDP also has an important effect here.

It is useful to end this description of MIDE with a summary of the important characteristics and properties of the model. Specifically, the MIDE model contains:

1) An aggregate consumption function which smoothes the effects of changes in income. It also integrates a wealth effect designed to stifle demand during

periods of high inflation. Increases in unemployment also dampen demand.

2) Investment accelerator functions which respond to activity in the investing industries and relative investment to production prices. The investment functions also depend on monetary conditions. At a given money supply, periods of slack demand and low prices imply monetary ease and domestic demand is stimulated. High demand and high prices will encourage the opposite effect.

3) Export equations which depend on demand conditions in Spain's trading partner countries, relative prices and exchange rates. Similarly, the import functions depend on domestic demand and the relative price of imports to domestic production.

4) Sectoral potential output which is modeled with essentially exogenous productivity trends. Excessive growth in demand will drive up prices through labor costs if the productivity level is not adequate. Rising prices choke off demand.

5) A wage function which responds to recent inflation and the gap between unemployment and the "natural rate of unemployment".

6) Sectoral profit functions which respond to wage costs and, for tradeable goods industries, international prices and tariff rates. Therefore, domestic prices are sensitive to foreign competitive pressures.

Some of these points may not be completely clear after a first reading of this chapter. However, they are explained in detail in the following chapters. For now, an example of how these mechanisms work to stabilize the model is helpful.

Since Spain is an open economy with a substantial dependence on foreign trade, the import and export equations play a key role for in the model. In the first place, increases in domestic demand lead to higher prices by increasing wages and profit margins, resulting in increased imports both because of relatively high income elasticities of demand and lower relative import prices. This increased import penetration tends to moderate pressure on domestic manufacturers. Domestic inflation also decreases exports, which works to stabilize the demand and price increases. Decreasing domestic demand will have the opposite effect of stifling imports and increasing exports, stabilizing the economy. Therefore, attempts to stimulate or slow the economy through monetary or fiscal policies will have only limited effects. Because this phenomenon is so important in the workings of the model, I have not imposed an explicit balance of payments constraint on the model. On the other hand, the balance of payments as a percentage of GDP is often the first quantity to be examined in any given simulation of the model. If the model projects what appears to be an untenable balance of payments, this is taken as a signal that exogenous assumptions, such as exchange rates, money supply, and government consumption, or equation parameters need to be revised.

4.4 Criteria for Equation Specification and Evaluation of Econometric Results

In *A Guide to Econometrics,* Peter Kennedy (1985) states that the skill of the econometrician lies in the judicious combination of sensible economic theory as well as sound statistical methods. In the words of Malinvaud:

> The art of the econometrician consists in finding the set of assumptions which are both sufficiently specific and sufficiently realistic to allow him to take the best possible advantage of the data available to him (1966, p.524).

Moreover, the economic theory behind functional forms and the statistical procedures used to estimate these forms is influenced by the underlying rationale for performing the econometrics in the first place. For the MIDE model, the ultimate role of each individual behavioral equation is to provide an estimate of the dependent variable which will be used, in conjunction with other similarly estimated variables, in a highly detailed economic model. This special purpose gives rise to a methodology of equation specification and estimation which diverges in a number of ways from more traditional research. This section first provides a description of the criteria I used to formulate the equation specifications of the MIDE model. It then lists some criteria that I used to evaluate the econometric results of the equation estimations.

Five specific criteria guide the selection of functional forms. The first two considerations are practical ones. First, the equations must include only variables that are available from official sources or can be reasonably constructed from official data. Earlier in this chapter, we encountered situations where the lack of quality data dictated the structure of the MIDE model. We shall see further illustrations in following chapters. Secondly, the functional forms of the equations should be relatively easy to estimate given existing human and computer resources.

The third criterion is that the equations must contain properties which are consistent with the actual behavior within commodity markets and account for the most important influences on the dependent variable. Such factors may include distributed lags on explanatory variables, or factors exogenous to the entire model. To satisfy this criterion, it is neither necessary nor sufficient that a functional form used to predict economic quantities be directly derived from neoclassical optimization theory. The consumption and labor supply functions are not based on utility maximization of a "representative agent"; nor are industry production functions derived from profit maximization of a "representative firm."

This fact does not imply any contradiction with micro-maximizing behavior. Rather, it recognizes that the empirical implementation of strict microeconomic theory on an aggregate level can be unnecessarily restrictive. For example, in the case of consumption demand, Slutsky symmetry (i.e. the equivalence of compensated cross-price elasticities) generally does not aggregate over individuals with different incomes, different utility functions, and through time. Therefore, aggregate consumption equations fully consistent with microeconomic utility maximization need not satisfy Slutsky symmetry. In the case of firms, only rather complex maximizing problems can give the sort of distributed lags which we in fact observe at the aggregate level. The fact that the lag patterns used in the model cannot be derived from oversimplified functions does not make them inconsistent with maximizing behavior.

Also, data limitations sometimes require that behavior modeling be less grounded in theory than we might desire. For example, conventional theory and econometric practice often assign important roles to sectoral capital stocks for determination of investment, international trade, productivity or profits. However, the absence of such data for Spain restricts us to more *ad hoc* specifications that use other variables to detect the presence of capacity constraints. Finally, as mentioned in the previous chapter, the solution to the MIDE model is constructed under the assumption of relatively rigid markets in the short run, with adjustment to full employment equilibrium in the longer run. Therefore, functions derived from neo-classical general equilibrium theory may be inconsistent with the reality of an economy in disequilibrium.

The general framework and stability of the model is a fourth consideration for choosing explanatory variables for each equation. In forecasting, every explanatory variable must be produced by the model or specified exogenously. Therefore, exogenous variables which have a marginal effect on dependent variables are excluded if forecasting these variable themselves is difficult. One example of this consideration is the omission of a variable for sectoral unemployment for industry wage equations. While historic series for this variable are available and would undoubtedly contribute to the estimation of wages, forecasting sectoral unemployment into the future requires difficult assumptions about labor force mobility. On the other hand, estimated equations may include coefficients which are "insignificant" from a statistical point of view, but which are necessary to provide important interactions, consistent from a theoretical point of view, and important in the context of the overall model.

The fifth and final criterion is that the functional form must have desirable long-run properties. The concern for the long-run properties of the equations has led to the almost total exclusion of the use of the lagged dependent variable as an explanatory factor. The use of this technique is often justified by reference to distributed lags or adaptive expectations, or as an error correction device. The truth is that it works well because the lagged dependent variable has, of course, the same trend as the dependent variable itself. For long-term models, we are interested in explaining the trend, not temporary deviations from the trend. An equation using the lagged dependent variable will not capture the fundamental structural influences on the dependent variable and will predict poorly in the long run. Without the lagged dependent variable, there is often substantial autocorrelation of the residuals in the equation. More often than not, however, autocorrelation is because important explanatory variables are omitted for lack of data. Recognizing that this is the case, the autocorrelation coefficient is used as an error correction mechanism in making the forecasts for the first few periods.

The error correction mechanism used for most of the equations of the MIDE model is known as the "rho adjustment." In this technique, the predictions in the forecast period given by the equation is adjusted by the error in the last year of the estimation period multiplied by the autocorrelation coefficient raised to the power of the forecast period, i.e.:

$$
\begin{aligned}
y_1' &= y_1 + r_0 \times \rho \\
y_2' &= y_2 + r_0 \times \rho^2 \\
&\;\;\vdots \\
y_n' &= y_n + r_0 \times \rho^n
\end{aligned}
$$

where y_n' is the model's prediction in forecast period n, y_n is the equation's prediction, r_0 is the error in the last period of the fit, and ρ is the autocorrelation coefficient. This error correction mechanism is similar in spirit, but not equivalent in implementation, to the cointegration error correction technique currently in vogue (see Engle and Granger 1987). I made several attempts to use this mechanism in constructing the MIDE model, but eventually abandoned the approach. The rho adjustment is considerably easier to implement and has a much longer track record of successful use than the relatively new cointegration-error correction technique. More important, it does not require that data used by the equation possess the integration and cointegration properties needed to implement the cointegration technique (I will have more to say about this in the following chapter). In my experimentation with this new technique, I have found that it is often impossible to satisfy the integration properties when working with disaggregated data. Furthermore, if one simply assumes that the data satisfies the integration tests (as is common in the literature, see, for example, Andres et. al 1990), the equation results are often so poor and are unusable in a complete model. It was this final factor which persuaded me to stick with the rho-adjustment.

In summary, the behavioral equation specifications of the MIDE model are intended to satisfy five criteria: 1) they include variables for which data is easily obtainable, 2) they are relatively easy to estimate, 3) they are consistent with actual economic behavior, 4) they are consistent with the general framework underlying the entire model, and 5) they have desirable long-run properties.

A second set of criteria must be established for evaluating and accepting estimation results. In this work, we regard econometric techniques as simple tools used to construct crude approximations of complicated processes, rather than complex statistical processes used to prove or disprove simple hypotheses. The functional specifications are not regarded as "true" equations, and there is no attempts to acquire "efficient" estimates of parameters. The objective is to obtain parameters which depict plausible economic behavior, fit the historic data reasonably well, and produce equation properties which work together to yield a useful forecasting or policy analysis tool. Therefore, like the majority of those who have constructed large disaggregated macroeconomic models, I chiefly employ ordinary least squares or simple non-linear estimation techniques (see, for example, Barker and Peterson, page 88).

Nevertheless, the importance of including independent variables in any given equation can be judged using the traditional t-statistics. Preferable, however, is the "marginal explanatory value," or "mexval." This statistic reports the percentage increase in the standard error of the estimate if the independent variable was left out of the specification. As a rule, the mexval is correlated with the t-statistic, but since it does not depend on any underlying statistical assumptions, its use for evaluating the importance of independent variable is more reliable. Another useful statistic is the elasticity of the dependent variable with respect to the explanatory variable. This figure assists in judging the reasonableness of the magnitude of the parameter estimate.

Other considerations for evaluating econometric results include the stability of the parameters when estimated over different estimation periods, and the accuracy of out-of-sample predictions given by the parameters. Parameter estimates that are not robust may not be suitable for a five or ten year forecast. Moreover, drastic changes in parameter values between two estimation periods often indicate the presence of structural or behavioral change through time. Poor out-of-sample predictions can also signal structural change. The model builder must be aware of such change when constructing and implementing the model. In the building of MIDE, the examination of estimated equations with these criteria has been very important since the structure and behavior of the Spanish economy has changed significantly over the past four years.

Regression exercises often provide inappropriate parameter estimates for use in a long-term forecasting model. When unsatisfactory estimates occur, it may be required to use Bayesian techniques which combine apriori subjective knowledge about the economy with the quantitative data to determine parameters which work well in the general model. To attain more reasonable estimates I employ "soft constraints" on the parameter values. Instead of minimizing the sum of squared residuals, a linear combination of the sum of squared errors and the deviations from the constraint is minimized. Observations imposing the constraint are added to the data and integrated into the least squares process. These techniques are often called "stochastic constraints" or "Theil's mixed estimation" or "Bayesian regression." Soft constraints are used in two ways in the work: one forces a single parameter to approach an apriori value, the other is the Almon procedure for the estimation of polynomial distributed lags on the independent variables.[5] When soft constraints are used, the addition of observations makes the use of standard errors, t-statistics and mexvals for parameter estimates questionable and difficult to interpret. They are therefore not included in the displays of regression results when the technique has been used.

The econometric approach outlined above sacrifices the theoretical benefits of

[5] For a complete description of soft constraints, see Almon (1989), pages 107-116.

consistency and cross equation error information which can be obtained by using system estimators, such a Full Information Maximum Likelihood. One reason for this is that is often impractical to implement system estimation because of the computational expense involved. For instance, it is often required to re-examine the specification and estimation of a single equation which is producing bad results in the general model. System estimation, however, would require the re-estimation of the entire system of equations in these cases. Furthermore, sectoral level behavioral equations do not contain much of the simultaneity which characterizes macroeconomic functions. For example, in a macroeconomic model it may be unsatisfactory to regard output as an exogenous variable in an aggregate investment equation since it contains the investment explained. In a disaggregated model, however, the exogeneity assumption is appropriate, and the need for the use of instrumental variable regression techniques is reduced.

A final constraint which often limits the application of the most sophisticated econometric techniques is the quality of the data. Kennedy (1985) illustrates this point with a quote from Valavanis:

> Econometric theory is like an exquisitely balanced French recipe, spelling out precisely with how many turns to mix the sauce, how many carats of spice to add, and for how many milliseconds to bake the mixture at exactly 474 degrees of temperature. But when the statistical cook turns to raw material, he finds that hearts of cactus fruit are unavailable, so he substitutes chunks of cantaloupe; where the recipe calls for vermicelli he uses shredded wheat; and he substitutes green garment dye for curry, ping-pong balls for turtle's eggs, and, for Chalifougnac vintage 1883, a can of turpentine (1959, p.83).

Such problems are especially pervasive when working with disaggregated data. The Spanish economy data used for the construction of the MIDE model are derived from several different sources. Often, the sources use different collection methods and may use different industry definitions for the data. Moreover, time series presented by the same source can suffer ruptures in data definitions or coverage which makes the series heterogeneous across time.[6] In the following chapters, we will observe cases where the unfortunate quality or quantity of sectoral level data precludes the estimation of equations with good econometric properties. The application of more sophisticated techniques rarely, if ever, is a solution to these problems. Moreover, to bundle the bad data with good data in a full system estimation can compound the problems. Therefore, the reliance on simple, straightforward methods is justified, especially where they yield sensible economic properties with little computational expense.

A final, and most important consideration, underlies both the definitive selection of functional form and the acceptance of estimation results for each equation of the MIDE model: the simulation and forecasting performance of the equation once it is inserted into the model. Often, equations which are reasonable both theoretically and econometrically often combine in a model to produce an unstable model or unreasonable results. At this stage, the model builder must return to the proverbial drawing board to re-specify and re-estimate one equation, a whole set of equations or several sets of equations. This scenario occurred several times during the construction of MIDE. Finally, however, the equations specifications and parameter estimates fell into place to produce a solid simulation model. The next three chapters describe these equations.

[6] Details of sources and methods used for the compilation of the data base of the MIDE model are given in the Appendix.

CHAPTER 5:

EQUATION SPECIFICATION AND ESTIMATION:

CONSUMPTION AND FIXED INVESTMENT

5.1 Private Consumption

Private consumption expenditure constitutes the lion's share of demand for every economy. For the Spanish economy, it typically accounts for 60 to 70 percent of GDP. Thus, the determination of private consumption is the crucial part of a macroeconomic empirical model. For a disaggregated model, the commodity composition of private consumption also becomes very important. The MIDE model takes a two step approach. In the first step, it determines total Private national consumption as a function of income, wealth, unemployment and interest rates. To attain Private interior consumption, MIDE subtracts Exterior consumption by Spanish residents and adds Interior consumption by nonresidents from the national consumption figure. In the second step, a system of commodity demand equations allocates Private interior consumption among the 43 products enumerated in the 1980-based, national accounts classification.

This section will cover each of these stages in turn. The first task is to provide the specification and estimation for the aggregate consumption equation. (Chapter 6 covers behavioral equations for Exterior consumption by residents and Interior consumption by nonresidents.) The following pages describe the system and provide the results for the disaggregated consumption equations.

Aggregate Private National Consumption

Over the years, various forms of aggregate consumption equations have been posited and estimated. A simple Keynesian function, where consumption is dependent on disposable income, inspired the original equation forms. Later, more elaborate functions integrated the permanent income hypothesis of Friedman. These approaches use distributed lags of changes in income as well as the current level. Recent approaches have attempted to integrate wealth and/or inflation effects into the consumption function (see, for example, Holtham and Kato 1986). This approach was influenced by the observation that high inflation in the 1970’s tended to decrease the proportion of consumption to disposable income. There are several reasons that this may be so, but the most convincing is that inflation tends to devalue the stock of wealth and people increase savings in order to maintain their asset stock. Specifications intended to capture this effect have varied. Some have attempted to include variables for real wealth, others have included the inflation rate, while still others have included both variables.

Recent research on consumption in the Spanish economy, conducted for construction of the MOISEES model, is Andres et al. (1990 - henceforth Andres). Their functional form uses the cointegration error correction methodology pioneered by Engle and Granger (1987). In this type of equation estimation, the specification distinguishes between explanatory variables that have a permanent effect on the dependent variable and those which have a transient effect on the dependent variable. An explanatory variable is determined to have long-term equilibrium relationship if it is "cointegrated" with the dependent variable. Variables are cointegrated if 1) each is integrated with degree of one (i.e., their first difference is stationary) and 2) a linear combination of the variables (e.g., a regression equation) produces a stationary series. Andres, after a rather tortured sequence of increasingly complicated Dickey-Fuller tests, shows that the hypothesis of cointegration for Spanish series of aggregate consumption, disposable income and wealth cannot be rejected. (Wealth is the broad money supply (M4) plus the real stock of bonds held by consumers, deflated by the consumption deflator, plus the stock of real private capital.)

The consumption equation of the MOISEES model, therefore, postulates a long term relationship between consumption and disposable income and wealth. The final functional form is estimated for the first difference in the log of consumption. Andres integrates the long-term income-wealth relationship into the final functional form by including, as a right hand side variable, the lagged residuals of the double-log OLS equation of consumption on current income and wealth (the cointegration equation). This variable is called the error correction term.

The functional form, which does not include an intercept, also includes the lagged dependent variable and several "short run" variables. First, the change in the log of real disposable income enters the equation with a positive coefficient that is less than the long-run marginal propensity to consume. This magnitude of the coefficient reflects that increases in income do not translate immediately into an equal increase in consumption, but are partly absorbed by savings (the permanent income effect). The equation also includes the second difference in the log of real wealth and the second difference in the log of the inflation rate. The coefficient on the second variable is negative, suggesting, as reasoned above, that consumers increase their savings rate with higher inflation. It is not clear, however, why all three influences (real income, real wealth and inflation) are present in this equation. The consumption deflator already enters in the equation in the computation of real income and real wealth. The authors explain that it can be considered a further short-run "inflation tax" on income and wealth (Andres et al. 1990, pp. 8-9). Finally, the last variables in the equation, the second difference in the unemployment rate and the first difference of the real interest rate, display negative signs on the coefficients.

Based on sophisticated econometric theory, and currently quite fashionable, the cointegration approach is attractive. However, in the interest of simplicity, I have not adopted the approach here. For example, in the Andres paper, over 25 pages of regressions and statistical tests conclude that the hypothesis of cointegration among consumption, income and wealth cannot be rejected. Notably, it is difficult to show that the first difference of the consumption and income series are stationary, without segmenting the series into different periods. In other words, they accept their a-priori hypothesis that consumption depends on income and wealth because there is no statistical evidence to refute it. The current work, however, does not have the space to devote to an exercise that does not reject to a hypothesis that is not only an accepted pillar of economic theory, but self-evident. Moreover, I find the final equation of Andres very difficult to interpret. The inclusion of the error-correction term makes the derivation of the income and wealth elasticity on consumption a formidable task. I prefer a simpler equation that is easier to interpret. Autocorrelation problems can be avoided by differencing of variables, and error correction for forecasting can be handled by the simple rho adjustment described in the previous chapter.

The consumption function for the MIDE model conserves most of the influences of the MOISEES aggregate consumption equation. The functional form is:

$$\Delta \ln CPC_t = a\Delta \ln YPC_t + b\Delta \ln YPC_{t-1} + c\Delta \ln WPC_t + d\Delta \ln U_t + e\Delta \ln R_{t-1}$$

where: CPC_t = real private national consumption per capita in year t,

YPC_t = real household disposable income per capita,

WPC_t = real private wealth per capita,

U_t = the unemployment rate, and

R_t = the nominal interest rate.

The equation is estimated in per capita terms to factor out the increases in consumption which occur from population growth from those which result from increases in the other variables. Wealth is defined as the broad money supply (M4) deflated by the national consumption deflator, plus the real housing stock at beginning of the year times the relative price of residential construction to aggregate consumption. One advantage of using this definition of wealth in the consumption equation is that the money supply has a positive impact on aggregate demand in the model. This wealth definition differs from the Andres equation because it uses a narrower definition of capital stock and excludes bonds held by consumers. While the bonds are undoubtedly an important component of wealth, there is not much hope in projecting this quantity without a full blown financial submodel. The housing stock is multiplied by the relative price of residential construction in order to revalue the stock at current market prices. The equation also contains a dummy variable for 1976, also used by Andres, which accounts for a steep fall in consumption which cannot be explained by the included variables. Table 5.1 displays the estimation results.

The first equation of Table 5.1, estimated from 1967 through 1990, is the result included in the MIDE model. Since subsequent regression results will be presented with similar tables throughout this paper, a brief explanation of some of the terms is in order:[1]

SEE = Standard error of estimate (i.e., the square root of the average of the squared residuals).

[1] The table is adapted from results given by the G data base and regression program created by Almon (1989).

SEE+1	=	SEE for forecasts one period ahead using the rho adjustment.
MAPE	=	Mean absolute percentage error.
RSQ	=	R-squared, or the coefficient of multiple determination.
RBSQ	=	R-bar-squared, the R-squared adjusted for degrees of freedom.
RHO	=	Autocorrelation coefficient of the residuals.
DW	=	Durbin-Watson statistic.
Obser	=	Number of observations.
DoFree	=	Degrees of freedom.
Mexval	=	Marginal explanatory value: percent change in SEE if the variable was left out of the equation.
T-stat	=	Student t values.

Each coefficient has the expected sign and is of reasonable magnitude. One interesting result is that the lagged difference in the nominal interest rate performs better than the contemporary change under a variety of specifications and estimation periods. In contrast to Andres, however, the real interest rate could not enhance the fit of the equation and often displayed the wrong sign. Figure 5.1 illustrates the fit for the model's equation. Especially in the later years, the parameters capture the turning points of the differenced series quite well. From this graph, we can also note why Andres had such a difficult time in proving that the consumption series is stationary. Over this interval, the first difference of consumption certainly displays different means for the three different periods of the economy discussed in Chapter 2. Most of the other macro magnitudes of the Spanish economy display similar behavior.

The second equation displayed in Table 5.1 shows the same equation estimated from 1967 through 1986, with the out-of-sample predictive power tested through 1990. The standard error of the estimate and mean absolute value for the test period confirm that the equation predicts well. The specification is also robust. Parameter estimates for the income and wealth terms are similar in magnitude to the first equation. However, the coefficients

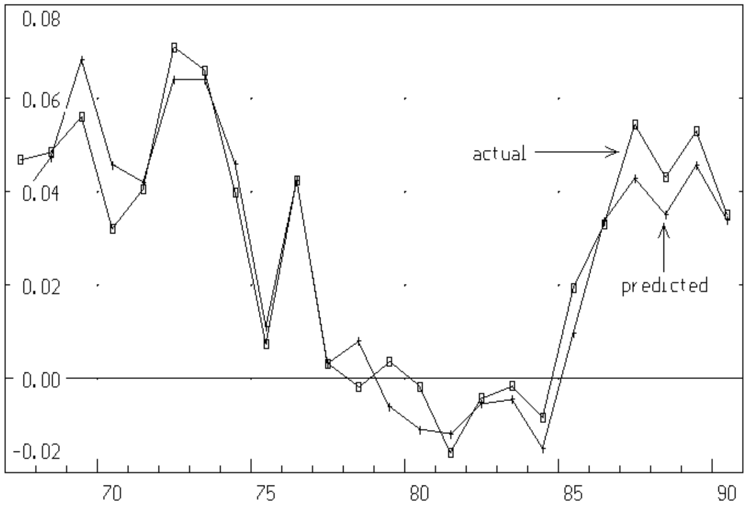
Table 5.1: Estimation Results for Private National Consumption

```
        Equation 1: 1967 - 1990, no inflation term
   SEE   =  0.00706    RSQ    = 0.9231    RHO    = 0.35
   SEE+1 =  0.00670    RBSQ   = 0.9018    DW     = 1.31
   MAPE  = 79.89       Obser  = 24        DoFree = 18
 Variable             Reg-Coef   Mexval   t-value     Mean
0 dlcpc              - - - - - - - - - - - - - -     0.0275
1 dlypc               0.43507     45.2     4.466     0.0243
2 dlypc(t-1)          0.21651     15.2     2.429     0.0246
3 dlwpc               0.25349     37.7     4.015     0.0529
4 dlunrat            -0.02815     10.6    -2.009     0.1091
5 dlr(t-1)           -0.05732     22.3    -2.986     0.0212
6 dum76               0.02659     23.4     3.065     0.0417


        Equation 2: 1967-1986, no inflation term,
                ex-post forecast to 1990.
   SEE   =  0.00650    RSQ    = 0.9379    RHO    = 0.25
   SEE+1 =  0.00643    RBSQ   = 0.9157    DW     = 1.50
   MAPE  = 85.25       Obser  = 20        DoFree = 15
   Test (1987-90):     SEE    = 0.01126   MAPE   = 19.12
 Variable             Reg-Coef    Mexval  t-value     Mean
0 dlcpc              - - - - - - - - - - - - - -     0.0237
1 dlypc               0.44953      33.0    3.280     0.0208
2 dlypc(t-1)          0.19237      15.5    2.159     0.0223
3 dlwpc               0.21729      24.8    2.794     0.0540
4 dlunrat            -0.01647       4.6   -1.148     0.1448
5 dlr(t-1)           -0.04251       6.3   -1.345     0.0238
6 dum76               0.02520      28.6    3.027     0.0500


        Equation 3: 1967-1990, with inflation term
   SEE   =  0.00641    RSQ    = 0.9367    RHO    = 0.10
   SEE+1 =  0.00638    RBSQ   = 0.9143    DW     = 1.81
   MAPE  = 87.44       Obser  = 24        DoFree = 17
 Variable             Reg-Coef   Mexval   t-value     Mean
0 dlcpc              - - - - - - - - - - - - - -     0.0275
1 dlypc               0.45734     56.9     4.986     0.0243
2 dlypc(t-1)          0.32093     26.8     3.221     0.0246
3 dlwpc               0.18206     18.3     2.606     0.0529
4 dlinfl             -0.01396     10.2    -1.906    -0.0050
5 dlunrat            -0.02026      6.2    -1.476     0.1091
6 dlr(t-1)           -0.05298     22.7    -2.931     0.0212
7 dum76               0.02885     31.5     3.523     0.0417
```

Figure 5.1: Real Private National Consumption Equation, 1967-90.
Actual vs. Predicted Values (change in logarithms).



on the unemployment and interest rate variables are significantly less powerful for this period. For the interest rate, this could be expected. Recent interest rate and retail banking deregulation have made consumer loans much more accessible and, therefore, consumption more sensitive to interest rates. The mean absolute percentage error (MAPE) for the test period also confirms that the equation is able to forecast this period.

Table 5.1 displays a third equation. The form of this equation includes the changes in the log of inflation, as in Andres. It's coefficient exhibits the correct sign. However, it does not add to the explanatory value of the equation. The major effect of including the inflation term is a decrease in the explanatory value of both unemployment and the interest rate. This is undoubtedly attributable to multicollinearity among inflation, unemployment and the nominal interest rate. Since, inflation already influences consumption through the real income, real wealth and nominal interest rates terms I do not incorporate it in the final model equation.

An Equation System for Consumption by Commodity Categories [2]

In order to compute the commodity composition of aggregate consumption, MIDE employs a system of estimated consumption equations. As with aggregate consumption, the specification and estimation of such econometric consumption "systems" is an area of abundant research activity.[3] A system utilized in a forecasting model should exhibit several features which reflect the behavior of real-world commodity markets and confer reasonable long-term properties. Specifically, the functional form used for the present model is designed to meet the following criteria:

1. It is capable of expressing either substitution or complementarity between goods. Moreover, it permits goods with close substitutes to have high price elasticities and goods with no substitutes to have low price elasticities.

2. It is homogeneous of degree zero in income and prices.

3. The sum of consumption of all the goods is equal to total consumption.

4. Price elasticities are independent of the level of income. Therefore, the consumption equations cannot be additive functions of prices and income, for this implies that as income increases, price elasticities would decrease, an implausible result.

5. As income rises, the budget shares of individual commodities must converge to values between zero and one (i.e., the system should be stable).

6. The marginal propensities to consume out of income is different for different goods. Furthermore, these propensities, and the asymptotic values of the budget shares should be allowed to depend on prices.

---

[2] The functional form used for the MIDE consumption system is an adaptation of a nonlinear functional form developed by Almon (1979). The following discussion of the properties of consumption functions in general, and the Almon system in particular, borrows heavily from that work.

[3] For general surveys of this literature see Guayacq (1985), Brown and Deaton (1972) and Barten (1977). Lorenzo (1987 and 1988) offers another survey which estimates three popular systems for the Spanish economy using four categories of goods.

Finally, the magnitude of the price dependence should be able to be estimated, not imposed by the functional form.

7. Non-price and non-income variables can be easily included in the function, and, as with income, the impacts of these variables should be dependent on prices. Moreover, price changes should alter the effects of income and non-income determinants in approximately equal proportions.

8. The number of parameters in the system is not so vast that they cannot be estimated given the number of observations, and, furthermore, the parameters are relatively easy to estimate. Although aggregate market demand need not satisfy Slutsky symmetry, assuming that it holds in the base year allows one to reduce the amount of parameters to estimate.

To attain these properties, the parameters for each of the consumption equations must be estimated together in an integrated system of nonlinear functions. Almon (1979) introduced the following system:

$$CPI_{i,t} = [a_i + b_i T_t + c_i(Y_t/P_t) + d_i \Delta(Y_t/P_t)] \times \prod_k P_{k,t}^{e_{i,k}}$$

where: $CPI_{i,t}$ = the constant-price, per capita consumption expenditures for commodity i in time t,

T_t = a time trend term or other relevant variables,

Y_t = the total, per capita nominal private consumption,

$p_{k,t}$ = the nominal price index for commodity k, and

P_t = $\prod_k p_{k,t}\ s_{k,o}$, where $s_{k,o}$ equals the budget shares in the base year, where all prices are equal to one.

Essentially, the function is a linear term in total expenditure and other variables, multiplied by a product of prices raised to various powers. The a_i, b_i, c_i, d_i and $e_{i,k}$'s are the parameters for each equation. The specification of separate own and cross price elasticities ($e_{i,k}$) for each of the commodities fulfills requirement 1. While it will be necessary to reduce the number of these parameters in the actual estimation, the desired properties will be preserved. The following restrictions are imposed on the parameters:

$\sum_{k=1}^{n} e_{i,k} = 0$ to give homogeneity of degree zero in total expenditure and prices, i.e., requirement 2, and

$\sum_{i=1}^{n} c_i = 1$ to give constant-price adding-up, at constant relative prices.

The individual marginal propensities to consume out of total expenditure ($\delta CPI_i / \delta(Y/P)$) depend on prices (a point we shall come back to in a moment). This implies that, if relative prices change, the second of the above restrictions cannot (and surely will not) guarantee that the individual quantities add up to aggregate consumption. To overcome this violation of property 3, the MIDE model allocates the difference between total expenditure and the sum of individual predictions across the consumption categories by the use of a "spreader" term. Since the c_i's represent the marginal propensities to consume out of total expenditure in the base year, and sum to one as required by the scaling procedure, they are the spreader weights. It will be shown below that the amount allocated is quite small.

The strength of this functional form is the multiplicative relation between the linear term of the equation and prices. This type of form is superior to both linear and double log (constant elasticity) forms. First of all, the form imposes a constant price elasticity regardless of the level of total expenditure. For example, if the own-price elasticity is -1.0, then a 5 percent increase in the relative price of a commodity leads to a 5 percent decrease in consumption *at any level total expenditure.* This property satisfies requirement 4. A system linear in price results in a falling price elasticity as demand increases over time, an implausible property that is especially undesirable for long term economic modeling.

On the other hand, a strictly logarithmic function imposes constant elasticities on both price and demand. In this case, if the income elasticity was greater than one, then expenditures for individual goods would eventually exceed total income. In this specification, as in a strictly linear function, the marginal propensity to consume the good out of total expenditure remains constant for any level of expenditure. As long as that quantity is below one, and practice has shown that the expenditure elasticity must be quite high before it exceeds one, we can be assured the system is stable, fulfilling requirement 5. On the other hand, the nonlinear formulation makes the marginal propensities to consume, and therefore, the budget shares, depend on relative prices *in a way that can be estimated*, providing the final properties under requirement 6.

It is precisely under these criteria (5 and 6) that other, more popular, equation systems flounder. One example is "Almost Ideal Demand System" (AIDS) system of Deaton and Muellbauer (1980). The estimation of this system invariably boils down to a double log function of the budget share on relative prices and income. Since the elasticity of the budget share with respect to income will be constant in such a system, it is probable that predicted budget shares could exceed one (or fall to less than zero, since some of the coefficients must be negative). This would be a particularly treacherous feature for multisectoral modeling. Another popular formulation is the Rotterdam system of Barten (1967) and Theil (1967), which is used in the estimation of the HERMES models (Dones et al. 1990). This system assures adding-up for each year regardless of relative price changes. However, it accomplishes the adding-up by imposing, through the functional form, a value for the price elasticity of the marginal propensity to consume out of expenditure. For a description of this point see Almon (1979). The Almon form, in contrast, sacrifices adding up to allow the estimation procedure to choose the price elasticity of the marginal propensity to consume out of income, rather than solving for it by hypothesis.

The linear term of the Almon equation can easily accept other explanatory variables. Besides per capita total interior consumption, the MIDE model form includes a constant, a time trend, and the first difference in total consumption as independent variables. The time variable accounts for changes in trends, such as in tastes or the age composition of the population, which cannot easily be modeled without additional data. The change in aggregate expenditure term represents the change in total income, included to account for incomplete consumption adjustments to income level. The coefficient on this variable could have either sign, depending on the nature of the product. For most commodities it would be expected to be negative. If income, and therefore total consumption, rises sharply, the expenditure term predicts an immediate adjustment in demand for each good to the new income level. However, in the first period, at least, a portion of the income increase would be perceived by consumers as transitory. Therefore, a negative sign on the change in consumption partially offsets the increase in predicted consumption due to the increased level of income, reflecting consumption smoothing behavior. For other commodities, such as consumer durables, the coefficient is positive to reflect a splurging effect when income increases sharply. As with the total expenditure term, the influence of these variables is affected by relative prices in identical proportions. This is requirement 7.

The form calls for an enormous number of parameters which easily exceed the number of observations. To reduce the present theoretical system to one that can be estimated, two modifications are made. The first is to impose symmetry in the base year, reducing the price parameters by half. Slutsky symmetry states that the income-compensated, cross-price elasticities for any two products are equal. In the base year, the compensated cross-price derivative is:

$$(\delta q_i \,/\, \delta p_j)^o_{compensated} \;=\; e_{i,j}\; q^o_i \,/\, p^o_j \;.$$

Symmetry implies that:

$$e_{i,j}\;(q^o_i \,/\, p^o_j) \;=\; e_{j,i}\;(q^o_j \,/\, p^o_i) \;.$$

Rearranging the terms:

$$e_{i,j} \,/\, e_{j,i} \;=\; q^o_j\, p^o_j \,/\, q^o_i\, p^o_i \;=\; s^o_j \,/\, s^o_i \;\; \text{and, therefore,}$$

$$e_{i,j} \,/\, s^o_j \;=\; e_{j,i} \,/ s^o_i \,,$$

where the s^o_i's are budget shares in the base year. Now, if $\sigma_{i,j} = e_{i,j} / s^o_j$, then $\sigma_{i,j} = \sigma_{j,i}$. The $\sigma_{i,j}$s become the parameters of the equations so symmetry can be easily imposed.

A second way to reduce the number of parameters to be estimated is by segregating groups and subgroups of related commodities and impose the restrictions that the σ's be equal between all goods within the same group or subgroup. Furthermore, the σ's between goods not in the same group will also be equal, but different from the group σ's. The division of commodities into specific groups and subgroups is based on common-sense knowledge of the relations between various commodities. Assumptions of complementarity and substitutability between goods play a role in the selections. Table 5.3 shows the grouping selected. For example, Expenditures for private use of vehicles and Vehicle purchases, which are presumed to be complements, reside in the same "Private transportation" subgroup. Therefore, there is a unique subgroup σ, which expresses the price relationship between these two commodities. They are also in the "Transportation" group. This grouping implies that Expenditures for private use of vehicles and Vehicle purchases are assigned the same group σ, and are therefore are equally substitutable with, Transportation services, the only other product in the group. Finally, all three commodities are equally, and relatively weakly, substitutable with all unrelated goods within other groups. This becomes clearer by examining the form of the estimated equation for a commodity in group G (composed of subgroups A and B) and subgroup A:[4]

$$CPI_{i,t} = [a_i + b_i T_t + c_i Y_t/P_t + d_i \Delta Y_t/P_t] \times (p_{i,t}/p_{A,t})^{\sigma_A} \times (p_{i,t}/p_{G,t})^{\sigma_G} \times (p_i/P_t)^{\sigma_O}$$

where:

$$p_A = (\prod_{j \in A} p_j\ s_j{}^o)^{\frac{1}{s_A}}, \quad s_A = \sum_{j \in A} s_j{}^o$$

$$p_G = (\prod_{j \in G} p_j\ s_j{}^o)^{\frac{1}{s_G}}, \quad s_G = \sum_{j \in G} s_j{}^o$$

$$\sigma_A = s_A(\sigma_A - \sigma_G)$$

$$\sigma_G = s_G(\sigma_G - \sigma_O)$$

For a product belonging to subgroup B, the *A*'s would be replaced by *B*'s. For products which belong only to a group, and not an additional subgroup, the first price term referring to subgroup A is not included. It is the group and the subgroup σ's, and the individual a_i's, b_i's, c_i's and d_i's which are estimated. σ_o is the same for each product; σ'_G is the same for each product in group G; σ'_A is the same for each product in subgroup A. If a σ' is positive, then the goods it relates are substitutes; if negative, complements.

The price of a product influences the demand for another product through its impact on the relevant price indices, and that this impact is proportional to its budget share. For instance, if product *i* and *j* are in the same subgroup, a change in the price of *j* influences

[4] For a complete description of the simplification, see Almon (1979), pages 107-116.

Table 5.2: Income-Compensated Price Elasticity Formulae
for the Almon Consumption System

η_{ij} = elasticity of demand for good *i* with respect to price *j*

For *i* in subgroup *A* and in group *G*:

$$\eta_{ii} = -\sigma'_A (1 - s^o_i / s_A) - \sigma'_G (1 - s^o_i / s_G) - \sigma_o (1 - s^o_i)$$

$$\eta_{ij} = \sigma'_A (s^o_j / s_A) + \sigma'_G (s^o_j / s_G) + \sigma_o s^o_j \quad \text{for } j \in A, j \neq i$$

$$\eta_{ij} = \sigma'_G (s^o_j / s_G) + \sigma_o s^o_j \quad \text{for } j \in G, j \notin A$$

$$\eta_{ij} = \sigma_o s^o_j \quad \text{for } j \notin G$$

For *i* in group *G*, but not in any subgroup:

$$\eta_{ii} = -\sigma'_G (1 - s^o_i / s_G) - \sigma_o (1 - s^o_i)$$

$$\eta_{ij} = \sigma'_G (s^o_j / s_G) + \sigma_o s^o_j \quad \text{for } j \in G, j \neq i$$

$$\eta_{ij} = \sigma_o s^o_j \quad \text{for } j \notin G$$

demand for *i* through all three price terms p_A, p_G, and *P*, and therefore through each of the three σ's. The strength of the different effects are proportional to the budget shares of *j* in each of the price indices. Additionally, if product *k* was also in this subgroup, a change in the price of *j* would affect demand of *k* by the same percentage that it affects demand for *i*. If *j* was in a different group than *i*, a change in the price of *j* would alter demand of *i* only through *P* and the parameter σ_o. Moreover, this cross-price effect, which is proportional to the budget share of *j* in *P*, is equivalent for all goods which are not in *j*'s group. Therefore, quantifying the actual own and cross-price elasticities from the estimated σ's requires specific transformations of these parameters. A careful examination of these transformations, displayed in Table 5.2, should clarify the above discussion.

Estimation of the System for Spain

The dependent variable for the regressions is per capita interior consumption of each of the 43 commodity categories in 1980 prices, for the years 1964 through 1989. Since disaggregated consumption data for 1964 through 1979 is published for private national consumption, and then for only 31 products, the actual data used here was constructed as described in Sanz (1989) and in the Appendix. While the commodity definitions were the same for the years 1980 through 1989, the data was homogenized to the 1980 based national accounts. Data was available in current and constant prices; price indices were constructed from the ratio of the two. Current price total expenditure is the sum of the commodity consumption. It is divided by population and deflated using the general interior consumption price index to yield per capita constant-price total Private interior consumption.

For most of the commodities, expenditure elasticities estimates come from the regression of cross-section data from the 1980-81 Household Budget Survey (Encuesta de Presupuestos Familiares), published by the Instituto Nacional de Estadística (1983). This survey of consumption provides data by commodity and income class. The elasticity is estimated by regressing the logarithm of per capita consumption of each commodity on the logarithm of total per capita consumption for each decile of income level. The independent variable is total per capita consumption for it better reflects permanent income for a particular year. For the detailed food categories, the *Encuesta* did not contain decile level of consumption. Expenditure elasticity estimates for these goods were taken from Moltó, et al. (1989). This work estimated elasticities using individual household observations from the survey which produced the *Encuesta*. To be consistent with the adding up constraint, the total expenditure elasticity estimates were scaled so their weighted average, using the base year budget shares, is equal to one in that year (1980). They were then converted to linear coefficients at the expenditure levels of the last year of the data. These coefficients become the c_i's in the time series equation.

One influence on consumption not accounted for in the functional form outlined above is the influence of financial conditions. While for most goods interest rates probably have little influence, for some, such as expenditures on motor vehicles, it is important. Interest rates are easily inserted in the linear term of the equation. However, because there is a high degree of collinearity between the two variables, it is preferable to replace the time trend with the interest rate variable. Initially, the interest rate was included in all the equations for durable goods. However, Motor vehicles is the only commodity for which the coefficient was both significant and displayed the proper sign. In the results presented below, only this equation includes the interest rate.

In two other cases, dummy variables replace the time trend. The first case of this occurs with Alcoholic beverages (Commodity 12). This dummy assumes the value of 0.0 from 1964 through 1974 and 1.0 for the rest of the years. It accounts for problems with the data. In the second case, retail financial market reforms have evidently decreased, dramatically, expenditure for Financial services (41). The equation requires a dummy to capture this effect. To represent the progressionary nature of these reforms the dummy is .5 for 1981, .75 in 1982 and 1.0 for each subsequent year.

To perform the estimation, a σ_o was chosen and used for all the groups. Each group of equations was estimated concurrently in order to impose the equality constraints for the group σ's. The nonlinear estimation is done iteratively using the Taylor series linearization of the demand function. The initial expansion values for the coefficients are the ordinary least squares estimates computed when the group σ's equal zero. In each case, three or four iterations were required before the sum of squared errors fell by less than one percent. Then another σ_o was selected and the process repeated.

The different values of σ_o attempted were .09, .1, .3, .5 and .7. The final choice of σ_o depended on a combination of evaluating the reasonableness of the parameters and the fit of the equations. The value of .3 was chosen under this criterion. Several of the group price elasticities are the result of softly constraining the σ parameters to take on feasible values while trading off some of the fit. In the Household expenditure group, for example, unconstrained regression produced positive own price elasticities for four of the five commodities, and the group elasticities displayed strong complementarity. In addition to conflicting with a-priori views for these parameters, the inclusion of such values in a larger model could make that model unstable. Therefore, the group σ was softly constrained to the value of .3. This was sufficient to produce reasonable parameters. The results for all the commodities are presented in Table 5.3.

Each row of the table displays the commodity number, subgroup number and title for each of the goods. We find subgroups only in the food, household operation, and transport groups. The first column after the title is the total expenditure elasticity. The second column displays the coefficient on time (or the dummy where applicable) as a percent of the actual per capita consumption in the last period, except for Motor vehicles where it displays the elasticity of per capita expenditure with respect to interest rates, evaluated at the mean values of the variables. The next four columns contain price elasticities. The first contains the own price elasticities, which are always negative. The second price parameter is the group elasticity, which indicates the percentage effect on the demand for other products in the same group, but not the same subgroup if this is relevant, if the price of that product

Table 5.3: Summary of Commodity Consumption Equations

No.	SG	Type of Good	Expend. Elast.	Time in % last yr.	Price elasticities Own	Group	Subgrp	Genrl	mape	rsq	rho
		Group 1: Food, Beverages and Tobacco									
1	10	Bread and cereals	0.17	0.1	-.269	-.002	.024	.009	1.7	.46	.32
2	9	Meat	0.59	-0.1	-.241	-.006	.039	.022	4.5	.88	.79
3	9	Fish	0.78	0.2	-.265	-.002	.015	.009	3.0	.67	.41
4	9	Milk, cheese & eggs	0.47	-0.1	-.260	-.003	.020	.011	2.8	.95	.69
5	10	Oils and fats	0.78	-0.4	-.282	-.001	.011	.004	2.6	.34	.64
6	10	Fruits & vegetables	0.78	0.2	-.258	-.003	.035	.013	3.3	.47	.75
7	10	Potatoes & oth. tubers	0.78	0.1	-.288	.000	.005	.002	6.3	.27	.72
8	10	Sugar	0.16	-0.4	-.291	.000	.002	.001	3.5	.79	.74
9	10	Coffee, tea & cocoa	0.39	-0.6	-.287	-.001	.006	.002	6.1	.49	.74
10		Oth. food products	1.25	0.1	-.287	-.001	.006	.002	4.6	.81	.85
11		Non-alcoholic bever.	0.78	0.3	-.270	.000	.025	.001	5.6	.56	.76
12	11	Alcoholic beverages	0.78	-0.4(a)	-.222	-.001	.073	.004	5.7	.34	.85
13		Tobacco products	0.78	-0.3	-.197	-.001		.003	3.8	.94	.76
	(a) Statistic is for dummy coefficient = 1 for 1975-89, 0 otherwise.										
		Group 2: Personal goods and services									
14		Clothing	1.57	0.0	-.211	-.075		.018	1.6	.95	.35
15		Shoes	1.25	-0.3	-.159	-.024		.006	5.3	.73	.77
37		Personal care prod.	0.78	-0.2	-.152	-.017		.004	3.1	.98	.54
38		Oth. articles n.e.c.	1.25	-0.4	-.153	-.017		.004	3.9	.95	.55
		Group 3: Household expenditures									
16	12	Rents & water	0.63	-0.6	-.178	-.124	-.200	.042	2.7	.98	.50
17	12	Heat & light	0.63	-0.1	-.011	-.021	-.034	.007	4.2	.97	.84
22	13	Maint. goods & serv.	0.63	0.3	-.341	-.013	.344	.004	7.0	.73	.91
23	13	Domestic services	1.57	0.0	-.432	-.009	.253	.003	4.1	.74	.69
32		Communications	1.57	0.1	-.074	-.007		.003	15.4	.90	.93
		Group 4: Household durable goods									
18		Furniture	1.88	-0.6	-.701	.165		.007	5.5	.70	.82
19		Household textiles	1.17	0.7	-.786	.080		.003	2.4	.92	.40
20		Domestic appliances	1.72	1.0	-.770	.095		.004	5.4	.82	.59
21		Domestic utensils	1.57	-0.3	-.812	.054		.002	3.8	.88	.62
33		Entertainment goods	1.88	0.3	-.671	.195		.008	2.6	.97	.25

Table 5.3: Summary of Commodity Consumption Equations (cont.)

No.	SG	Type of Good	Expend. Elast.	Time in % last yr.	Price elasticities Own	Group	Subgrp	Genrl	mape	rsq	rho
		Group 5: Health and Medical Expenditures									
24		Drugs	1.25	0.1	-.410	.102		.005	11.7	.64	.91
25		Therapeutic apparatus	1.46	-0.7	-.501	.012		.001	7.3	.76	.72
26		Prof. medical serv.	1.64	0.0	-.451	.062		.003	4.3	.95	.64
27		Hospital services	2.30	-0.5	-.481	.031		.002	5.3	.91	.75
28		Priv. medic. insurance	1.73	-0.1	-.495	.017		.001	3.6	.94	.64
		Group 6: Transportation									
29	14	Motor vehicles	1.57	-.245(b)	-.272	.034	-.006	.009	11.0	.92	.71
30	14	Vehicle expenses	1.00	0.0	-.279	.080	-.013	.022	3.7	.99	.82
31		Transport services	1.58	0.1	-.376	.023		.006	5.5	.91	.87
		(b) Statistic is interest elasticity at average expenditure and interest rate.									
		Group 7: Educational goods									
35		Books & periodicals	1.78	-0.8	-.221	-.027		.002	3.1	.92	.36
36		Education	1.57	-0.1	-.266	-.071		.006	3.4	.84	.82
		Group 8: Other Services									
34		Entertainment serv.	1.88	-0.4	-.547	.034		.005	3.4	.92	.70
39		Restaurants & hotels	0.63	0.3	-.337	.244		.034	4.7	.95	.83
40		Travel services	0.63	0.2	-.577	.004		.001	13.3	.71	.92
41		Financial services	2.82	-2.0(c)	-.561	.020		.003	6.7	.93	.32
42		Other services	0.78	-0.2	-.576	.006		.001	7.4	.95	.80
43		Oth. expend., n.e.c.	2.25	-0.4	-.563	.019		.003	19.3	.71	.92
		(c) Statistic is for dummy coefficient = .5 for 1981, .75 for 82, 1 for 83-89, 0 otherwise.									

increases by one percent. The subgroup elasticity shows the same cross-price effect within a good's subgroup. Finally, the general price elasticities show the impact of a price increase for the product on the demand for all products outside the product's group. A positive value for a cross price elasticity signifies that the products which it relates are substitutes, a negative value indicates complements. The last three columns exhibit the mean absolute percentage errors, the R-squares and rhos (autocorrelation coefficients) for each equation.

In general, the parameters exhibit reasonable values and the fits of the equations are satisfactory. Low values for the time trend parameter suggest that the income and price variables provide most of the explanatory power in the equations. The magnitudes of the own price elasticities are sensible. Necessities, such as food, rent, heat and light, and those with no close substitutes, such as education and clothing, have relatively low own-price elasticities. Durable goods, luxuries and items with close substitutes have higher own-price elasticities. An exception is the purchase of Motor vehicles (Commodity 29) which has a relatively low own-price elasticity.

The values for cross-price elasticities are small. Within most of the groups and subgroups, the products are substitutes. The exceptions are the Food and Education groups and the Private transportation subgroup. This result in the food group indicates that Meat, Fish and Milk products (Commodities 2-4) are substitutes for each other, but complements with all the other food categories. The same is true with all other foods and beverages. The general cross-price elasticities suggest weak substitutability between products not contained in the same group.

Many of the low R-squares for particular sectors result from data limitations rather than problems with the method. For example, the series for Potatoes and other tubers (Commodity 7) was separated from Fruits and vegetables (6) for the period previous to

1980. Apparently, these two series behaved quite differently during the income boom of the 60's and early 70's, but there is not enough information to capture these characteristics in the regressions. While the Potatoes series would fit better with a much larger income elasticity, it would not be realistic.

Figure 5.2 exhibits equations plots for some of the more important products. The □'s represent the actual values and the +'s represent equation-predicted consumption. The figures are for billions of pesetas in 1980 prices. The first plot displays the sum of all the predicted values versus the actual total interior consumption. The striking behavior exhibited by the actual series is one of very high growth through the early 1970's, progressively moderating growth through the late 70's, almost no growth through 1984, and finally a resumption of growth in 1985. The higher growth continued through 1989. Most of the individual series, especially those for durable goods, display this behavior. It is clear that the estimated total expenditures are very close to the actual expenditure. This is a result of the adding-up constraint. For individual commodities, however, the results are mixed.

For example, while the fit for Meat products (Commodity 2 - Figure 5.2) is satisfactory, that for Fish products (3), a very volatile series, is not. This product could use a much higher own price elasticity, but the ability to specify a different one is limited by the estimation scheme. The plots for Furniture (18), Domestic appliances (20) and Motor vehicles (29) show that the equations do capture the cyclical movements in demand. Equations predictions for several of the largest expenditure components, such as Clothing (14), Rents (16), and Vehicle expenses (30) are encouraging. However, the equations for Motor vehicles (29) and Restaurants and hotels (39), while generally displaying satisfactory fits, have missed recent growth.

Figure 5.2: Regression Fits for Commodity Consumption Equations.
Predicted (+) and Actual (□) (Billions of pesetas, 1980 prices).

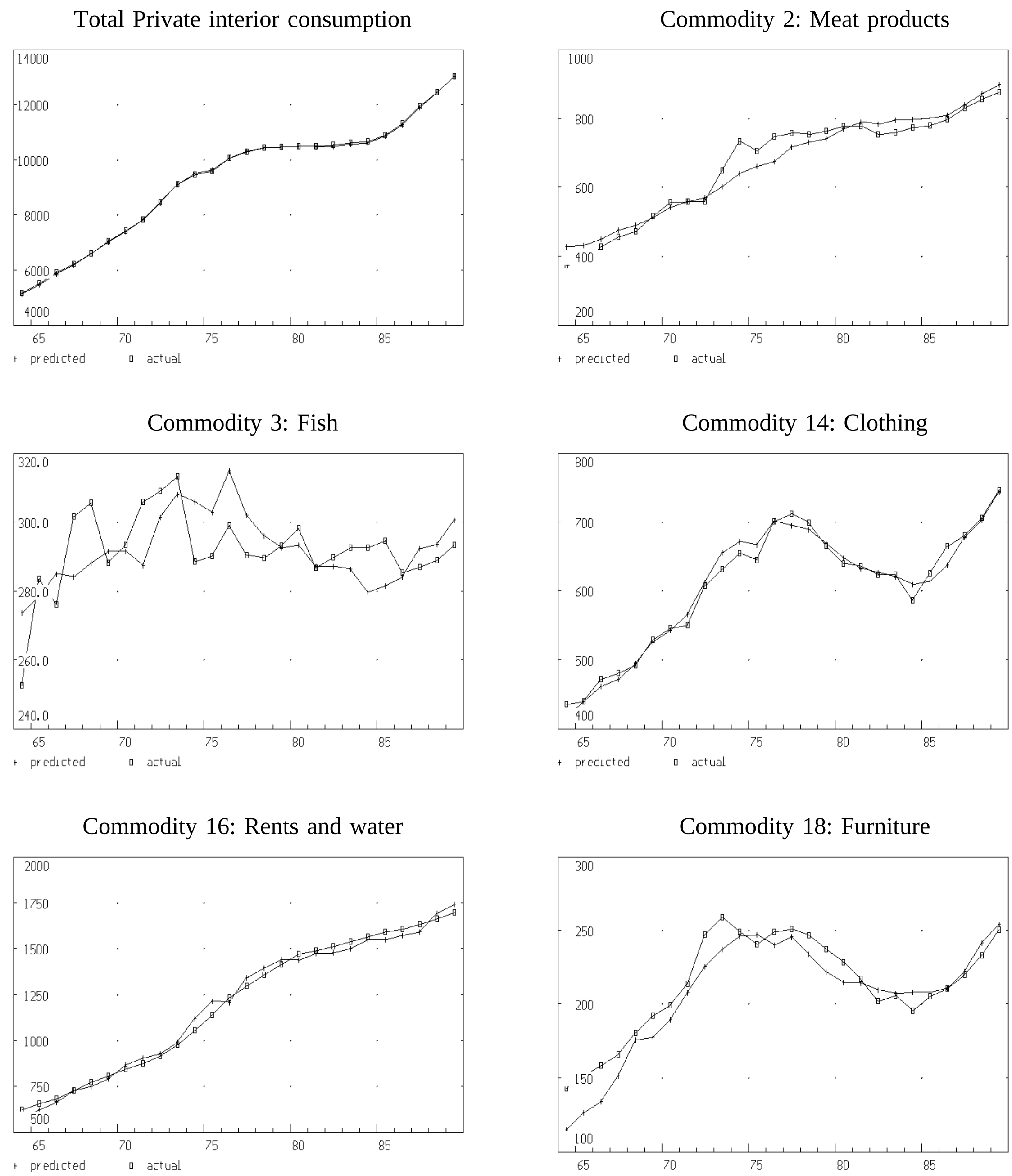
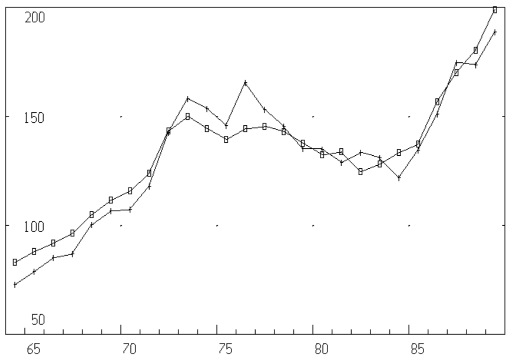
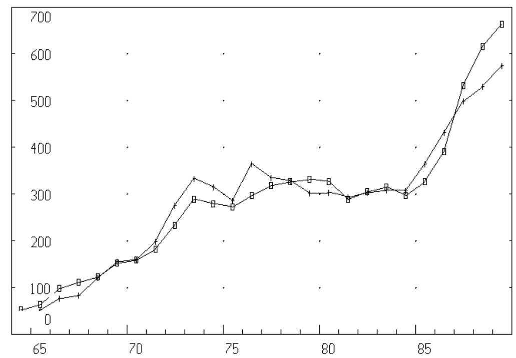


Figure 5.2: Regression Fits for Commodity Consumption Equations (cont.) Predicted (+) and Actual (□) (Billions of pesetas, 1980 prices).

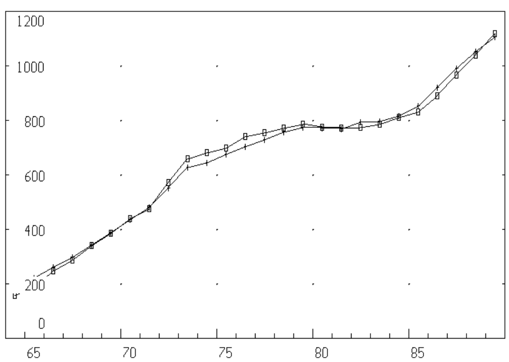
Commodity 20: Domestic appliances



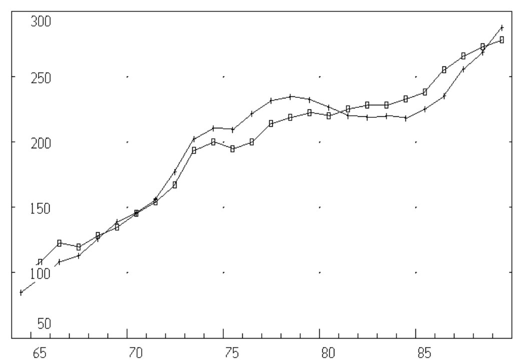
Commodity 29: Motor vehicles



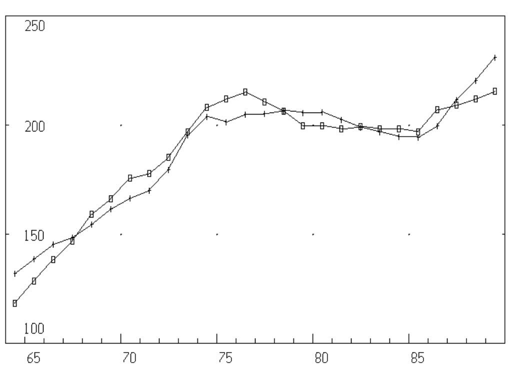
Commodity 30: Vehicle expenses



Commodity 31: Transport services



Commodity 36: Education



Commodity 39: Restaurants and Hotels

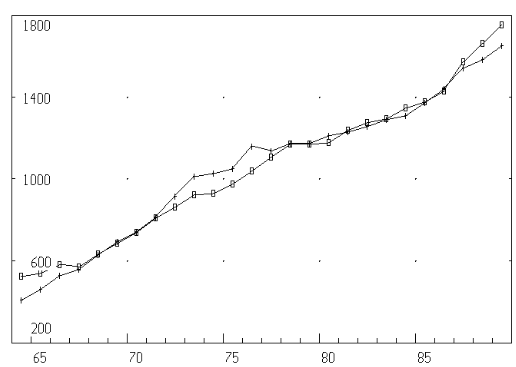


Table 5.4: Consumption Elasticity Comparisons
between HERMES-España and the MIDE Model

Sector nos. HERMES	MIDE	Description	Expend. elast. HERMES	MIDE	Own-price elst. HERMES	MIDE
1	1-13	Food, bev. & tobacco	0.85	0.62	-.90	-.26
2	14-15	Clothing & shoes	0.54	1.49	-.78	-.20
3	16	Rents	0.67	0.63	-.18	-.18
4-5	17	Domestic energy	1.53	0.63	-.28	-.11
6	23	Domestic service	0.38	1.57	-.21	-.43
7	18-22	Household durables	1.70	1.43	-.92	-.66
8	29	Motor vehicles	1.30	1.57	-.76	-.27
9	30	Oth. transp. person.	0.50	1.00	-.44	-.28
10	31	Oth. transp. expend.	0.69	1.58	-.10	-.38
11	32	Communications	0.77	1.57	-.62	-.07
12	24-28	Health & Medical	1.00	1.55	-.52	-.44
13	34-36	Educ. & entertain.	0.95	1.72	-.45	-.36
14	33,37-43	Oth. goods & serv.	1.09	1.04	-.62	-.38

Note: Where necessary, elasticities are a weighted average of individual product elasticities using 1980 shares.

Source for HERMES elasticities: Dones et al. (1990)

As a final analysis of the results, it is constructive to compare the elasticity estimates with other consumption system estimations for the Spanish economy. In their survey of the HERMES-España model, Dones et al. (1990) display the expenditure and own-price elasticity parameters, for 15 products, derived from the Rotterdam system estimation. (Product 15, however, is expenditures abroad which is not included in the MIDE system.) For comparison it is necessary to construct weighted the MIDE elasticities. I have used the 1980 budget weights. Table 5.4 contrasts the elasticities between the HERMES-España and MIDE models. While the product definitions are not exactly equal, a comparison of the 1980 budget shares (also provided by Dones et. al) assures that the displayed correspondence is close enough for comparison purposes. Unfortunately, we do not know the estimation period of the HERMES system. The one generalization that can be made from Table 5.4 is that there is little similarities between the estimates. Comparing expenditure elasticities, one notes that in eight cases the MIDE parameters are much larger than the HERMES parameters. In four cases the HERMES estimates are larger, and in two of the fourteen products (Rents and Other services) they are essentially the same. Undoubtedly, the differences stem from the fact that the MIDE elasticities are estimated with time series data.

The reverse situation is true of the price elasticities, where in eight cases the HERMES elasticities are substantially higher (in absolute value). Unfortunately, the a-priori expectation would have been different. The MIDE systems models more goods. This greater accounting for potential substitutes within a group of similar products should have yielded a relatively high average price elasticity for, for instance, food products. On the other hand, in the HERMES system there is no potential substitute for food, and, therefore, we could expect a lower price elasticity. Alas, there is a myriad of possible reasons for these discrepancies.

Using a linear expenditure system, Abadía (1984) estimated consumption functions for a larger number of products. The estimation used quarterly data stretching from the third quarter of 1976 through the second quarter of 1981. The product correspondence of his system and the MIDE model is a bit more satisfactory. Table 5.5 compares expenditure and own-price elasticities. The Abadía system distinguishes several more food products than the MIDE model. However, there is no readily available data for constructing weighted averages of the Abadía food elasticities. Nevertheless, the parameters shown in the table, in most cases, are of similar magnitude and we can safely employ them for comparison purposes. Abadía tends to like high expenditure elasticities and, therefore, there is a bit more correlation between his estimates and the MIDE numbers. The price elasticities are also relatively high, and certainly higher than the MIDE price parameters. However, following Deaton (1974), we can confirm, with a calculator if the reader is so inclined, that the ratios of price to expenditure elasticities are equal across products. With the linear expenditure system you cannot have products with low price elasticities and high expenditure elasticities, and, at the same time, products with low price elasticities and high expenditure elasticities. Such a relation has no common-sensical of empirical support.

Table 5.5: Consumption Elasticity Comparisons
between Abadía (1984) and the MIDE Model

Sector Ab.	Sector MIDE	Description	Expend. elast. Abadía	Expend. elast. MIDE	Own-price elast. Abadía	Own-price elast. MIDE
1	1	Bread	-0.12	0.17	-0.12	-0.27
2		Cereals	0.62		-0.57	
3	2	Beef	0.72	0.59	-0.66	-0.24
4		Lamb	0.59		-0.54	
5		Pork	0.47		-0.43	
6		Chicken	0.14		-0.13	
7		Other meat	0.76		-0.70	
8	3	Fish	0.69	0.78	-0.64	-0.27
9	4	Eggs	0.23	0.47	-0.21	-0.26
10		Milk	0.27		-0.25	
11		Milk products	0.52		-0.48	
12	5	Oils and fats	0.43	0.78	-0.40	-0.28
13	6	Fruit	0.47	0.78	-0.43	-0.26
15		Vegetables	0.40		-0.37	
14	7	Potatoes	0.06	0.78	-0.05	-0.29
17	8	Sugar	0.81	0.16	-0.74	-0.29
16	9	Coffee, tea & cocoa	0.74	0.39	-0.67	-0.29
18	10	Oth. food products	0.29	1.25	-0.26	-0.29
19	11	Non-alcoholic bever.	0.74	0.78	-0.67	-0.27
20	12	Alcoholic beverages	0.54	0.78	-0.49	-0.22
21	13	Tobacco products	0.51	0.78	-0.47	-0.20
22	14	Clothing	0.91	1.57	-0.84	-0.21
23	15	Shoes	0.70	1.25	-0.64	-0.16
24	16-17	Rents & utilities	1.16	0.63	-1.05	-0.15
25	18-21	Household durables	1.48	1.65	-1.31	-0.75
26	22-23	Domestic serv. & goods	0.84	1.03	-0.77	-0.38
27	24-28	Health & Medical	1.02	1.55	-0.93	-0.44
28	29-30	Vehicle purch. & maint.	1.84	1.16	-1.56	-0.28
29	31	Oth. transp. expend.	0.90	1.58	-0.82	-0.38
30	32	Communications	0.84	1.57	-0.77	-0.07
31	33	Entertainment goods	1.53	1.88	-1.37	-0.67
33	34	Entertainment serv.	1.37	1.88	-1.24	-0.55
32	35	Books & periodicals	1.36	1.78	-1.23	-0.22
34	36	Education	1.52	1.57	-1.36	-0.27
35	37-38	Pers. care & oth. prod.	1.02	1.02	-0.97	-0.15
36	39	Restaurants & hotels	1.36	0.63	-1.21	-0.34
37	40-43	Other services	1.61	2.18	-1.45	-0.57

Note: Where necessary, MIDE elasticities are a weighted average of individual product elasticities using 1980 shares.

5.2 Fixed Capital Investment

Non-residential Investment

The most important economic event in Spain from 1985 through 1989 was the rapid expansion of fixed capital investment. Table 5.6 displays the average annual growth rates of the ten categories of non-residential investment enumerated in the MIDE model. The figures are divided into four, five-year periods: 1970-74, 1975-79, 1980-84 and 1985-89. It is clear that, after a period of stagnation from 1975 through 1984, capital spending for eight of the commodities expanded vigorously after 1984. Commentators offer several explanations for this extraordinary growth (see, for example, González-Romero and Myro, 1989). Much of it is attributed to exogenous factors related to the entry of Spain into the EC. In Chapter 2, I cited several arguments why Spain's entrance into the EC stimulated both domestic and foreign direct investment. These points deserve repeating once again:

1) Once EC membership was assured, foreign investors perceived the advantage of gaining a foothold in an EC country with both low relative labor costs and a rapidly expanding domestic market.

2) Domestic producers recognized the opportunity of expanded exports markets provided by EC integration, but also the need to update their production technologies in order to compete in those markets.

3) EC integration reduced uncertainty of future economic regulation. Before 1986, the Spanish government played a high role in the economy, compared to the average EC government. By accepting the EC rules of the game, the Socialist administration demonstrated the willingness to move forward with drastic, and permanent, liberalization. More important, it was apparent that EC membership was very popular with the Spanish people. Thus, even with a change of government attitudes, investors could be confident that future economic regulation would be less subject to the whims of the local political environment.

4) A very important aspect of the economic liberalization was a greater availability and a reduction in the costs of imported inputs. Therefore, trade reforms raised the rate of return to capital.

Table 5.6: Fixed Capital Non-Residential Investment, 1970-89.
(Average annual growth rates, constant 1980 prices.)

Investment product	70-74	75-79	80-84	85-89	%tot*
1. Agricultural, forestry & fishery products	3.1	-0.9	2.0	-0.2	0.4
2. Metal products	6.0	0.1	-2.8	13.6	5.9
3. Agricultural machinery & tractors	11.7	-8.2	-2.1	2.2	1.0
4. Industrial machinery	7.4	-5.9	-1.1	17.0	11.4
5. Office mach., computers, precis. & optic. instr.	8.8	-0.0	10.7	16.2	4.9
6. Electrical & electronic machinery	15.6	0.4	3.0	12.5	9.8
7. Motor vehicles	4.7	7.5	-4.6	14.7	9.1
8. Oth. transport equipment, incl. ships, planes & r.r.	23.3	-13.4	-15.8	40.6	3.3
9. Nonresidential construction	7.4	-1.0	-1.0	12.2	48.5
10. Other products	7.0	-2.8	-0.8	10.9	5.8
Total non-residential fixed capital investment	8.5	-1.8	-1.4	13.3	100.0

* -- Percentage of total in 1989.

5) With the help of EC regional development funds, the Spanish government initiated an expanded program of infrastructure investment. (This factor appears mostly in the Other construction category.)

There are at least three other policy developments which worked to encouraged investment. Although these policies would have probably been implemented even if Spain had not joined the EC, membership certainly sustained their pace and momentum. The first policy, a program of incentives to foreign investors, especially for activities in certain high technology sectors or in regions of interest, stimulated direct capital inflow. It is difficult to judge, however, whether the impact of the incentives was significant. Much of the direct investment covered by these programs would have probably occurred even without the incentives. A second, and more important, government policy stance concerned the labor market. In the early 1980's the government embarked on a program of labor market reforms intended to decrease rigidities in the labor market. The most important reforms reduced the fix costs of hiring and firing employees. Given the high level of Franco-style labor regulation in the Spanish economy, these reforms were vital for stimulating investor confidence. I will have much more to say about these reforms in the next chapter.

The third set of policies, and in my opinion the most important, were financial market reforms that have reduced the amount of credit rationing in the economy. The changes have been gradual, but steady. Deposit and lending rates were totally deregulated in 1987, setting of an intense battle in retail banking. The securities markets were completely overhauled in 1989. The "investment coefficient" (coeficiente de inversión) regulations, which obligated banks to set aside a specified proportion of deposits for government approved investment projects, usually for public-sector firms, have been eased and will eventually be eliminated. The gradual liberalization of foreign capital flows to EC standards will be complete by mid-1992. The reforms have improved investor access to credit, particularly for smaller firms. Traditionally, these firms were the first to be squeezed for investment finance in times of credit rationing. Capital market reforms will continue to have a large impact on the Spanish economy.

Taken together, these influences on investment behavior present important concerns for the estimation of the capital expenditure functions of the MIDE model. As described in the last chapter, the MIDE model contains accelerator functions for ten different categories of capital goods. This explanation of investment purchases assumes that net capital formation is a function of past and present production in the purchasing sectors, and that replacement investment is identical to depreciation of the capital stock. The equations will fill two roles. One is to forecast investment through the 1990's and the other is to simulate the history or investment through the middle to late 1980's. These two roles may conflict. If the recent spectacular investment growth is only temporary phenomena related to EC entry, then equations estimated over the period may produce parameters that perform well in historic simulation but are inappropriate for forecasting.

Clearly, the investment explosion is not a permanent phenomena. It is unreasonable to expect to continuation of 10 or 15 percent investment growth. Moreover, 1990 saw a marked slow down in aggregate investment growth and 1991 saw *negative* growth for equipment goods. The party is already over. Therefore, the specification of the functions must account for the temporary, exogenous influences on investment behavior from 1985 to 1989. The equations must produce investment growth rates (i.e., have slopes) which reflect a slow-down of investment activity. Are the correct forecasting coefficients the same parameters displayed by the economy previous to 1985?

Important and continuing reforms in the labor, capital and foreign trade markets and the change in the political climate have permanently changed the investment behavior of Spanish producers. Simply assuming that investment behavior will return to its pre-1985 trends is precarious. Since there are now fewer obstacles to implementing investment decisions, capital expenditure should become more responsive to output growth. Ideally, we should look for forecasting equations which display this property. At the same time, we must also consider the econometric and historical simulations properties. The estimation process described below addresses these issues.

Economists have devoted much work in attempting to explain the determinants of investment.[5] Investment remains, however, one of the most difficult components of economic activity to model and forecast. While there are many alternative models of investment, I chose the accelerator function for the MIDE model for several reasons. First, the model is attractive because it is simple and easy to estimate. Second, the explanatory variables are readily produced within the MIDE model. Finally, the contemporaneous and lagged changes in output determine investment demand dynamically. Accelerator equations assume that firms adjust their capital stock depending on the market conditions of their output. A distributed lag on the changes in output accounts for slow adjustments in either expectations or concrete responses, or in both. This "adaptive expectations" approach avoids the wild instability of dynamic input-output models which attempt to integrate future solutions of the model to the equation to reflect expectations (Steenge, 1990).

The general form for each of the equations is:

$$I_{i,t} = a_i + \sum_{k=0}^{3} b_{i,k} \, \Delta Q_{i,t-k} + c_i R_{i,t} + d_i P_{i,t} + e_i (M2_{t-1} / GDP_{t-1})$$

where: $I_{i,t}$ = gross investment in capital good i at time t;

$\Delta Q_{i,t}$ = the change in the weighted average gross output index of the purchasing sectors of good i between the periods $t-k$ and $t-k-1$, k = 0,1,2,3;

$R_{i,t}$ = a measure of depreciation of the capital stock, and, therefore, represents replacement investment,

$P_{i,t}$ = the price index of capital good i over the weighted average output price for the purchasing

[5] Two recent surveys of investment models are provided by Meade (1990) and Ford and Poret (1991). Meade's study evaluates the estimation and forecasting properties of eight different types of models, estimated for different industries, in the context of the INFORUM macroeconomic, multisectoral model of the U.S. Ford and Poret present a cross-country study of the use of the accelerator model for aggregate investment data.

sectors;

$M2_t$	=	the money supply, M2, and
GDP_t	=	nominal GDP.

The inclusion of the relative price variable adds neoclassical content since it integrates the prices of production inputs, including labor, into the purchasing decision. The lagged ratio of the money supply (M2) over nominal GDP accounts for financial conditions. This "money availability" variable is invariably superior to interest rates in the Spanish equations, presumably because of the substantial amount of credit rationing, capital controls and interest rate regulation that have dominated the economy. As I have argued above, however, these influences should have less influence in the future. Nevertheless, the most important underlying determinant of real interest rates, and therefore, financial conditions, is the money supply. In every equation the lagged money availability strongly outperformed the contemporaneous value, illustrating the lagged effects of monetary policy. Therefore, the specification includes only the lagged availability.

The replacement investment variable is formed assuming that physical depreciation is a constant proportion of the capital stock. No information exists on the service lives of capital equipment in Spain. In forming the capital stock variable for the MOISEES model, the builders assumed a depreciation rate of ten percent per year (Corrales and Taguas 1989; Andres et al. 1988b). This figure seems quite high for certain types of capital, especially buildings. For office machinery and computing equipment, on the other hand, ten percent is probably low. For disaggregated modeling, the depreciation rates should vary. The rates used in this study are primarily intuitive estimates which straddle the ten percent figure. They vary from 6 percent per year for Non-residential construction and the non-electric machinery categories to fifteen percent per year for Office equipment and computers. Further evaluation of the chosen rates was done in the equation estimation process.[6] The replacement variables ($R_{i,t}$) and capital stocks ($K_{i,t}$) for each commodity are constructed from the investment series ($I_{i,t}$) using the following identities:

$$R_{i,t} = (d_i \times K_{i,t-1})$$

$$K_{i,t} = (1 - d_i) \times K_{i,t-1} + I_{i,t}$$

where d_i is the depreciation rate for capital good *i*.

The MIDE model contains equations of this type for the ten categories shown in Table 5.6. This classification corresponds to the national accounts 1980 based data. The accounts provide current price series from 1980 through 1989 for each of the products, and constant price series for five categories: Agricultural products (Commodity 1), Machinery products (Commodities 2-6), Transport material (7-8), Non-residential construction (9) and Other products (10). Data previous to 1980 exists in constant and current prices for only 3 categories of goods: Machinery and other products (1-6 and 10), Transport material, and Non-residential construction. These series have been homogenized and extended back to 1954 by Corrales and Taguas (1989).

The first item to note about the 10 disaggregated series is their close correspondence with production sectors of the input-output table. With the exception of category 10, Other products, each commodity is manufactured by only one industry. This direct correspondence simplifies the construction of a matrix which allocates the quantities demanded to the

[6] Since the a priori value for the parameter c_i is 1.00, an intuitive depreciation rate which results in the closest parameter estimation to this value, and which also produces reasonable estimates for the other parameters, is judged to be superior to others. In reality, there is usually little difference to the estimated parameters for the range of depreciation rates which would be considered realistic.

production sector (referred to in Chapter 4 as the B matrix). However, since the investment series are in purchaser prices, they include commercial margins, transportation costs and services provided by five other input-output industries. To create the B matrix, these mark-ups were allocated to the respective service sectors using information on the construction of the 1980 IO table provided by INE (see Sanz 1989).

The information provided by the share matrix allowed the construction of a price for each product using the production and import prices from the corresponding input-output sectors. Constant prices series for the products were then estimated for the years previous to 1980, by using the aggregate investment quantities and the relevant production sector domestic demand as indicators. While the regression period is 1969 through 1989, it is necessary to have estimations extending back to 1954 to construct estimations of capital stock and depreciation for each product. The Appendix provides details on the derivation of this data.

The next step was to construct indices for the changes in output and producer prices for the purchasing sectors. The only data of this nature available at present for the Spanish economy is a series of capital investment matrices, covering the years 1980 through 1983, constructed by Antón and Escribano (1988). These matrices show the flows of investment sales from the type of product to the purchasers, classified according to the 40 non-government sectors of the 1980 IO table. This information was converted to a coefficient matrix for each year by dividing the demand by purchaser by the total sales by product. The coefficients were then averaged over the period. The resulting coefficients show, albeit roughly, the share of sales for each product demanded by each of the 40 producing sectors. For example, the Agriculture sector makes up 94 percent of the demand for Agricultural machinery; the Communications sector exerts a high influence for purchases of Electric and

Electronic equipment. The variable $Q_{i,t}$ was formed by multiplying the share coefficient for each of the purchasing sectors by their respective production, indexed to be equal to 100 in 1980. The price deflator for the purchasing sectors was constructed in the same fashion. This procedure proved to be very satisfactory for the estimation of equations.

To determine the most robust specifications, the equations were estimated for several variations of the general form and under three different regression intervals, from 1969 through 1989, from 1969 through 1984 and from 1980 through 1989. If required, the Almon technique for smoothing distributed lags was used on the accelerator variables, and the coefficient on the replacement variable was softly constrained to be equal to one. This exercise revealed the appropriate length and structure (quadratic or linear) of the distributed lag on output change, the best depreciation rate, and the relevance of including the money availability and the relative price variables (i.e., did they provide significant and reasonable coefficients). Comparison between the 1969-89 and 1969-84 equations also provided the opportunity to compare the performance of the equations for within-sample and out-of-sample simulations and to attain an understanding of how much of the rapid growth from 1985 through 1989 could be attributed to the explanatory variables of the functions. The results were not encouraging. Figure 5.3 displays regression fits (in billions of 1980 pesetas), a graph of coefficient estimates and summary regression results for Industrial machinery (Commodity 4). The following discussion will progressively refer to and explain the information on this figure in order to illustrate the general regression results by way of a typical, and important, example.[7]

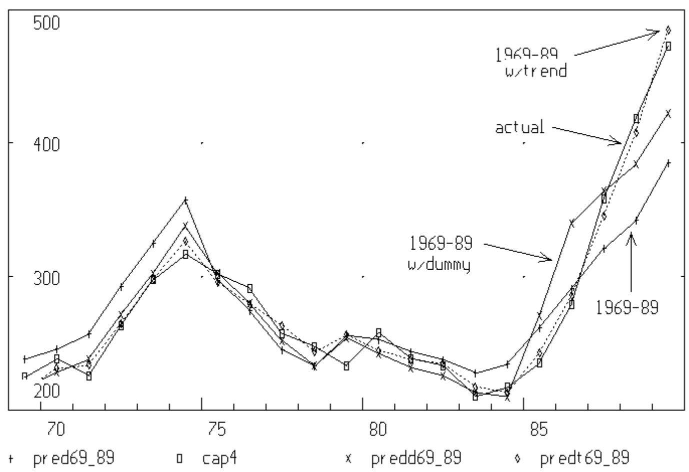
[7] The first category, Agricultural products investment (mostly livestock), is excluded from this discussion since it is a rather special case. The equation estimated for 1969-89 handles this series satisfactorily. Moreover, since it is a trivial figure (0.4 percent of total non-residential investment in 1989) there is no need to devote any further space to a description of its equation.

Estimations for the regression interval of 1969-84 produced reasonable econometric results, but failed miserably in predicting the actual 1985-89 data. For seven of the products, Chow tests conducted for the 1969-84 and 1969-89 intervals produced significant F-statistics. This is evidence of structural change. In general, the 1969-89 estimations fit the data fairly well (in terms of RBSQ), but they also underestimated investment for 1985-89 (Figure 5.3). Some are much worse than others in this respect. As could be expected, the equations estimated from 1980-89 produced terrific fits to the data. However, in some of the categories, the loss of observations played havoc with the parameter values. In others, the accelerator parameters were so high that they would be explosive for forecasting (see the regression coefficient plot in Figure 5.3).

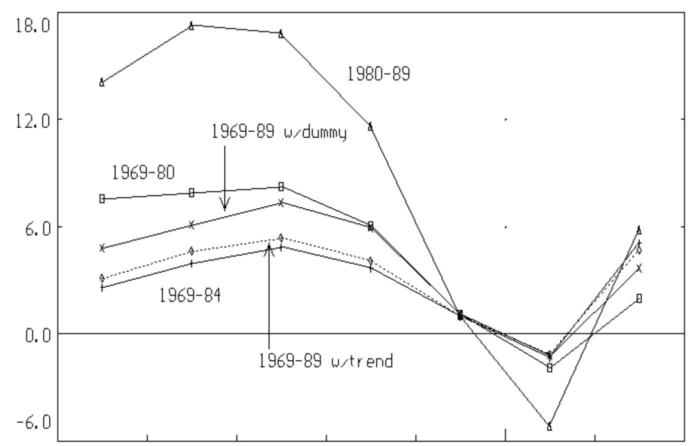
Another problem for some of the 1969-89 equations was their tendency to place the bulk of the explanatory power in the replacement terms with unconstrained parameters taking values much greater than 1.0 (1.3 - 2.0). While it was easy to softly constrain the 1969-84 replacement parameters to be 1.0, the 1969-89 estimates were particularly stubborn. Progressively harder constraints produced substantial autocorrelation and began to affect the other coefficients, producing unreasonable values. Despite these problems, the 1969-89 estimations were satisfactory enough to allow their use for forecasting equations of the MIDE model. The coefficients of the equations are between the 1969-84 (sluggish) and 1980-89 (explosive) values (Figure 5.3). While this is a desirable property for forecasting, the regression plot shows that the 1969-89 equation would produce lousy historic simulations for 1985-89. Obviously, there is something missing in the equations that would enable an accounting for the above cited exogenous influences on investment between 1985-89.

Figure 5.3: Summary Regression Results for Investment in Industrial machinery (4)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 6%)



dQ_t dQ_{t-1} dQ_{t-2} dQ_{t-3} repl. relpr. M2/GDP

equation	see	mape	rbsq	rho	t-stat
1969-84	8.72	2.84	.857	-.35	
1980-89	15.42	4.64	.859	.30	
1969-89	32.34	8.02	.631	.78	
1969-89 w/dummy	22.53	5.68	.806	.45	1.92
1969-89 w/trend	9.32	2.84	.967	.23	9.04

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.Sim. results	poor	fair	good
Forecast growth rate	high	medium	low

Final equation choice: 1969-89, w/trend

One alternative is to add a simple dummy variable to the 1969-89 regressions for the years 1985 through 1989.[8] This is equivalent to assuming that the *intercept* of the function changed. For most of the equations, this approach yielded more satisfactory results. For others, however, the fits and historical simulation performance for 1985-89 are not particularly better than the other 1969-89 equations. To return to the example of Industrial machinery, the within-sample 1985-89 predictions of this equation are superior to the equation which does not include the dummy (Figure 5.3). However, we would not trust this equation to produce good historical simulations. The equations also required relatively hard constraints to obtain a value of 1.0 for the replacement parameter, with the accompanying autocorrelation problem. The inclusion of the dummy does produce accelerator coefficients which lie below the 1969-89 estimates, but above the 1969-84 values.

Another issue must be addressed: if we are to use intercept dummies for the forecasting equations, what value should the dummy take on in the forecast (i.e., post 1989) period for predictions of the full model? Since the dummy represents exogenous factors, the answer depends on how we perceive these influences will change in the forecast period. Since integration in the EC and the wider availability of financing will continue to affect investment in the future, it is appropriate to keep the dummy variable at its 1987 value indefinitely. However, assuming a general growth trend for each of the investment series, the proportional effect of the dummy will decrease through time. This is a desirable property. It reflects that changes in the environment initiated in 1985 will exert a decreasing effect on investment through time.

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[8] The dummy variable is specified as equal to .5 in 1985, 1 for 1986-89, and 0 for all other years. The differential between 1985 and the other years reflects that fact that the exogenous factors cited at the beginning of the section became important only in the second half of 1985.

Another option for estimating the functions is to change the *slope* of the equation by inserting a time trend that begins in 1985.[9] This solves several estimation problems, not to mention the historic simulation difficulties. The fit for 1985-89 is excellent. The pressure on the replacement parameter disappears, hard constraints are no longer needed to obtain a value of 1.0. The accelerator parameters, more or less, revert to their values from the 1969-84 regressions (Figure 5.3). Consequently, this technique introduces an important forecasting question: What happens to the trend after 1989? If it continues along it's merry way, the model assumes that the extraordinary behavior of 1985-89 continues, a fact we know is not correct. An alternative is to fix the trend at its 1989 value. Note that this is equivalent to assuming that the investment behavior reverts to the sluggish pre-1985 behavior, a dubious assumption. A third possibility is to allow the trend variable to grow, but at a decreasing rate. While this option places much of the forecast burden onto the assumptions of the forecaster, it will often lead to the most realistic projections. I will have more to say about this presently.

To summarize, there are three possibilities to choose from: the 1969-89 equation (**1969-89**), the 1969-89 equation with the EC slope dummy (**1969-89 w/dummy**), and the 1969-89 equation with the EC time trend (**1969-89 w/trend**). The choice among the alternatives often involves stark tradeoffs among econometric results, historical simulation performance and forecasting properties. The dilemma for Industrial machinery is summarized by the regression results and "comparison matrix" displayed at the bottom of Figure 5.3. The regression results display the standard error of the estimate (see), the mean absolute percentage error (mape), the R-bar-squared (rbsq), the autocorrelation of the residuals (rho)

---

[9] The time trend variable is specified as equal to .5 in 1985, 1 for 1986, 2 in 1987, 3 in 1988 and 4 in 1989. Again, the peculiar 1985 value is due to that fact that the exogenous positive influences on investment were important from the second half of 1985.

and the t-statistic on the dummy or trend coefficient (t-stat) where it applies. In this example, the "1969-89 w/trend" equation displays superior econometric and historical simulation properties.[10] This result is noted in the line of the comparison matrix labelled "Economet./Hist.Sim. results."[11] As illustrated by the "Forecast growth rate" line, each equation assumes a different underlying, forecast growth rate of investment. Once we admit this item into the utility function, we choose among somewhat arbitrary assumptions concerning investment behavior. In this case, I have inserted the "1969-89 w/trend" equation into the MIDE model because of its better econometric performance and the high significance of the time trend. Also, forecasts for Industrial machinery investment with the time trend frozen at its 1989 value are not unduly pessimistic but seem rather plausible.

Unfortunately, the choice among equation forms must be made for each category. For example, for Office machines, computers and precision instruments, the "1969-89 w/dummy" equation displays better econometric results than the trend equation. The dummy is significant, while the trend is not (Figure 5.6). Therefore, I have selected the dummy equation for computers.

Figures 5.4 through 5.11 display the results and equation selection for each of the other categories. I have made the selections with more or less equal weighting toward the sensibility of the coefficient estimates, the econometric and historic simulation performance, and the suitability of forecasts. Although less important, the statistical significance of the dummy or trend variables is also considered. For example, the high t-statistics on the time

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[10] In terms of historic simulation properties, I am primarily concerned with the 1985-89 period, since the MIDE model will rarely be used for earlier periods.

[11] The terms in this and the following comparison matrices are relative only among the three equations being compared. There is no consideration given to the 1980-89 or 1969-84 equations, nor is there any attempt to compare equation results across products.

trend coefficients reinforces the choice of trend equations for Metal products (category 2), Industrial machinery (4) and Motor vehicles (7). On the other hand, the Electric and electronic machinery sector (6) uses the dummy equation where the dummy is not significant and does not contribute to the improvement of the regression statistics. A close scrutiny of the coefficient plot reveals that this equation provides more moderate and reasonable values. Furthermore, the dummy allowed a much softer constraint on the replacement parameter.

Certainly, I have injected a large amount of subjective judgement into the determination of these investment functions. Since the general economic growth projected by the MIDE model depends heavily on the growth of investment, the choices made here will determine the forecasts to a large extent, even before they are run. Moreover, with the open possibility of manipulating the exogenous time trend the forecaster can further inject his personal views into forecasts.[12] This can be understandingly troubling for the reader. He should be aware, however, that this "eclectic econometric" approach is standard practice in macroeconomic models used for forecasting. Indeed, model building would be quite impossible without this approach. In a recent commentary on macro-forecasting, Zarnowitz (1991) makes this clear. He cites a variety of surveys which shows that forecasters use a large amount of subjective opinion in making projections, and that even those that rely primarily on large-scale empirical models use a significant amount of judgement to modify these models (pp. 7-10). The determination of capital expenditures for the MIDE model illustrates a typical application of the discretionary techniques of empirical model construction.

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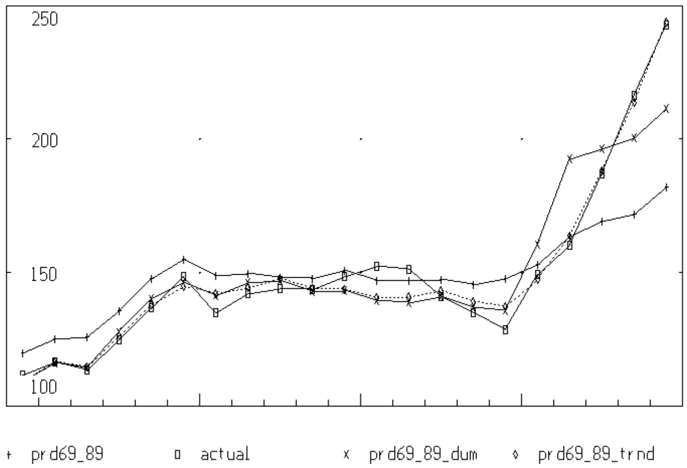
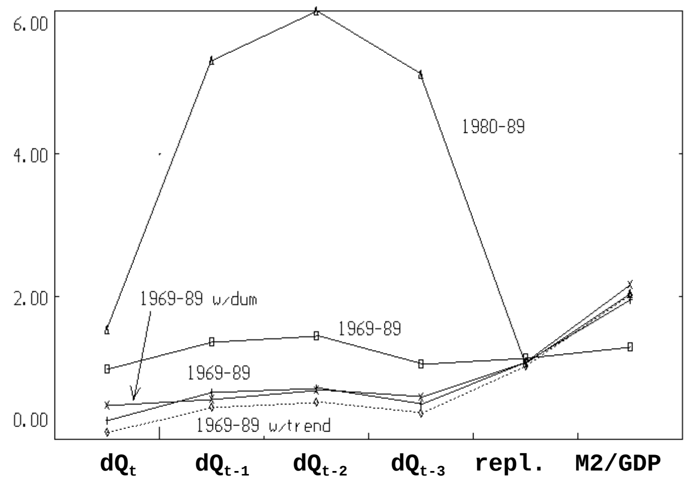
[12] All of the forecasts presented in Chapter 8 have the time trend frozen at 1989 level.

Figure 5.4: Summary Regression Results for Investment in Metal products (2)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 6%)



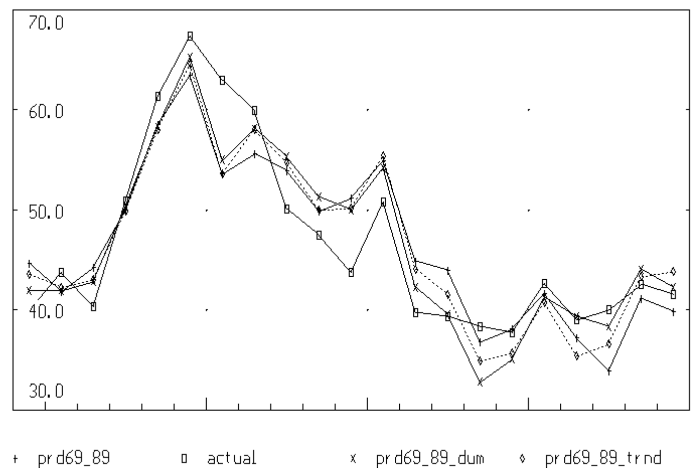
equation	see	mape	rbsq	rho	t-stat
1969-84	5.33	2.87	.715	.54	
1980-89	15.64	5.74	.420	.58	
1969-89	18.85	7.77	.478	.86	
1969-89 w/dummy	11.99	4.78	.773	.62	2.64
1969-89 w/trend	4.77	2.47	.964	.36	8.15

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.sim. results	poor	fair	good
Forecast growth rate	high	low	lowest

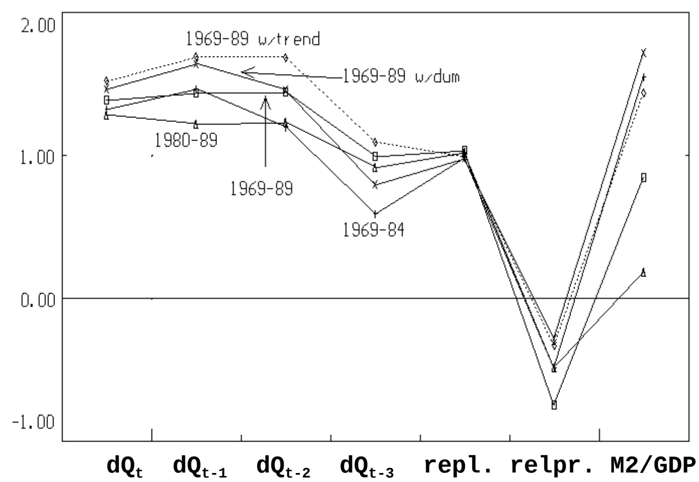
Final equation choice: 1969-89, w/trend

Figure 5.5: Summary Regression Results for Investment in Agricultural machinery (3)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 6%)



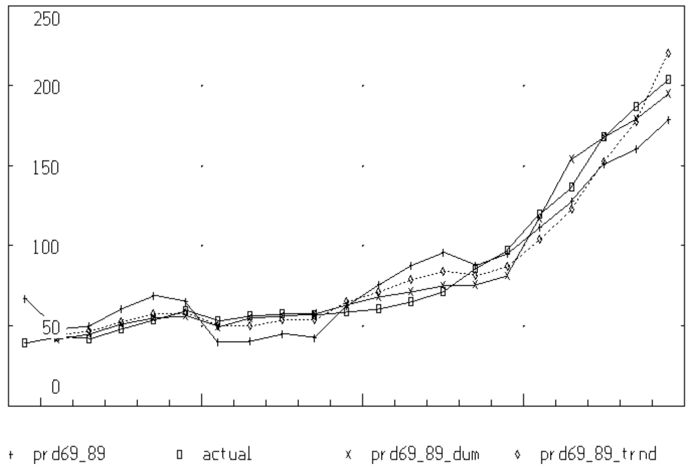
equation	see	mape	rbsq	rho	t-stat
1969-84	3.76	6.63	.706	.46	
1980-89	1.18	2.57	.512	.00	
1969-89	4.15	7.51	.662	.51	
1969-89 w/dummy	3.38	5.81	.757	.47	2.46
1969-89 w/trend	3.77	7.05	.698	.52	1.59

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.sim. results	fair	fair	fair
Forecast growth rate	little practical difference		higher

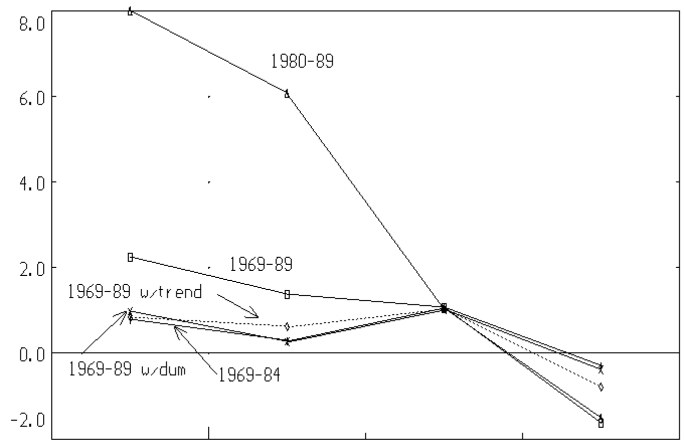
Final equation choice: 1969-89, w/dummy

Figure 5.6: Summary Regression Results for Investment in Office machines, computers and precision instruments (5)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 15%)



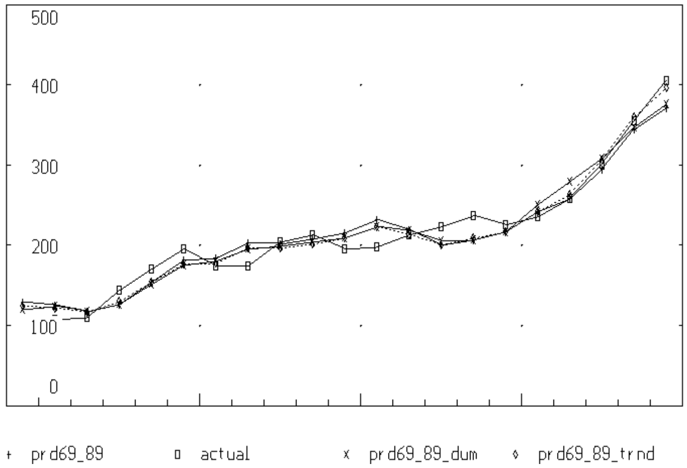
equation	see	mape	rbsq	rho	t-stat
1969-84	5.64	6.35	.801	.70	
1980-89	5.83	5.11	.975	.35	
1969-89	15.75	20.11	.868	.78	
1969-89 w/dummy	6.88	6.54	.973	.36	7.98
1969-89 w/trend	9.65	10.62	.947	.65	4.98

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.sim. results	fair	good	fair
Forecast growth rate	higher	little practical difference	

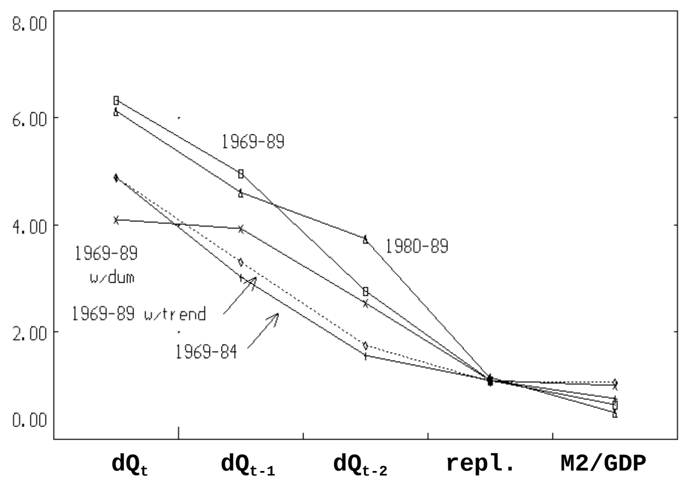
Final equation choice: 1969-89, w/dummy

Figure 5.7: Summary Regression Results for Investment in Electric and electronic equipment (6)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 10%)



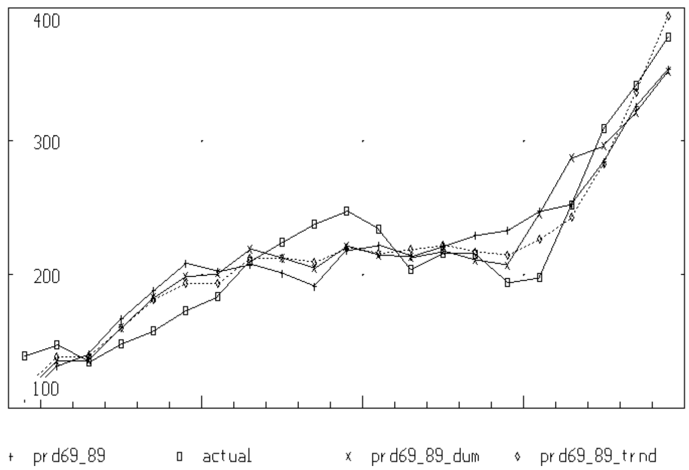
equation	see	mape	rbsq	rho	t-stat
1969-84	16.69	8.98	.773	.45	
1980-89	16.64	5.80	.798	.55	
1969-89	18.91	8.73	.912	.56	
1969-89 w/dummy	17.33	8.41	.921	.51	1.11
1969-89 w/trend	15.28	7.46	.938	.47	2.32

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.sim. results	good	good	good
Forecast growth rate	highest	medium	lowest

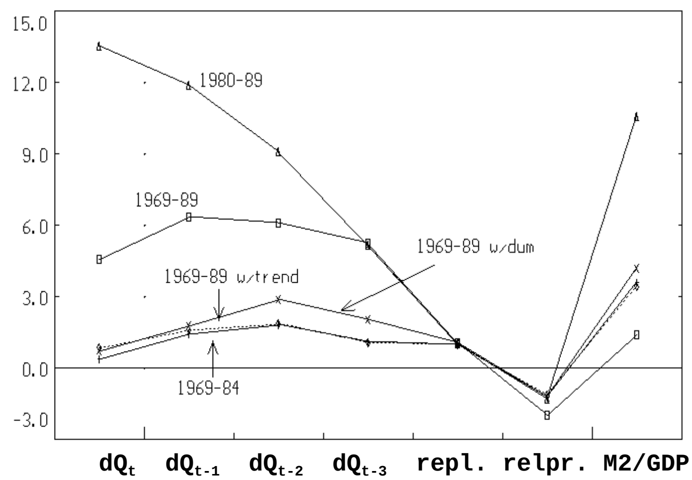
Final equation choice: 1969-89, w/dummy

Figure 5.8: Summary Regression Results for Investment in Motor vehicles (7)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 10%)



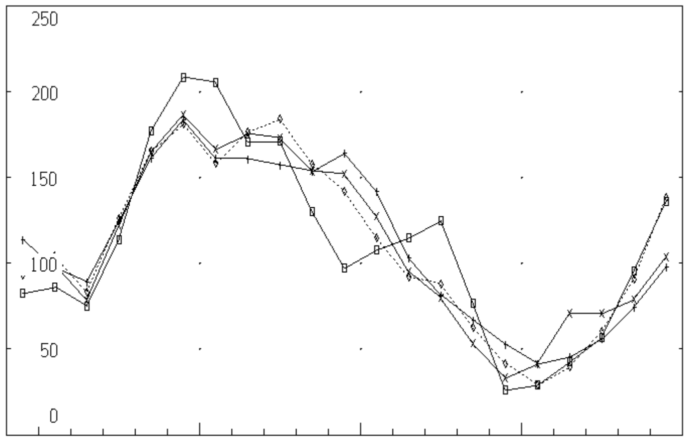
equation	see	mape	rbsq	rho	t-stat
1969-84	16.62	7.81	.609	.68	
1980-89	8.55	3.22	.915	-.35	
1969-89	25.58	10.87	.746	.71	
1969-89 w/dummy	21.93	9.00	.798	.66	2.25
1969-89 w/trend	17.67	7.55	.869	.57	4.41

	1969-89	1969-89 w/dum	1969-89 w/trend
Hist. simul. performance	fair	fair	good
Forecast growth rate	highest	low	lowest

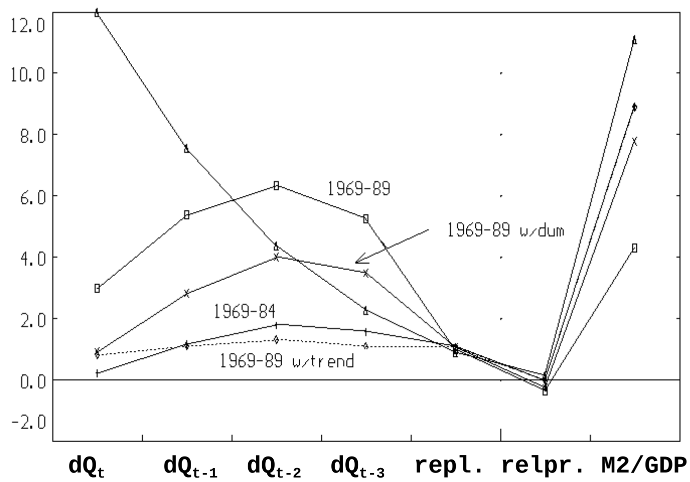
Final equation choice: 1969-89, w/trend

Figure 5.9: Summary Regression Results for Investment in Other transport machinery (8)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 6%)



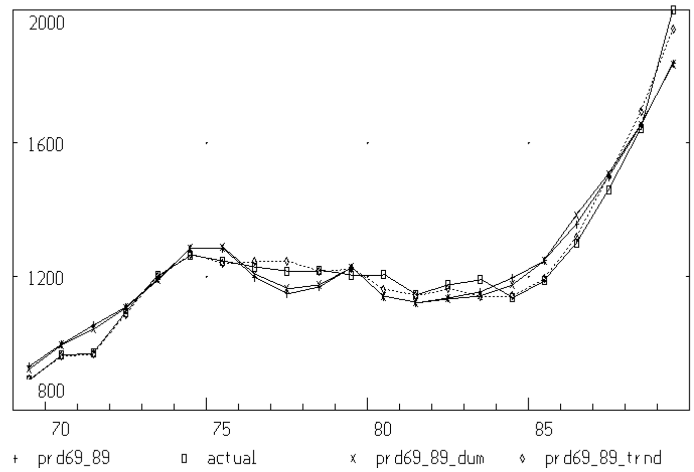
equation	see	mape	rbsq	rho	t-stat
1969-84	23.25	18.82	.589	.52	
1980-89	21.50	23.75	-.404	.20	
1969-89	27.30	24.59	.577	.56	
1969-89 w/dummy	24.12	22.38	.642	.56	1.93
1969-89 w/trend	20.85	15.88	.733	.50	3.00

	1969-89	1969-89 w/dum	1969-89 w/trend
Economet./Hist.Sim results	fair	poor	good
Forecast growth rate	highest	medium	lowest

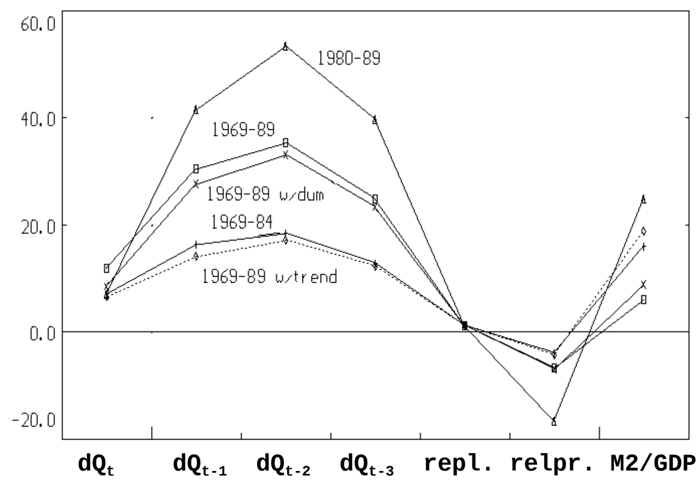
Final equation choice: 1969-89

Figure 5.10: Summary Regression Results for Investment in Non-residential construction (9)

Predicted vs. Actual, 1969-89



Regression coefficients (depr. rate = 6%)



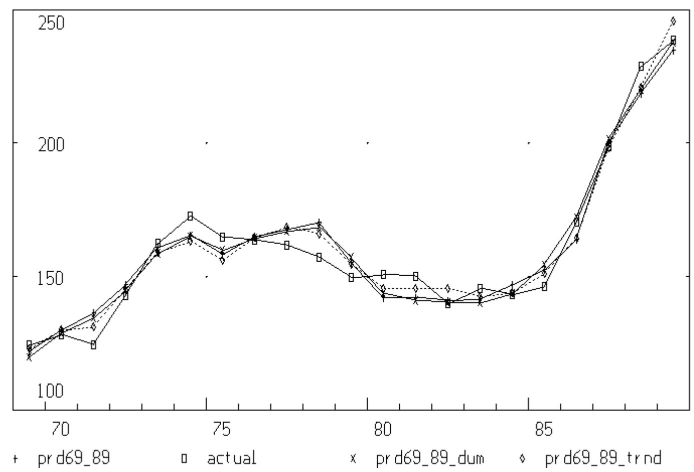
equation	see	mape	rbsq	rho	t-stat
1969-84	17.37	1.09	.951	-.39	
1969-89	57.32	3.72	.906	.47	
1980-89	27.75	1.77	.952	-.13	
1969-89 w/dummy	57.10	3.59	.899	.47	0.63
1969-89 w/trend	27.32	1.41	.977	.10	4.76

	1969-89	1969-89 w/dum	1969-89 w/trend
Hist. simul. performance	good	good	good
Forecast growth rate	little practical difference		low

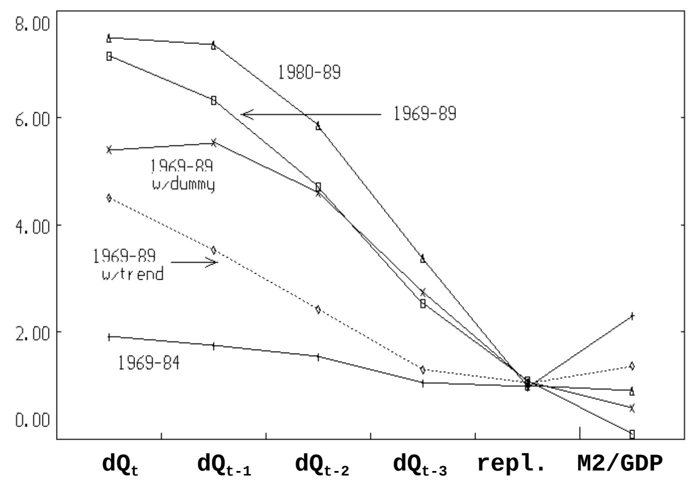
Final equation choice: 1969-89

Figure 5.11: Summary Regression Results for Investment in Other products (10)

Predicted vs. Actual, 1969-89



Regression coefficients



equation	see	mape	rbsq	rho	t-stat
1969-84	5.06	3.00	.791	.37	
1980-89	4.29	2.27	.956	-.58	
1969-89	6.50	3.53	.929	.30	
1969-89 w/dummy	5.98	3.16	.936	.32	1.25
1969-89 w/trend	5.52	2.98	.945	.19	1.92

	1969-89	1969-89 w/dum	1969-89 w/trend
Hist. simul. performance	good	good	good
Forecast growth rate	highest	medium	lowest

Final equation choice: 1969-89, w/dummy

Residential Construction

Residential construction is estimated in per capita terms. The equation contains three explanatory factors: disposable income per capita, the stock of housing per capita, and a three year moving average of the M2 over nominal GDP ratio. The underlying concept of the function is that the desired consumption of houses depends on disposable income (Y), and that the investment (I) depends on the difference between this desired consumption and the actual consumption level (K) (Almon 1988, pp.201-2):

$$I = (a + bY) - K$$

The influence of the income level will apply with a lag because of the permanent income effect and adjustment costs. Additionally, consumers are constrained by financial conditions. Historically, interest rates have exerted little influence in the market. The availability of money is much more effective in the equation. The full functional form of is:

$$I_t = a + bY_{t-1} + \sum_{k=0}^{2} c_k \Delta Y_{t-k} + dK_t + e\sum_{k=0}^{2} w_k (M2_{t-k}/GDP_{t-k})$$

where:

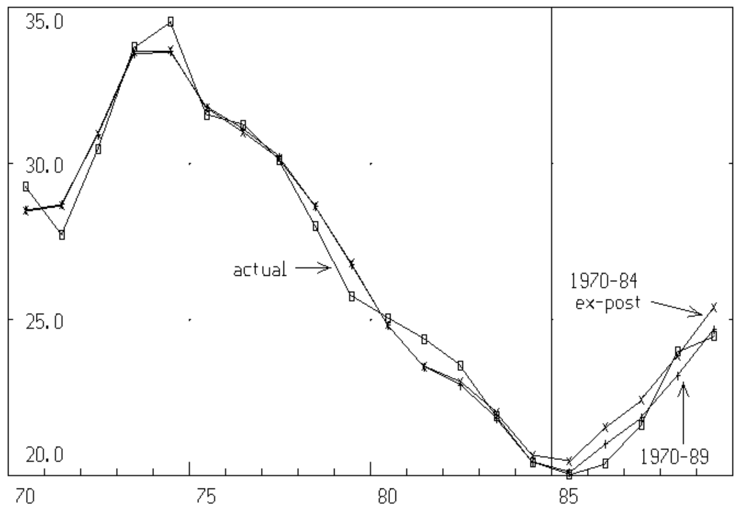
I_t	=	per capita gross investment housing at time t,
Y_{t-1}	=	per capita real personal disposable income,
ΔY_{t-k}	=	changes in per capita real disposable income between periods t-k and t-$(k$-$1)$, k = 0, 1, 2,
K_t	=	a measure of housing stock per capita,
$M2_t$	=	the money supply, M2,
GDP_t	=	nominal GDP, and
w_k	=	.3, .5, .2 for k = 0, 1, 2, respectively.

The housing stock was constructed in the same fashion as the non-residential stocks with a depreciation rate of 3.3 percent per year. The coefficient on this variable, *d*, was softly constrained to take on the value of negative one as demanded by the theory. The coefficients on the distributed lag on changes in income were constrained to lie on a straight line. The constraints required were extremely light. Figure 3.12 displays the results for two regression intervals: 1970-89 (the MIDE model equation) and 1970-84. All of the parameters exhibit the correct signs and reasonable values. Moreover, they are remarkably stable between the two regression periods. Both equations fit very well and the ex-post forecast for the 1970-84 equation, while systematically over-shooting the actual values, tracks them nicely. The results are all the more satisfactory when one considers the importance of residential construction in the economy, and therefore, in the MIDE model.

However, the equation must be used with care for forecasting. The retail banking reforms now taking place in the Spanish economy should have a particularly marked impact in the housing market. In 1991, long-term mortgages which would finance a majority of the cost of a new home appeared for the first time. Moreover, foreign banks will increasingly become a source of housing loans. One outcome of these changes will probably be a greater influence of the interest rate on housing construction. It is impossible to judge the impacts of the banking changes given the available data. However, as stated earlier in the chapter, because money availability plays the most important role in determining the interest rate, the present equation is responsive to credit conditions and will likely yield satisfactory predictions.

Figure 5.12: Summary Regression Results for
Residential construction, 1970-89.

Actual vs. Predicted Values.
(thousands of 1980 pesetas per capita)



	1970-89			1970-84		
	SEE = 0.57	RHO =	0.15	SEE = 0.59	RHO = 0.17	
	RBSQ = 0.98	DW =	1.69	RBSQ = 0.96	DW = 1.65	
	MAPE = 1.76			MAPE = 1.77		
Variable name	Reg-Coef	t-value	Mean	Reg-Coef	t-value	Mean
resid. const. pc	- - - - -	- - - - -	26.38	- - - - -	- - - - -	27.82
intercept	-0.966	-0.27	1.00	0.121	0.03	1.00
Ypc(t-1)	0.065	6.96	284.93	0.068	4.22	279.24
dYpc	0.065	*	5.66	0.074	*	4.08
dYpc(t-1)	0.043	*	5.71	0.052	*	5.11
dYpc(t-2)	0.024	*	5.30	0.026	*	5.85
housing stock	-1.010	*	21.96	-1.012	*	21.92
M2/GDP 3-yr mov avg	0.590	20.02	51.16	0.558	6.955	54.31

* - denotes restricted coefficient

Test period (1985-89):
SEE = 0.78 MAPE = 3.15

CHAPTER 6:

ECONOMETRIC SPECIFICATION AND ESTIMATES:

FOREIGN TRADE, PRODUCTIVITY AND EMPLOYMENT

6.1 International trade

As a small country, international trade is very important to Spain. In 1990 the current price imports to GDP ratio was 20.9 percent; the export to GDP ratio was 17.6 (figures include tourism). Trade played an important role in the modernization of the Spanish economy. As Dehesa et al. (1988) reported, spurts in growth for the Spanish economy were highly correlated with high trade growth. Between 1960 and 1974, when the real economy expanded at an average of 6.9 percent per year, real imports expanded at an average rate of 16.4 percent per year, and exports grew at 14.9 percent per year. Between 1975 to 1985, the corresponding figures were 1.9 percent for imports and 6.6 percent for exports as GDP grew by only 1.5 percent. Recent years, however, present a more mixed picture. From 1986 through 1990, while average GDP growth registered 4.5 percent, imports rose by 15.2 percent per year, but exports grew only 4.9 percent per year. Since this period coincides with Spain's membership in the European Community, the future direction of foreign trade under increasing integration has become a major question concerning the Spanish economy.

Starting in 1993, intra-EC merchandise trade will be completely free, and service trade will become more liberalized as time goes by. Additionally, Spanish trade barriers with the rest of the world will be further reduced for many key categories of goods and services, as Spain harmonizes its trade policy with that of the EC. For example, under a recent agreement between the EC Commission and Japan, Spanish import quotas for Japanese made automobiles, now a miserly two percent, will gradually increase to around ten percent by

1999 (Economist June 8, 1991, p.25). This additional liberalization will occur when Spain is already sustaining enormous trade deficits. Consequently, an extensive discussion over whether the Spanish economy can compete in international markets has dominated economic discussion over the past few years.[1]

Chapter 2 discussed the role of international trade in the history and future of the economy and outlined some sectoral trends for imports and exports. It is helpful to recall some of these points here:

1) Disequilibriums in the trade balance has often stymied the growth of the Spanish economy. Since joining the EC in 1986, imports have increased rapidly, but exports increases have been disappointing. Possible explanations include the higher income price and wage growth rates of Spain relative to its EC partners, reduction of Spanish trade barriers, and the steady appreciation of the peseta since integration. Also, substantial inflows of direct foreign investment since 1985 have stimulated a direct flow of imports.

2) At the sectoral level, high demand elasticities for imports, especially for investment goods, insure a deteriorating trade balance as soon as growth gets under way. In some industries, strong domestic demand growth diverts potential exports toward the domestic market, further aggravating trade deficits.

3) In industries that are labor intensive (textiles, toys) or resource intensive (fruit and vegetables), Spain appears to have a comparative advantage vis-á-vis the EC. However, strong competition in these areas can be expected from developing and formerly centrally planned economies. In many high growth industries, such as electronics, Spanish industry suffers a comparative disadvantage. Many Spanish service industries also seem vulnerable.

4) Presently, most of Spain's best export performances are registered by firms dependent on foreign capital, technology and marketing resources. Two key sectors, automobiles and computers, are cases in point.

5) While it is too early to judge, it is possible that the growth of the mighty Spanish tourist industry may come to a halt. The sector must accommodate domestic price increases and changing consumer tastes to remain the foundation of Spanish

[1] For a review of this discussion, see the collection of nine articles by the major commentators entitled "Commercial Deficit and Competiveness," in the magazine *3conomi4* 1990, 5.

exports.

In order to project a future path for imports and exports, it is helpful to access the relative importance of the above points. Interestingly, several commentators have asserted that EC membership produced a fundamental structural change in foreign trade (an argument similar to that made in the last chapter on investment). These observers maintain that this structural change has increased the underlying propensity to import, but left unchanged the export potential, boding poorly for the future of the Spanish trade balance (see, for example, Martínez, Sanso and Sanz 1991; Martínez and Montañes 1991; Montes 1988). The econometric estimation of the aggregate import and export functions of the MOISEES model shed light on this issue (Fernandez and Sebastián 1990a, 1990b and 1989; Manzanedo and Sebastián 1989). In general, Fernandez and Sebastián reject the hypothesis of EC-induced structural change. Their work shows, instead, that equations estimated over the period of 1964-88 for non-energy imports (excluding tourism), energy imports, and exports (again excluding tourism) are relatively stable through time. Using a "dynamic structural approach," which included error correction mechanisms based on cointegration techniques, they obtained the following conclusions:

1) Non-energy imports were significantly influenced by changes in investment as well as the level of GDP, the relative price and domestic capital utilization. Using dummy variables to detect both one-time and long-term structural changes in the parameters of the equations, they found no evidence of EC entry induced structural change for non-energy imports. Fernandez and Sebastián found that domestic activity and relative prices could not satisfactorily explain energy imports. The behavior of energy imports since 1986 have been quite strange, increasing slowly despite large falls in price and a rapidly expanding economy. In 1988, the volume of energy imports actually fell. According to Fernandez and Sebastián, the uncertainty of the oil market led to a large accumulation of oil stocks when the expected future price was much larger than the actual price in the early 1980's. When these expectations were not met, refiners reduced the stocks and imported less.

Therefore, Fernandez and Sebastián included a variable for the accumulated changes in relative prices to represent the expectations of future prices and obtained a better equation.

2) Over the long run, Spanish exports of good and services can be explained almost completely by variations in commercial indexes, that is, foreign demand. However, a loss in price competiveness since 1983 has significantly reduced the growth rate of exports. A negative impact of domestic demand pressure on exports, while statistically significant, is minor. Finally, Fernandez and Sebastián did find some evidence of structural change, represented by a significant and negative intercept changing dummy, for exports from 1986. However, the temporary dummy (i.e., equaling 1 in 1986 and 0 elsewhere) was slightly more important compared to a permanent dummy (equaling 1 in 1986 to 1988 and 0 elsewhere), leading the authors to suspect that the changes will be temporary. They gave several potential reasons for such a short run change, including the loss of direct export subsidies prohibited by EC policy, and the loss of indirect export subsidies experienced because of the change of indirect tax regime.[2]

This work suggests that the recent behavior of *aggregate* international trade can be explained by the more traditional factors of relative demands and prices. But they also leave many questions open. Often, an aggregate analysis can hide changes in the trade environment that affect individual industries quite significantly. Moreover, they tell us nothing of the composition of trade and where the comparative advantage of the Spanish economy lies. For both imports and exports, there is no elaboration of which sectors are relatively demand sensitive and which are price sensitive. These questions are very important for the prospects of individual industries. They require a disaggregated examination of foreign trade. Except for work done by Carmela Martín and her colleagues

[2] Previous to EC entry, the Spanish indirect tax regime was a cascade tax which fell on all sales, including intermediate consumption. When goods were exported, the exporters received a refund of the taxes paid on intermediate inputs. In practice, the refund or *desgravación fiscal a la exportación* (DFE), resulted in an indirect export subsidy because the refund was not available if the goods were sold domestically. Moreover, the refund was often greater than the amount of taxes actually paid. This system was replaced by a value added tax (VAT) in 1986. Under the VAT, taxes paid on intermediate inputs are refunded whether sold domestically or exported.

at Fundación Empresa Pública (see, for example, Martín and Moreno 1990; Martín, 1990a; and Martín, et. al. 1987), and this only for manufacturing trade, research in Spain has not touched a sectoral analysis of international trade.

A Sectoral Analysis of Spanish Foreign Trade

The following describes the estimation of the import and export equations of the MIDE model. Since the model links the Spanish economy to most of its major trading partners at the sectoral level through the INFORUM international system, it provides a particularly good vehicle to investigate trade by industries. This aspect is important because exchange rate fluctuations and differential movements of international inflation rates affect the prices of commodities differently. Appreciation of the Japanese yen, for example, increases the cost of consumer electronic imports, but not that of coffee imports. High inflation in France will drive up the cost of imported food, but have no effect on the price of imported oil.

Imports and exports each have 25 merchandise categories, 8 service categories and 1 tourism category. The compilation of sectoral level foreign trade data for the Spanish economy was a large task. Current price import and export data was provided by the Instituto Nacional de Estadística (INE) for the 56 sectors of the 1985 input-output data for the years 1981 through 1987, while the 1980 data comes from the input-output table. For 1970 through 1979, and 1988 through 1989, Fundación Tomillo aggregated detailed customs data on merchandise imports and exports to the sectoral scheme of the input-output table. Merchandise prices for the entire period and for each sector are unit value indices also computed by Tomillo using detailed customs data.[3] For the same years, current price

[3] Of course, the use of unit value indices for both deflating data and estimating regressions presents well known problems. These problems are especially apparent for industries whose production is heterogeneous, such as agriculture and machinery. However,

service imports and exports were compiled from the balance of payments accounts of the Bank of Spain and adjusted to conform with the national accounts data. They are then deflated by their respective domestic production deflators.

Constant price values are scaled to the merchandise and service totals supplied by the national accounts. For service imports, this scaling procedure provides new deflators which drive a wedge between the sectoral domestic prices and the import prices in proportion to the difference between the aggregate service domestic prices and the aggregate service import prices. Industry import tax rates have been constructed with information from Cañada and Carmena (1989), and Bajo and Torres (1989). Finally, the trade and transport margins contained in merchandise exports are allocated to the respective service sectors according to the margins indicated in the 1980 input-output table. In general, while the merchandise data is of high quality, that of services (excluding tourism which comes directly from the national accounts) has some problems. Fortunately, service trade comprises small shares of both aggregate trade and sectoral outputs. A detailed description of the entire process in contained in Fierros (1990).

The approaches to modeling and forecasting both exports and imports of the MIDE model have several common features. First of all, most of the equations have a similar functional form and a corresponding estimation procedure. The general equation, a linear term of demand and other explanatory variables multiplied by the relative price, can be expressed as:

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aggregation of the unit value indices from six and seven digit trade data allowed for the removal of outliers and great accuracy in computing price indices. The resulting sectoral indices have been compared with domestic production deflators for exports, and trade weighted production deflators, adjusted by exchange rates, of source countries for imports. They compare very favorably, normally with correlation coefficients exceeding .9. For details, see Fierros (1990).

$$Y = (a + bD + cX)P^{\eta}$$

where: Y = the dependent variable (imports or exports),

D = a demand variable (domestic of foreign),

X = other relevant independent variables,

P = a relative price variable, and

a, b, c and η (the price elasticity) are the parameters to be estimated.

This nonlinear form is similar to the type that we encountered for the estimation of private consumption in Chapter 5. Again, it is superior to both linear and double log (constant elasticity) forms. The form imposes a constant price elasticity (η) regardless of the level of demand. For example, if the export price elasticity is -2.0, then a 5 percent reduction in the relative price of exports should lead to a 10 percent increase in exports *at any level of foreign demand.* A function linear in price results in a falling price elasticity as demand increases over time, an implausible property that is especially undesirable for long term economic modeling.

Also for the nonlinear form, the marginal quantity traded per unit of demand (bP^{η}) depends on the relative price. This is a desirable feature lacking in both linear and double log equation forms. Moreover, at any given relative price, the nonlinear equation compels the demand elasticity to fall as the import (export) to domestic (foreign) demand ratio increases. This is an especially important property for import equations. A constant elasticity import function imposes a constant elasticity on demand. Then, if the demand elasticity was greater than one (a fairly common result), the amount imported would eventually exceed the amount demanded. Since the demand elasticity falls with the import to demand ratio, the nonlinear equation is stable for plausible demand elasticities and relative price movements.

The estimation of the equations is done using a Bayesian approach. At the sectoral level of foreign trade, there can be many factors affecting exports and imports which cannot be easily integrated into a functional form. Frequently, there is a lack of data on quotas, subsidies, long term contracts, discounting and the like. This specification problem can often yield nonsensical regression results, and in particular, positive price elasticities. As I have stressed, such nonsensical parameters cannot be used in a large structural model. Therefore, to avoid positive price coefficients, an *a-priori* price elasticity is chosen for each of the equations. The estimation does not simply maximize the R-squared of the equation but maximizes the "utility" function:

$$U = \bar{R}^2 - (0.001 \times \frac{|\hat{\eta} - \eta|}{|\eta|})$$

where $\bar{R}^2$ is R-bar-squared, $\hat{\eta}$ is the estimated parameter and η is the a-priori elasticity. The function is linearized by dividing the level of the dependent variable by the price term raised to the a-priori η and estimated with ordinary least squares. The price elasticity is then varied between the range of 0 and -3.00 by .05 and the final result chosen was that which optimized the utility function.[4] In most of the import and export results shown below, the a-priori elasticity was -1.0 and the minimization of R-squared also maximized the utility function.

[4] The refusal to consider price elasticities outside the given range, of course, is a not so subtle constraint. There was 11 cases out of 55 where elasticities outside this range would have yielded better fits, all but one of these where this elasticity was positive.

Another common feature of both sets of equations is that the price variable is computed as a moving weighted average of current and lagged relative prices. For several different reasons, such as long term contracts and marketing arrangements, importers do not instantly adjust their purchasing levels in response to relative price changes. Therefore, the specification recognizes that price changes affect international trade with a lag and bestows this reality on the model. For example, when a country's currency depreciates, the change in relative prices does not immediately influence trade volumes. However, the domestic currency value of imports increases because they are more expensive, and the domestic currency value of exports falls because they are less expensive. Therefore, initially the trade balance in the domestic currency deteriorates until the relative price changes act to reduce imports and increase exports. This is known as the *J-curve* effect of currency depreciation. Since both the response lags and price elasticities vary between different products, the impact of exchange rate changes will vary greatly across sectors. Therefore, a multisectoral model is a particularly useful framework to analyze the impacts of international price and exchange rate movements.

In the estimation of both import and export equations the maximum length of the price weight is three years, being limited by the desire to conserve observations. The final designation of the weights was reached through a three-stage process. Initial estimations were made by estimating double log regressions of imports on demand and an Almon distributed lag on the prices. If the results of these equations were unreasonable or counter-intuitive they were thrown out and I borrowed weights from other studies (Nyhus 1975; Grassini 1983). If these weights didn't work, I imposed my own weights with an eye on the R-squared.

A third common focus of the estimations was the attention paid to the possibility of structural change for import and export behavior as a result of Spanish integration into the EC. This is somewhat difficult since the available data runs from 1970 through 1989, giving only four years of EC integration to detect evidence of such change. Moreover, under the hypothesis that behavioral change would probably occur only slowly, again, four years of data would not reveal much effect. Nevertheless, to construct viable forecasting equations, we cannot ignore the possibility that a data set running from 1970 does not reflect the current behavior in the foreign sector. This is especially true for a disaggregated model, for certainly the magnitude of behavioral changes varies between sectors. The simplest technique for assessing the presence or absence of such structural change is to insert dummy variables to test for changes in the intercept and/or slopes of the estimated equation. This technique is often called a switching regression.

I must caution the reader, however, that even though the following analysis includes inferences made from t and F statistics, I am not attempting to provide a rigorous statistical analysis of the extent of structural change. That topic is beyond the scope of this project. As will become evident, the final decision of which equation estimates to include in the MIDE model rests on several criteria, including the reasonable of the parameter values, their ability to explain the historic data, and, most importantly, their performance when included in the entire model both in historical simulations and future projections. The switching regression method and its statistical results play the role of an additional guide for the final choice of model equations.

The final common aspect between the import and export equations is that the exogenous variables which reflect foreign price and demand conditions come from the INFORUM international data base and system of trade linked multisectoral models.[5] While specific details of the formation of these variables are given below in the relevant import or export section, some general observations can be made here. For the compilation of historic data of world merchandise prices and the demand for Spanish exports, data from fourteen countries and 119 products (SITC classification) are differentiated. The countries are:

1) The Federal Republic of Germany	8) The United States
2) France	9) Canada
3) The United Kingdom	10) Japan
4) Belgium	11) Austria
5) The Netherlands	12) Mexico
6) The United Kingdom	13) South Korea
7) The Rest of the EC	14) The Rest of the World

The coverage and availability of the actual data varies for each country and series (import demand and domestic prices). For example, base year exports and import shares exist for each of the countries and products, but several price series are not available. For sectors where this occurs, another country's data could be used. For the Rest of the EC, German prices are used; for the Rest of the World, US prices are used. For historic foreign demand and prices for services, I used various other, more readily available indices. These are detailed below.

The exogenous foreign variables used for forecasting in the MIDE model come from projections produced by system of linked models. Currently, the system consists of fully inter-linked models of the United States, Canada, Japan, the Federal Republic of Germany, France, Italy, Belgium, Spain (MIDE), Austria, Mexico and South Korea. Each of these

[5] The most recent description and application of the INFORUM system can be found in Nyhus (1991). Other papers describing the system and other applications are Almon (1984) and Nyhus (1988). Of the individual models of the system the two most documented are the U.S. LIFT model (Almon 1986 and McCarthy 1991), and the Italian INTIMO model (Grassini 1983, 1985).

country models provides forecasts of prices and import demand to the system and draws foreign demand and prices from the system. In addition, projections for industry imports and prices using single equation models for the Netherlands, the United Kingdom and the Rest of the World find their way into the system. A full model for the UK will be integrated shortly.

While this method for obtaining exogenous data appears to be complicated and unwieldy, it is actually quite necessary for the development of a proper foreign trade sector in a multisectoral model. For aggregate modeling, the model builder has the luxury of readily available world demand and price indices such as those compiled by the OECD. However, the use of such aggregate figures is clearly unsatisfactory for estimating industry level equations or projecting disaggregated international trade. A model in the spirit of MIDE requires a disaggregated approach. The following sections describe the specific functions and estimation results for imports and exports.

Imports

The full functional form for the import equations is:

$$M_{i,t} = (a_i + b_i DUM_{i,t} + c_i DEM_{i,t} + d_i (DEM_{i,t} \times DUM_{i,t}) \left(\sum_{k=0}^{2} (PM_i (1 + TM_i) / PD_i)_{t-k} \right)^{\eta_i}$$

where: $M_{i,t}$ = imports of sector *i* at time *t*,

$DUM_{i,t}$ = a dummy for EC integration,

$DEM_{i,t}$ = the domestic or total demand,

$PM_{i,t}$ = the import price at the border,

$TM_{i,t}$ = the import tax rate, and

$PD_{i,t}$ = the domestic price.

While the historical import prices are known from the data set, they are forecasted using the percentage change of the foreign price of Spanish imports, calculated from the INFORUM international model forecasts. The definition of theses prices is:

$$FPI_{i,t} = \sum_k (w_{i,k,87}\ p_{k,i,t}\ r_{k,t})$$

where: $FPI_{i,t}$ = the foreign price index for imports of commodity i in year t,

$w_{i,k,87}$ = the share of Spanish imports for commodity i from country k in 1987,

$p_{i,k,t}$ = the domestic production price index (1980 = 1.0) for commodity i and country k in year t, and

$r_{k,t}$ = the exchange rate index (1980 = 1.0) of country k in year t.

The estimation results for the import equations of the MIDE model are displayed in Table 6.1. Normally, the first year of the estimation period varies from 1971 to 1972 depending on the length of the price lag, the last year is 1989. (There are four exceptions, these are explained below.) The equations are driven by internal demand and the ratio of import to domestic prices. For most of the equations, the demand variable is sectoral domestic demand defined as output minus exports plus imports.[6] However, for several industries, especially those of machinery such as computers and automobiles, Spanish manufactured exports have a high content of imported inputs. This is also true in the

[6] Readers who may be uncomfortable with the dependent variable playing such a large role in the formation of the independent variable are reminded that output plus imports minus exports is equivalent to intermediate demand plus domestic consumption and investment.

petroleum sector where all the exports are refined products and virtually all the imports are crude oil. For these sectors, exports appear in the demand variable, termed here as total demand. In Table 6.1, an asterisk beside the demand elasticity shows where this applies. The displayed demand elasticities are evaluated with the imports and final demand in the last year of the data, 1989.

Dummy variables appear in the equations when they contribute to explaining the past behavior of imports and provide reasonable model simulation results. The equation for two sectors, Coke products (Sector 3) and Wholesale and retail trade (Sector 28), include intercept dummies to account for outliers in the middle of the historical data that distorted equation results. The rest of the dummy variables represent structural change as a result of EC membership. Most of these equations use the full switching regression form. That is, they not only represent a change in the intercept of an equation, but also a change in the demand coefficient, or slope, of the equation. All the dummies kick in at 1986, except for Communications services (Sector 33) where they begin in 1985. For industries including a demand dummy, the demand elasticities displayed in Table 6.1 represent the elasticities implied by the *sum* of the demand coefficient and the demand dummy coefficient.

There are several reasons to suspect a change in the behavior of sectoral level imports because of EC membership. The first possibilities concern the changes that could occur because of the reduction of both tariff and non-tariff barriers to imports from both EC and third countries. First, the constraints posed by low import quotas would bias downward any estimate of demand elasticity. The lifting of quotas, therefore, would appear as an increase in demand elasticity. Not coincidentally, many of the industries which display evidence of structural change are those for which significant non-tariff trade barriers existed before integration (Meat, Dairy products, Textiles and apparel, Leather products, Automobiles).

Table 6.1: Summary of Import Regression Results.
(t statistics in parentheses)

Sector	Constant (a)	Cst Dum (b)	Demand (c)	Dem Dum (d)	Demand elast[1]	Price elas(η)	Price weights	Rbsq	Rho	1989 imports
1 Agric, forestry, and fisheries	39.553		0.094		0.700	-0.95	[.2 .5 .3]	.76	.47	282.591
	(0.76)		(3.65)							
2 Coal and radioactive material	19.821		0.084		0.375	-0.25	[.6 .4 .0]	.80	.36	37.256
	(8.95)		(5.47)							
3 Coke products	-1.561	1.468	0.073		2.956	-0.05	[.4 .3 .3]	.70	.24	1.004
	(-1.99)	(3.73)	(4.73)							
4 Crude petroleum and refining	-198.854		0.517		1.165*	-0.05	[.3 .4 .3]	.91	.16	1078.428
	(-2.61)		(13.87)							
6 Metal mining and processing	-165.161		0.290		1.171	-1.50	[.4 .5 .1]	.79	.49	367.142
	(-1.93)		(4.16)							
7 Nonmetallic mining and products	25.597	-48.771	0.037	0.100	0.993	-1.35	[.6 .3 .1]	.90	.67	84.806
	(1.47)	(-1.17)	(1.32)	(1.54)						
8 Chemicals	-39.165	-648.557	0.264	0.618	2.502	-0.30	[.3 .5 .2]	.99	-.14	457.457
	(-1.40)	(-7.84)	(8.66)	(8.67)						
9 Metal products	-15.382	-17.737	0.092	0.053	1.273*	-0.05	[.3 .5 .2]	.78	.75	118.094
	(-0.41)	(-0.28)	(2.01)	(0.75)						
10 Industrial and agric. machinery	-311.559		0.731		1.652*	-0.05	[.5 .3 .2]	.90	.56	434.358
	(-7.46)		(12.42)							
11 Off. & computing mach., instruments	9.982		0.431		0.884*	-0.95	[.5 .3 .2]	.99	.30	278.027
	(2.87)		(38.08)							
12 Electric & electronic prod.	-174.763		0.448		1.155*	-1.30	[.5 .3 .2]	.97	.54	440.008
	(-8.73)		(17.25)							
13 Motor vehicles	-55.578	-145.130	0.153	0.169	1.565*	-0.05	[.2 .5 .3]	.98	.43	347.267
	(-3.00)	(-2.45)	(6.59)	(3.75)						
14 Other transport equipment	14.828	-166.736	0.051	0.583	2.279*	-0.75	[.2 .5 .3]	.90	.19	103.719
	(1.69)	(-7.13)	(2.25)	(9.94)						
15 Meat & other animal products	-118.269		0.223		2.758	-1.25	[.6 .3 .1]	.94	.27	63.862
	(-5.80)		(7.78)							
16 Dairy products	8.249	-39.211	0.011	0.171	2.028	-0.55	[.8 .2 .0]	.91	-.03	23.195
	(1.69)	(-1.50)	(0.52)	(1.82)						

Table 6.1: Summary of Import Regression Results (continued).
(t statistics in parentheses)

Sector	Constant (a)	Cst Dum (b)	Demand (c)	Dem Dum (d)	Demand elast[1]	Price Elast	Price Weights	Rbsq	Rho	1989 Imports
17 Other food products	33.323 (1.28)	-240.353 (-2.15)	0.025 (0.93)	0.213 (2.58)	1.986	-1.00	[.8 .2 .0]	.89	.11	164.407
18 Beverages	6.856 (3.60)	-23.295 (-1.56)	0.004 (0.63)	0.069 (2.00)	0.874	-1.30	[.8 .2 .0]	.98	-.02	36.598
19 Tobacco products	-2.599 (-0.70)		0.110 (3.84)		0.931	-0.35	[.6 .3 .1]	.65	.31	15.837
20 Textiles & apparel	-89.000 (-4.64)		0.240 (10.01)		1.037*	-3.00	[.5 .3 .2]	.99	-.05	177.858
21 Leather products, shoes	-3.948 (-0.42)		0.060 (1.61)	0.055 (6.32)	0.658*	-2.35	[.8 .2 .0]	.83	.26	30.088
22 Wood & wood prod., furniture	20.505 (3.29)		0.035 (2.08)		0.236	-2.90	[.5 .3 .2]	.99	-.17	73.391
23 Paper & publishing	3.750 (0.87)		0.088 (9.77)		0.481	-1.85	[.6 .2 .2]	.99	.41	145.807
24 Rubber & plastic products	-78.864 (-7.18)		0.314 (10.79)		1.409*	-1.00	[.5 .3 .2]	.87	.76	97.584
25 Other manufactured products	14.791 (2.08)		0.146 (3.12)		0.628*	-1.40	[.6 .2 .2]	.59	.18	36.762
28 Wholesale & retail trade	-107.001 (-6.89)	118.454 (3.46)	0.056 (8.48)		3.142	-0.65	[.4 .4 .2]	.87	.56	42.989
31 Maritime & air transport	19.255 (6.36)	-8.010 (-0.57)	0.009 (0.37)	0.102 (1.08)	0.396	-2.25	[.8 .2 .0]	.94	.09	30.437
32 Services associated with transport	-96.585 (-10.70)		0.744 (15.61)		3.138	-0.20	[.8 .2 .0]	.94	.48	74.330
33 Communications	1.853 (3.31)	-0.130 (9.29)	0.003 (2.14)	0.013 (6.65)	0.767	-0.50	[.8 .2 .0]	.93	.43	8.375
34 Banking & insurance	-2.363 (-0.51)	10.721 (3.31)	0.013 (2.72)		0.681	-0.30	[.8 .2 .0]	.79	-.12	29.968
35 Business services	20.272 (1.10)		0.085 (4.04)		0.741	-1.25	[.6 .3 .1]	.81	.36	96.892

Notes: * - denotes that exports are part of demand   1 - demand elasticity computed for 1989 imports and demand

Second, both tariff and non-tariff trade liberalization could change the composition of imports within a sector. If we assume, for example, that within an industry the effective protection is higher on final products than on intermediate inputs,[7] we could conclude that a proportional reduction of protection across the sector would increase the proportion of final product imports in that sector. Since final goods often have higher import demand elasticities than intermediate goods, this would increase the average import demand elasticity for that industry.

A third source of structural change could lie with the increasing presence of foreign firms within the Spanish economy. Foreign firms may favor intermediate inputs imported from affiliates outside of Spain. An increasing level of foreign owned production facilities, therefore, implies an increasing import demand elasticity. Another possible source of change in the behavior of imports is the increasing scale of Spanish retailing operations. Large retail firms are able to construct larger wholesale buying operations which find it easier to import merchandise. Moreover, several of the larger retail operations in Spain are either foreign owned or have significant foreign participation, increasing their propensity to buy from foreign sources. I suspect that the expansion of retail firm size is the major factor for the increased import penetration for consumer goods.

Of course, the dummy variable analysis given here cannot identify which of the above, or other, effects account for structural changes. More importantly from the point of view of forecasting, the analysis cannot tell us whether these effects are temporary of permanent. The exploration for which factors may have been responsible and what these imply for the

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[7] This appears to be a valid assumption for Spain. In one study, Melo and Monés (1982) found that at the level of 127 sectors, pre-1986 effective protection on final products such as consumption goods and machinery was higher than that for intermediate goods. Cañada and Carmena (1991) and Dehesa et al. (1988) also offer evidence at a more aggregated level that protection has tended to favor final goods.

future requires a more subjective and qualitative approach. Nevertheless, significant dummies alert us to sectors influenced by EC membership, and, therefore, aid us in constructing the MIDE model and making projections into the future.

From the information included on Table 6.1 alone, the location of dummy variable inclusion appears arbitrary. For example, the t-statistics on the dummies included for Sectors 3, 8, 13, 14, 21, 28, 33 and 34 display significance. On the other hand, those for sectors 7, 16, 17 18 and 31 do not. In these five cases, however, F tests for joint significance of the two dummies were significant at the .99 percent significance level. There were several other criteria which were used to choose the final equations for use in the model. Figure 6.1 summarizes this process.[8]

In Stage 1 of Figure 6.1, the initial estimations of the basic functional form are made. Unfortunately, six out of the total of 33 equations yield nonsensical results: negative demand coefficients. There are data problems with Meat products (Sector 15) and Tobacco products (19). The prevalence of cigarette smuggling led to a large discrepancy between published data on consumption, imports and production of tobacco products from 1970 through 1978. The initial estimation yields a negative demand elasticity. To remedy the problem, we change the estimation period for to 1978 through 1989, years for which the data are reasonably consistent. Meat products, where early production and final demand data has been understated by substantial home production, was handled similarly.

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[8] Though Figure 6.1 implies that testing of the equations in model simulations (both historical and forecasts) occurred only a Stage 4, this is not the case. Results from each stage of estimation were thoroughly tested and retested in the model. In reality, Figure 6.1 should be nested in a giant loop which includes continuous testing of the import equations simultaneously with the development of all the other parts of the model. Indeed, it was model simulations that led to the switching regression approach when they revealed that the basic-form equations for several sectors would be inadequate for forecasting.

Figure 6.1: Import Equation Selection Process

1. Does basic functional form (i.e. w/o dummies), estimated over entire sample period, yield positive demand elasticities?

   YES ↓ NO: Sector 5 (Electricity) - Imports very small proportion of domestic demand. Forecast with avg. proportion of dom. dem. 1986-89.

   Sector 15 (Meat) - Data problems before 1983. Use basic equation estimated between 1983-89.

   Sector 19 (Tobacco) - Severe data problems previous to 1978. Use basic equation estimated between 1978-89.

   Sector 20 (Textiles and apparel) - Imports heavily administrated before EC integration. Use basic form estimated between 1984-89.

   Sector 30 (Interior transport) - Imports very small proportion of domestic demand. Forecast with avg. proportion of dom. dem. 1986-89.

   Sector 39 (Cultural & oth. services) - Imports small proportion of domestic demand. Forecast with avg. proportion of dom. dem. 1986-89.

2. Does F-test at 1 percent level of significance reject the null hypothesis that dummies are equal to zero?

   YES ↓ NO: Sectors 1, 2, 3*, 4, 11, 12, 23, 25, 28*, 32, and 35. Use basic equation, intercept dummy for outliers (*).

3. Does full switching equation (i.e. both intercept and demand dummies) provide reasonable parameter estimates?

   YES ↓ NO: Sector 22 (Wood) - Combined demand elasticity becomes negative. Basic equation estimated over entire period gives insignificant parameters. Use basic equation estimated between 1984-89.

   Sector 21 (Leather) - Using only demand dummy performs best.

   Sector 34 (Banking services) - Using only intercept dummy performs best.

4. Is full switching equation stable inside the full model?

   YES ↓ NO: Sectors 6 (Metal mining & proc.) and 10 (Machinery). Use basic equation.

5. Sectors 7, 8, 9, 13, 14, 16, 17, 18, 33. Use full switching equation.

For Electricity (Sector 5), Interior transport (30), and Other services (39) there is no estimation period which gives satisfactory results. Since imports are such a small proportion of domestic demand for each of these industries (well under one percent for Electricity and Transport, under two percent for Other services) it is not surprising to find no stable empirical relation between the variables. Import forecasts for each of these sectors use the average proportion of domestic demand between the years 1986 and 1989. (Since there are no regressions for these industries, they are not included in Table 6.1.)

Textiles and apparel (Sector 20) are quite another story. This sector has been so heavily protected by quotas over the years that it was not until EC integration that imports responded at all to domestic demand. To obtain a positive demand parameter we are forced to estimate over the ridiculously short period of 1984 through 1989. Nevertheless, the parameters are reasonable and the equation functions well in model simulations.

In Stage 2, the full switching function is estimated and the joint significance of the structural dummies are tested with an F-statistic. For eleven sectors the dummies are found to be insignificant. Imports of these sectors, therefore, use the basic functional form in the model. Moving on to Step 3, we discover that the dummy coefficient estimates for Wood and wood products (Sector 22), while significant, implied a negative demand elasticity. A re-examination of the basic equation for the entire estimation period for this sector revealed that the demand coefficient was insignificant. Because the historical relationship between the imports and demand was anything but robust, we hypothesize a situation similar to Textiles and apparel and handle the situation similarly, estimating between 1984 and 1989. Additional investigation of the results show that the equations for Leather products (21) and Banking services (34) perform better in terms of both fitting and model simulation if one or the other dummies were left out.

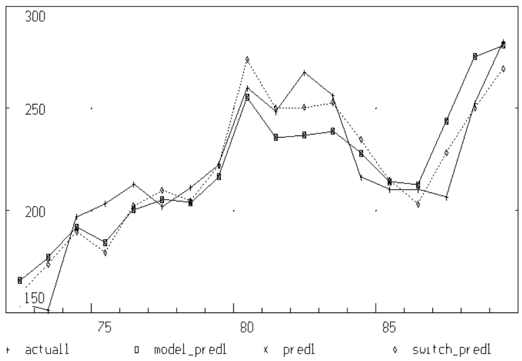
Finally, simulation testing revealed severe instabilities with the switching model version for Metal mining and processing (Sector 6) and Industrial and agricultural machinery (10). The imports of both of these sectors are considerable and their share in domestic demand very high. The switching specification led to a problem within the Seidel input-output computation loop, and imports were consistently exploding while output was shrinking. The same problem was not present with the basic form. I suspect that this problem is due to the discontinuity of the switching functions.

Figure 6.2 presents regression plots for twelve of the most important import sectors. Each picture contains a graph for the actual imports (the +'s - labeled "actual" in the graph legend) and the predicted values from the regression equation shown in Table 6.1 (■ - "model_pred"), which is ultimately included in the MIDE model. The plots also contain a third line, which shows the predicted values from the equation *not* included in the model, either the non-switching form (x - "pred") or the full switching form (♦ - "pred_switch"). (Actually, there are four lines to each graph, but the model equation line is superimposed on the appropriate equation line.)

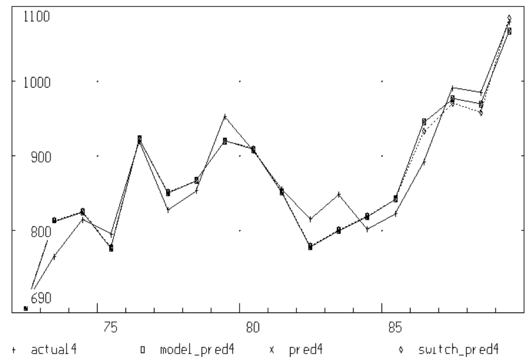
The first plot is for Agriculture (Sector 1), a sector which does not use the switching equation in the model. The graph demonstrates that the dummy variables added little to the explanatory power of the equation. In other cases, the two sets of predicted values are virtually indistinguishable (4 Crude and refined petroleum, 11 Computers, 12 Electric machinery and 23 Paper products), and the switching regression is not used. Some of these sectors are precisely where imports have rocketed over the past years, and a-priori, one might expect structural change in the equation. Note especially the Electric machinery (12) and Computer (11) sectors. Nevertheless, demand and price go a long way towards describing their behavior. Conversely, the plots for Non-metal minerals and products (7),

Figure 6.2: Regression Fits for Import Equations
(Billions of pesetas, 1980 prices)

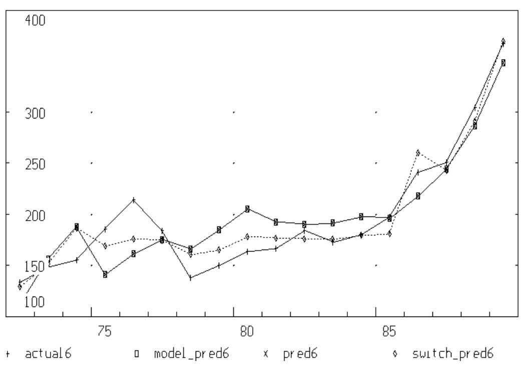
Sector 1: Agriculture



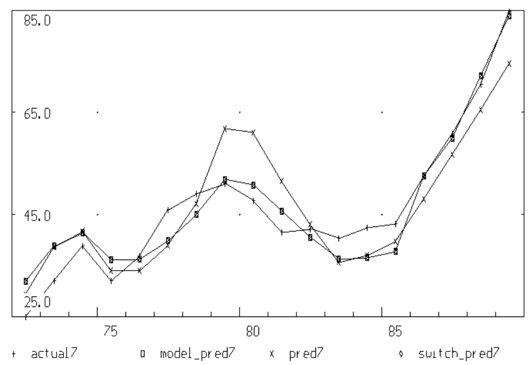
Sector 4: Crude and refined petroleum



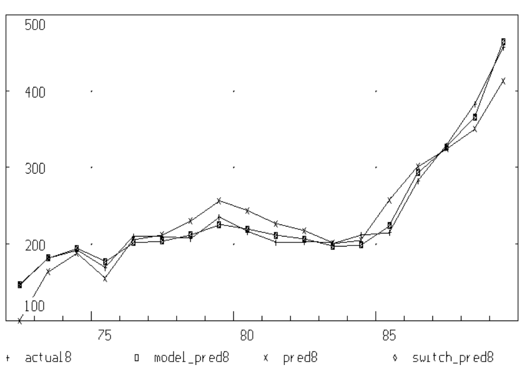
Sector 6: Metallic minerals and base metals



Sector 7: Non-metal minerals and products



Sector 8: Chemicals



Sector 9: Metal products

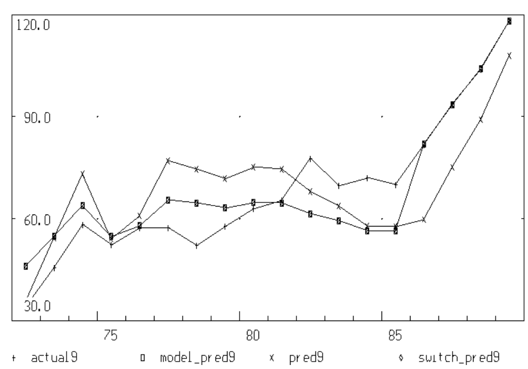
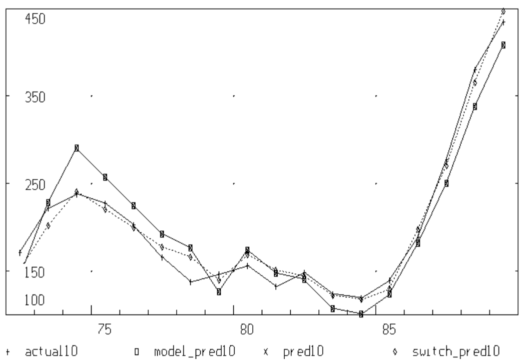
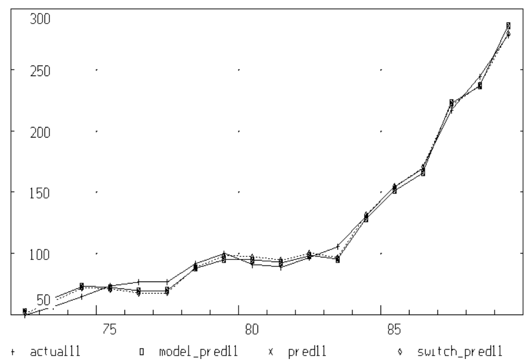


Figure 6.2: Regression Fits for Import Equations (cont.)
(Billions of pesetas, 1980 prices)

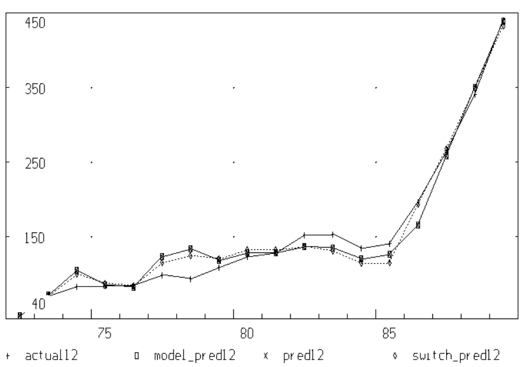
Sector 10: Industrial machinery



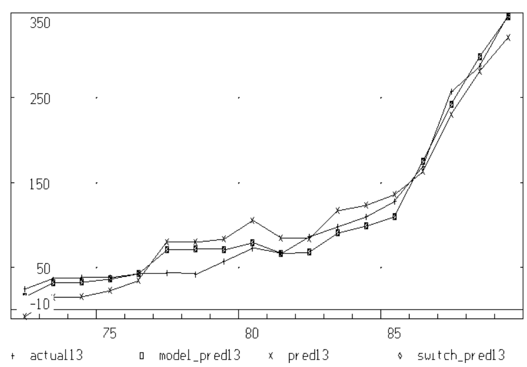
Sector 11: Off. mach. & computers



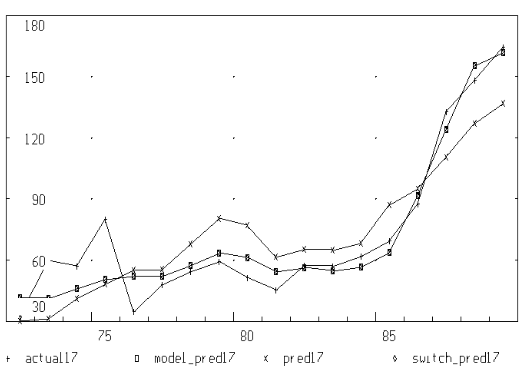
Sector 12: Electric machinery



Sector 13: Motor vehicles



Sector 17: Food products



Sector 23: Paper products

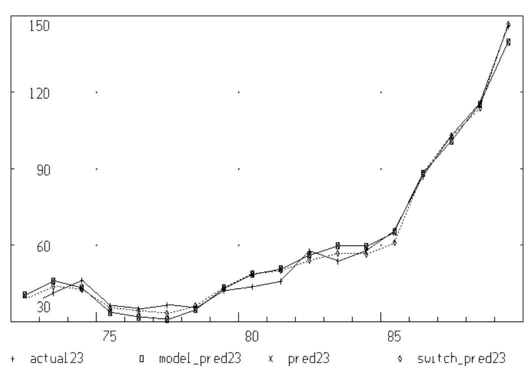


Table 6.2: Import Elasticity Comparisons between Fernandez-Sebastián (1989) and the MIDE Model.

		Total	Non-energy	Energy	Merchandise	Services
Demand elasticities						
MIDE Model		1.35	1.41	1.14	1.41	1.14
Fernandez-Sebastián (a)		1.67	1.73	1.79		
Price elasticities						
MIDE Model		-0.75	-0.94	-0.06	-0.74	-0.84
Fernandez-Sebastián	(b)	-0.30	-0.66	-0.56		
	(c)	-0.08				

(a) - GDP (b) - price of non-energy imports
(c) - price of energy imports (both prices appeared)

Chemicals (8), Metal products (9), and Food products (17) clearly show the effectiveness of the switching equation. In each of these cases, the equation without the dummy variables systematically under-predicts imports.

To summarize, it is interesting to contrast the results of this study with that of the aggregated equations of Fernandez and Sebastián (1989, hereafter called FS). Table 6.2 contrasts the estimated price and income elasticities. The values shown for the FS were derived from the long term cointegrating equation, which is simply a log linear equation of imports on Gross domestic product and relative price. This study finds a lower aggregate demand elasticity effect. Of course, it is difficult to compare these results since the nature of the demand variables are so different. In aggregating the results of the present study, we incur some double counting of demand, since demand for a final good is combined with the demand of its intermediate inputs. The price elasticities for total and non-energy imports estimated in this study are larger (in absolute value) compared to FS. This is not surprising, since it has been known since Orcutt (1950) that the aggregation bias for international trade elasticities is downward. The biggest discrepancy exists in the price elasticity of energy imports. Where FS find a price elasticity of -.56 (only .1 below the non-energy elasticity), this study computes it to be -.06.

This study also diverges in its findings concerning the structural implications of EC integration. If we include Textiles and apparel and Wood products in the structural change camp, but Metal products and Machinery (because of their simulation problems) in the no-change camp, we find that 15 out of the 30 sectors for which equations were estimated display structural change. However, if we weight the importance of these sectors according to 1989 real imports, the proportion falls to only one third of the imports. If we exclude energy imports (Sectors 2 through 4) from the calculation it rises again to 43 percent. FS claim that the correct way to examine this situation is the dynamic structural approach where the dependent variable, the change of imports, is regressed on the changes in short-term variables and the errors given by the cointegrating equation mentioned above. However, the most important short term effect in their analysis was the change of investment. Investment goods tend to have large demand elasticities and account for a large proportion of total non-energy imports (approximately 40 percent). Moreover, according to the results shown here, import functions for the major equipment goods (Sectors 10-12) display stable behavior. Therefore, it is possible that estimating equations that lump the equipment goods with all other types of goods overestimates the structural stability of import behavior. It would be interesting to adopt the FS approach to more disaggregated quantities (consumer, intermediate and equipment goods, for example) and compare the results.

Merchandise Exports

The full functional form for merchandise exports (Sectors 1-25) is:

$$X_{i,t} = (a_i + b_i FDM_{i,t} + c_i \Delta DD_{i,t} + d_i DUM_t) \left(\sum_{k=0}^{2} (PX_{i,t-k}/FPE_{i,t-k}) \right)^{\eta_i}$$

where: $X_{i,t}$ = the exports of sector *i* in time *t*,

$FDM_{i,t}$ = an index of foreign demand,

$\Delta DD_{i,t}$ = the change in domestic demand,

$DUM_{i,t}$ = the dummy variable reflecting EC membership,

$PX_{i,t}$ = the export price at the border, and

$FPE_{i,t}$ = the foreign price of competing exports.

The foreign demand index, computed from the INFORUM international data base, is:

$$FDM_{i,t} = \sum_k (w_{i,k,87} \; M_{k,i,t} \; / \; M_{k,i,87})$$

where: $w_{i,k,87}$ = the share of Spanish exports for sector *i* which went to country *k* in 1987,

$M_{i,k,t}$ = the imports for sector i and country k in year t.

As in any weighting scheme across time, the question of an appropriate base year muddles the analysis. There is no doubt that the destinations for Spanish exports have changed and will continue to change. Although it is near the end of the estimation period, the year 1987 was chosen because it is in the middle of the estimation-forecast period and reflects two years of EC integration.

The change in domestic demand variable reflects that domestic demand pressures can divert exports towards the domestic market. While capital utilization would be a better variable to capture this effect, data is not available as this level of aggregation. It is important in nine out of the twenty five industries. There is no particular pattern here, it is significant in intermediate good sectors (4, 6, 7, and 8), equipment sectors (10 and 14) and consumer good sectors (20, 22 and 23).

The foreign competing price of exports, calculated from the INFORUM international base and model forecasts, are defined as:

$$FPE_{i,t} = \sum_{k} (w_{i,k,85}\ p_{k,i,t}\ r_{k,t})$$

where: $w_{i,k,85}$ = country k's share of world exports of commodity *i* in 1985,

$p_{i,k,t}$ = the domestic production price index (1980 = 1.0) for commodity *i* and country *k* in year *t*, and

$r_{k,t}$ = the exchange rate index (1980 = 1.0) of country *k* in year *t*.

The model projects export prices with the percentage change in domestic prices. Table 6.3 shows the estimation results for the merchandise export equations.

Evidence of EC-induced structural change is not as clear here as with imports. Intercept dummies starting after EC integration and varying in starting dates from 1986 through 1988, are important in eight industries. In each case, the dummies enhanced the fit sufficiently enough that full switching regressions were not necessary to obtain equations that performed well in full model simulations. Apparently, exports of Agricultural (Sector 1), Meat (15) and Dairy (16) products have benefitted from the Common Agricultural Policy (CAP) of the EC. The Spanish government used to buy up the surpluses of these sectors. Some of the surpluses, now purchased by the EC, are classified as exports. Exports of refined Petroleum products (4) grew under integration as Spanish companies took advantage of the void left by capacity reduction in the rest of Europe. Under a three year transition plan starting in

Table 6.3: Summary of Merchandise Export Regression Results.
(t statistics in parenthesis.)

Sector	Constant (a)	Demand (b)	Demand elast[1]	ΔDom Dem (c)	Dummy (d)	Price elas(η)	Price weights	Rbsq	Rho	1989 exports
1 Agric., forest. & fisheries	-164.55 (-6.00)	2.97 (10.14)	1.63		85.435[2] (7.59)	-1.00	[.6 .4 .0]	.94	.09	269.580
2 Coal & radioact. material	0.028 (0.11)	0.001 (0.21)	0.04		1.489[3] (17.81)	-0.05	[.3 .5 .2]	.95	-.45	1.291
3 Coke products	-0.004 (-0.01)	0.112 (0.20)	0.11		0.430[2] (4.35)	-0.10	[.3 .5 .2]	.51	-.23	0.644
4 Petroleum products	102.070 (1.10)	2.347 (5.75)	0.82	-0.108 (-2.47)	160.349[2] (9.03)	-0.05	[.3 .5 .2]	.95	.37	369.443
5 Electricity, gas & water	1.611 (1.12)	0.022 (1.26)	0.38		5.925[5] (4.76)	-0.05	[.2 .2 .6]	.60	.32	4.877
6 Metal mining, processing	-209.983 (-2.17)	4.056 (3.78)	2.39	-0.312 (-2.36)	-100.271[2] (-2.29)	-1.60	[.3 .5 .2]	.67	.66	226.679
7 Nonmetal mining and products	-25.214 (-2.45)	0.946 (9.48)	1.35	-0.199 (-3.55)		-0.05	[.5 .3 .2]	.86	.48	96.074
8 Chemicals	-112.790 (-8.90)	2.300 (19.05)	1.57			-0.40	[.3 .5 .2]	.95	.44	216.591
9 Metal products	-58.034 (-6.73)	1.498 (18.14)	2.12	-0.022 (-0.58)		-2.30	[.3 .5 .2]	.87	.40	93.351
10 Indust. & agric. machinery	-77.914 (-10.16)	1.912 (23.91)	1.59	-0.031 (-1.30)		-1.00	[.3 .5 .2]	.97	-.01	169.020
11 Off. mach., comput. & instr.	-3.006 (-1.74)	0.229 (18.55)	1.14			-0.15	[.3 .5 .2]	.95	.30	54.162
12 Elect. & electron. material	-2.373 (-0.99)	0.579 (26.73)	1.07			-0.45	[.3 .5 .2]	.97	.41	94.199
13 Motor vehicles	-126.257 (-10.28)	2.698 (24.44)	1.60			-0.75	[.3 .5 .2]	.96	.31	310.124
14 Oth. transp. material	50.037 (7.01)	0.005 (0.10)	0.01	-0.044 (-1.61)	29.968[4] (6.30)	-2.55	[.2 .5 .3]	.72	-.05	53.809

Table 6.3: Summary of Export Regression Results (continued).
(t statistics in parenthesis)

Sector	Constant (a)	Demand (b)	Demand elast[1]	ΔDom Dem (c)	Dummy (d)	Price elas(η)	Price weights	Rbsq	Rho	1989 exports
15 Meat products	0.869 (0.61)	0.027 (1.81)	0.33		3.586[2] (4.30)	-0.05	[.5 .3 .2]	.83	.46	13.954
16 Dairy products	-0.921 (-0.92)	0.015 (1.42)	0.31		3.526[2] (4.50)	-0.05	[.5 .3 .2]	.83	.22	9.540
17 Other food products	-3.913 (-0.26)	1.368 (8.86)	1.28			-1.15	[.5 .3 .2]	.82	.24	134.090
18 Beverages	16.011 (4.87)	0.055 (1.97)	0.35			-2.00	[.5 .3 .2]	.48	-.12	24.500
19 Tobacco products	0.001 (0.01)	0.009 (3.74)	1.05			-0.75	[.5 .3 .2]	.62	.38	0.830
20 Textiles & apparel	-7.716 (-0.94)	0.744 (9.14)	1.23	-0.047 (-1.17)		-1.75	[.5 .3 .2]	.90	.56	80.398
21 Leather products	29.202 (5.76)	0.434 (9.99)	0.79			-0.25	[.5 .3 .2]	.81	.15	95.097
22 Wood products	-17.586 (-6.47)	0.430 (17.5)	1.82	-0.052 (-2.20)		-1.45	[.5 .3 .2]	.87	.34	41.904
23 Paper & publishing	-48.581 (-6.32)	1.040 (14.14)	1.75	-0.186 (-2.76)		-1.15	[.5 .3 .2]	.89	.53	91.606
24 Rubber & plastic prod.	-30.950 (-3.98)	0.868 (12.34)	1.02			-0.05	[.5 .3 .2]	.90	.65	144.062
25 Oth. manuf.	-7.419 (-2.40)	0.266 (9.29)	1.23			-0.40	[.3 .5 .2]	.78	.30	36.529

Notes: 1 Demand elasticities computed at 1989 export and demand values.
2 dummy = 1 for 1986 through 1989, 0 all other years.
3 dummy = 1 for 1987 through 1989, 0 all other years.
4 dummy = 1 for 1988 through 1989, 0 all other years.
5 dummy = 1 for 1981 through 1983, 0 all other years.

1986, Spanish government subsidies were progressively reduced to the iron and steel industry (Metal mining and processing, 6). The reduction of subsides hurt exports to third countries, and exports to the EC were still covered by (increasing) quotas (Salmon, 1991). These factors account for the negative sign on the dummy parameter. Even though the industry is now fully covered by the European Coal and Steel Community, the export potential from the iron and steel industry is limited.

Curiously, the results displayed here seem to contradict the Fernandez and Sebastián conclusion of a slight negative export impact of EC integration. Except for Metal mining and processing (Sector 6) the seven dummies are positive. I suspect that the major reason for the difference is that the disaggregated approach links exports with more precise measures of foreign demand. The aggregate trade indices simply cannot capture the changes in the components of demand. It is also true that the seven industries with positive dummies account for only 26 percent of the total exports, so the aggregate effect of the dummies is small. An aggregate equation could miss this effect.

Service Exports

Service exports in the MIDE model are treated differently than merchandise exports for two reasons. First, since exports of Wholesale and retail trade (Sector 28) and the transport sectors (30 through 32) consist mostly of margins earned by services rendered to merchandise exports, they depend primarily on the volume of merchandise exports. Second, price indices and world export shares for different countries are not available. Therefore, it was not feasible to use relative price variables in the equations. In this event, the nonlinear functional form is not applicable. Instead we utilize a simple linear function of exports on the relevant demand variable. The equation results are displayed on Table 6.4.

Table 6.4: Summary of Service Export Regression Results
(t statistics in parentheses)

Sector	Constant	Demand	Demand elast[1]	Dummy	Rbarsq	Rho	1989 exports
28 Retail & wholesale trade	8.229 (-1.95)	0.059 (22.76)	1.01		.97	.68	153.055
30 Highway & RR transport	-0.631 (-0.74)	.0115 (19.33)	0.71	13.203[2] (12.26)	.99	.38	42.680
31 Air & water transport	82.909 (9.56)	0.062 (11.70)	0.66		.88	.39	245.682
32 Services assoc. with transport	9.411 (2.90)	0.023 (11.55)	0.85		.88	.45	70.836
33 Communications	-36.476 (-3.38)	0.458 (4.13)	3.38		.46	.61	16.150
34 Banking & insur.	-36.885 (-5.03)	0.630 (8.07)	1.41	16.019[2] (6.22)	.94	.46	53.409
35 Business serv.	-79.857 (-6.92)	1.193 (10.06)	2.60		.84	.40	54.629
39 Other private services	0.578 (0.47)	.061 (5.71)	0.93		.94	-.50	7.832

Notes: 1 Demand elasticities computed at 1989 export and demand values.
2 dummy = 1 for 1987 through 1989, 0 all other years.

For Wholesale and retail trade (28), Highway and rail transport (30), Air and water transport (31), and Services associated with transport (32), the demand variable is merchandise exports. An EC integration dummy is also highly significant for Highway and rail transport. These equations explain the variables well. For the other sectors, Communications (33), Banking and insurance (34), Business services (35) and Other private services (39), external demand is represented by a variable which is simply a weighted (50-50) index of the Gross domestic products of the United Kingdom and Federal Republic of Germany. The variable is forecasted using the GDP projection taken from the German model of the INFORUM international system. An EC integration dummy is used for Banking and insurance. The fits for each of these sectors, except for Communications, are very good.

Table 6.5: Export Elasticity Comparisons between
Fernandez-Sebastián (1989) and the MIDE Model.

	Total	Non-energy	Energy	Merchandise	Services
Demand elasticities					
MIDE Model	1.33	1.39	0.82	1.40	1.07
Fernandez-Sebastián (a)	1.78				
Price elasticities					
MIDE Model (b)	-0.80	-0.92	-0.05		
Fernandez-Sebastián (c)	-0.87				

(a) - world trade index
(b) - merchandise exports only
(c) - domestic vs. world price index

Table 6.5 displays aggregate elasticities for the results given here, again using 1989 weights. While recognizing that the nature of the respective demand variables are very different, I include results for one of the Fernandez and Sebastián aggregate export equations. They estimated five equations, each corresponding to different combinations of international trade and price indices (world, industrialized countries and EC countries). For the comparison, I chose the equation using the world trade and price indices. Notably, the weighted MIDE model total price elasticity (-.80) is lower than the FS result. If energy exports (mostly refined petroleum products) is taken out, it rises to -.924.

Tourism Imports and Exports

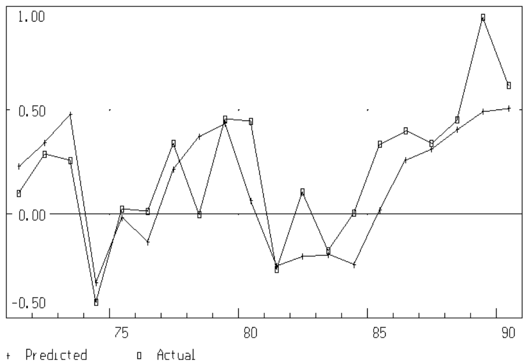
The MIDE model equation for real, per capita Exterior consumption by Spanish residents (tourism imports) is specified in first differences. It does not have an intercept. The explanatory variables are the current and lagged differences in real per capita household disposable income, the difference in the moving average of the relative price, and a dummy from 1974 through 1976. The relative price is the price index for the dependent variable from the national accounts divided by the price index for Private interior consumption. The moving average weights are .3 in the current year, .5 for the last year, and .2 for two years ago. The MIDE model projects the price index of tourism imports with a simple regression equation using a two period weighted average of the exchange-rate-adjusted German and UK consumption deflators. The deflator is forecasted with the German consumption deflator from the INFORUM system German model. The dummy variable reflects the oil crisis and the political turmoil surrounding Franco's death. The combination of these events generated a decline in the outflow of tourists. The equation results, statistics and regression plot for are shown in the top half of Figure 6.3. A second graph displays the estimation in the level of Exterior consumption using the actual lagged value of the dependent variable as the base for computing the current predicted value.

The tourism export equation is similar to the import equation. The first difference of the variable depends on a constant, the first difference of a demand index and the first difference of a two-period moving average relative price. The weights on the moving average are .4 for the current year and .6 for the previous year. Spanish tourism exports depend to a large extent on the inflow of German and British tourists. While the numbers of French and Portuguese visitors is larger, most of these make only day trips. The Germans and British tend to fly in to the holiday resorts and stay for a week or more. The demand variable for tourism exports, therefore, is the weighted index between the UK and German GDP (the same variable used for the service export equations). The denominator of the relative price is the same variable which projects the tourism import price (combined German-UK consumption price deflator). The bottom half of Figure 6.3 displays the regression results. While the general results are disappointing, the equation did capture the sharp decline in 1989 and 1990. The striking result from both equations, especially the export equation, is the powerful influence exerted by the relative price variables.

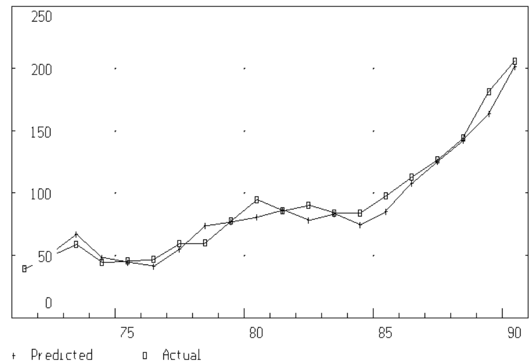
Figure 6.3: Estimation Results for Imports and Exports of Tourism, 1971-90

Exterior consumption by Spanish residents (imports)

Predicted vs. actual in first differences



Predicted vs. actual in levels

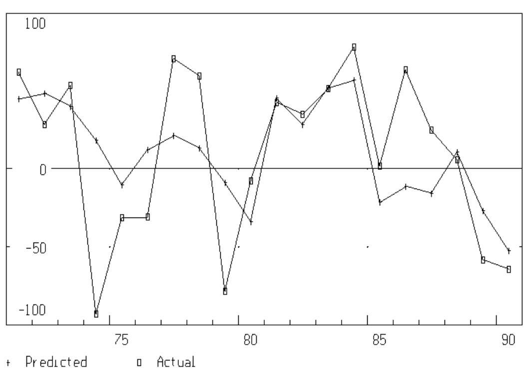


SEE = 0.21 RSQ = 0.5356 RHO = 0.25 Obser = 20 from 1971
SEE+1 = 0.21 RBSQ = 0.4485 DW = 1.50 DoFree = 16 to 1990
MAPE = 1016.25

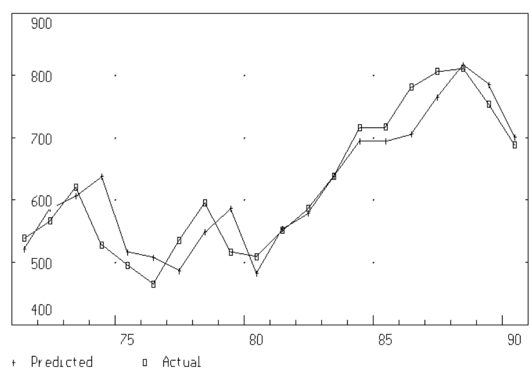
Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 dimptourpc	- - - - -	- - - -	- - - -	- - - -	0.21
1 dYpc	0.0096	3.2	1.026	0.28	6.16
2 dYpc(t-1)	0.0118	3.0	0.992	0.32	5.66
3 dmarelprice	-4.5799	23.2	-2.878	0.44	-0.02
4 dum74-76	-0.4132	33.0	-3.507	-0.39	0.20

Domestic consumption by non-residents (exports)

Predicted vs. actual in first differences



Predicted vs. actual in levels



SEE = 41.96 RSQ = 0.3558 RHO = 0.06 Obser = 20 from 1971
SEE+1 = 41.91 RBSQ = 0.2800 DW = 1.89 DoFree = 17 to 1990
MAPE = 136.40

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 dexptour	- - - - -	- - - -	- - - -	- - - -	10.63
1 intercept	54.2929	18.2	2.600	5.11	1.00
2 ddem (UK&Germ)	2.0288	0.3	0.340	0.46	2.40
3 dmarelprice	-9.9750	23.9	-3.015	-4.57	4.87

6.2 Productivity and Employment

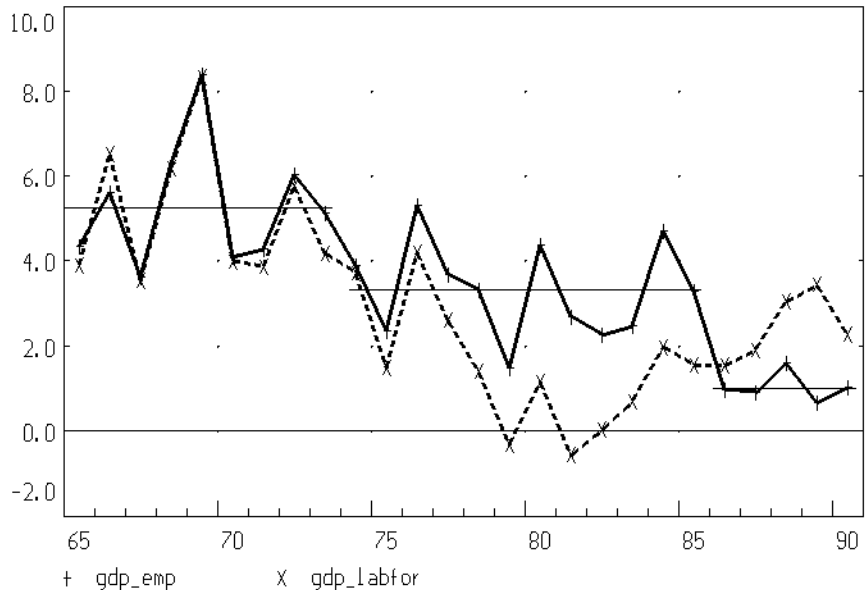
Productivity growth is a crucial issue in any discussion of economic development and policy. The productivity level determines the competitive standing of and the relative level of living standards in an economy. Paul Krugman (1990) expressed this fact by saying, "Productivity isn't everything, but in the long run it is almost everything" (p.9). Economists have long conceded that it is difficult to quantify the underlying factors contributing to productivity growth. Solow's famous empirical results on the origins of growth estimated that technical progress, an admittedly ambiguous concept, accounted for about half of the growth in per capita output. It is clear that growth is the result of many interrelated factors such as age, composition and expansion of the capital stock; the educational level, experience and abilities of the labor force; research and development efforts; and the exploitation of economies of scale. The output composition of an economy also influences productivity growth. Some industries display consistently healthy productivity growth; others, consistently slow growth; and still others, quite variable growth. Therefore, an interindustry modeling approach provides a particularly convenient framework for examining the questions surrounding the course of productivity performance.

Sectoral labor productivity in the MIDE model is a simple variable: constant-price output divided by the total hours worked by all workers, including the self-employed. This concept is different from total factor productivity which is net of increased output contributed by additional capital and intermediate goods, as well as additional labor inputs. Total factor productivity growth is a more appropriate measure of the additional output resulting from technical progress, economies of scale, increased know-how, and other factors. However, since the primary role of productivity in the MIDE model is to determine the amount of employment in each industry, labor productivity is the variable modeled.

After generating estimates for sectoral labor productivity, the MIDE model computes sectoral employment in hours worked by dividing output by the productivity estimate. The model also contains sectoral equations to estimate the average annual hours worked per worker. Dividing this figure into the total hours worked in the industry provides the total jobs in each industry. Sectoral employment affects the computation of wages. If labor productivity in a certain sector increases at a rate high enough to decrease the unit labor costs in that sector, the relative price of its product will fall and, demand for the product will increase. Moreover, total employment (via the unemployment rate) enters into the aggregate wage index equation. In this equation, productivity growth decreases wage pressure because it reduces labor requirements. This reduction in inflationary pressures increases real income and aggregate demand, allowing for faster growth in the economy as a whole. Therefore, as in the real economy, productivity plays a key role for determining real economic growth in the model. Before discussing the sectoral level behavioral of productivity, however, some remarks on aggregate labor productivity are in order.

Since 1960, average annual labor productivity growth (measured as GDP over employment) in Spain has been substantially higher than in the rest of the OECD (Larre and Torres, 1991). This tendency is consistent with theoretical expectations. Neoclassical growth models conclude that a nation starting from lower levels of productivity will catch-up to the levels of more advanced nations. Lower relative levels of labor productivity imply a higher return on capital, which will induce flows of labor-augmenting capital investment from more productive countries. Moreover, this investment normally embodies more advanced technology than that already existing in the country. The upshot of this theory is that convergence in living standards (real convergence as defined in Chapter 2) between less developed and developed countries is a spontaneous process. However, various institutional

Figure 6.4: Productivity growth: GDP/employment vs. GDP/labor force, 1965-90.
(Annual percentage change)



factors, such as political turmoil, undeveloped market mechanisms, inadequate educational systems or social rigidities caused by the prevalence of interest groups, can prevent the diffusion of technological progress and delay or cancel the catch-up process. The Spanish economy of the last thirty years illustrates an interesting case in this context.

Figure 6.4 displays the percentage growth in both the GDP to employment ratio (solid line marked with the "+"), a traditional measure of total labor productivity, and the GDP to labor force ratio (dashed line marked with the "x") for the years 1965 through 1990. Focussing on the former, we can distinguish three distinct periods of growth: 1965 through 1973, where labor productivity growth average 5.3 percent per year; 1975 through 1985, 3.3 percent per year; and 1986 through 1990, 1.0 percent per year. The averages are marked on the graph with horizontal lines. The story illustrated by the first two periods coincides with developments in the rest of the industrialized countries during the same span of time. Starting sometime in the early 1970’s, productivity growth stagnated across the world, in contrast to the very high rates of growth displayed from 1945. Spain was not immune to this phenomena. As explained in Chapter 2, various international economic and domestic political circumstances contributed to a general stagnation of the economy from 1975 through 85. What is curious about Spain, however, is the significant fall in productivity growth which started in 1986 (Figure 6.4). This decline started at the very time that the economy began to expand.

Another description of the story is given by the second line of Figure 6.4, which depicts the growth in the GDP to labor force ratio. It illustrates that the productivity problem of the economic crisis, especially from 1977, was much worse if we consider the utilization of labor. The difference between the two lines suggests that the economy maintained labor productivity growth precisely because employment fell. Explanations for this phenomena are many and complex. It is evident, however, that stagnation of demand led to the idling of the least efficient plant and equipment. The accompanying job losses, therefore, were of relatively less productive positions. Moreover, the political climate, large rates of inflation, and the rigid regulation of the labor market created an unfavorable environment for the formation of employment. Various studies conclude that throughout the 1970's, productive investment tended to favor capital intensive techniques because of the accelerating real costs of labor and the high fixed costs of hiring (Ballabriga et al. 1990; Malo de Molina 1990). Moderation of labor cost growth in the early 1980's did not change the story because capital formation was anemic, and government sponsored restructuring gave over-staffed industries the opportunity to increase productivity by releasing workers.

Continuing labor market reforms initiated by the Moncloa Pacts of 1977 and the *Estatuto de los Trabajadores* (Worker's Statute) of 1980 have gradually decreased the rigidities in the labor market. Probably the most significant aspect of this reform was the introduction of fixed-term employment contracts as opposed to the permanent employment contracts. The existence of these contracts opened the door for part-time work and employment-training programs, which were previously nonexistent. These arrangements increase the flexibility of the labor market and reduce the fixed costs of hiring. Although they apply to new jobs only, by 1990 almost thirty percent of new jobs were covered under these contracts (Jimeno and Meixide 1991). More competition and flexibility in the labor markets suppresses excess wage growth and encourages capital formation in line with the relative factor endowments. Therefore, when economic growth started to pick up in 1986, the growth of aggregate labor productivity, paradoxically, fell dramatically. Rather than being a negative development, the employment creation and renewed growth of labor force productivity shows that the economy is providing a more favorable environment for the increase in living standards. On the other hand, one percent growth of labor productivity is certainly not a figure which encourages contentment. The hopeful expectation is that once the labor market tightens, firms will again find it profitable to invest in labor-saving production techniques that will again boost Spanish productivity growth above the developed world average.

Labor Productivity

All previous examinations of industrial level productivity for the Spanish economy used either annual output, or more commonly value added, divided by annual employment (number of workers) as the measure of labor productivity (see, for example, Segura et al. 1989, Martín Marcos 1990 and Treadway 1990a). This is the most convenient method since reliable employment data is available from the *Encuesta Población Activa* (Labor Force Survey) of the Instituto Nacional de Estadística (INE). However, employment is an inaccurate measure of labor input because annual hours per worker tend to fluctuate from year to year. More important, hours per worker year have displayed a strong tendency to decrease over time. Because of this tendency, previous studies have underestimated labor productivity growth.

This work attempts to measure and analyze productivity growth in terms of output per hours worked. The sectoral hours worked figures are acquired by multiplying employment by the annual hours worked by employee. The endeavor is complicated by the lack of disaggregated data on hours. The *Encuesta de Salarios* (Wage Survey) of the INE is the best source of such data. It publishes a quarterly figure of the average monthly hours worked for that quarter. In 1989, the Wage Survey began to publish hours worked data at a sufficient disaggregation for MIDE's sectoral scheme. Previous to then, published data enumerated only 17 sectors. The collection of the data suffered several methodological breaks, which made it difficult to compare data from different periods. However, Carbajo and Perea (1987) homogenized the series to provide continuous time series from 1963 for each of the 17 sectors. In order to reach hours worked per year for each of the MIDE sectors, I assumed that the annualized Carbajo and Perea data is the same for the MIDE sectors covered by a single Wage Survey sector. For example, the Wage Survey published one figure for the food processing, beverage and tobacco industries. Therefore, the corresponding MIDE sectors (15-19) have identical series for annual hours worked per worker.

This assumption probably distorts productivity estimates for individual sectors over production cycles. However, it goes a long way towards reducing the downward bias in productivity growth produced by using output over employment productivity measures. If the downward trend in annual hours worked per worker were a simple linear function, the productivity bias would not have was serious consequences for employment projections. This is because the effect of the work-year trend would be captured by the time-trend variable in the equation explaining productivity growth. As explained below, however, the downward trend in annual hours has recently been moderating. Therefore, if the MIDE model does not explicitly consider the non-linearities in the trend, productivity projections assuming a linear inclination of hours worked would overstate growth. Over a long period, this would have serious repercussions for the computation of employment.

Theoretical approaches for determining labor required per unit of output use various production functions which include other factors of production, especially the capital stock, to estimate own and cross-price elasticities of demand for labor. Therefore, labor productivity becomes a function of all the factor prices. Unfortunately, the lack of industry level capital stock data for the Spanish economy prevents me from taking such approach. At any rate, when production-function-based labor demand equations are used in multisectoral models, a time trend term is inevitably included in order to account for technical progress. Often, the time trend becomes the overriding explanatory variable and the price elasticity terms are insignificant (Almon, et.al. 1974, pp.173-177). Other INFORUM models have normally modeled labor productivity specification as a simple function of time and output (see, for example, Werling 1989). While lacking in microeconomic theoretical content, the approach is simple, easy to implement, and provides well behaved and accurate employment predictions. This approach is used here.

The logarithm of labor productivity is projected using regression equations which include time and two output fluctuations as independent variables. The labor market upheaval which occurred during the estimation period makes any estimation of sectoral level productivity trends a difficult endeavor. Sectoral productivity trends have tended to follow a pattern similar to aggregate productivity. Growth in the late 70's and early 80's was very high, but started to rise at a declining rate in the mid-80's. In manufacturing, employment reduction effects of reconversion programs (most were completed or almost completed by 1986) have inflated productivity growth trends. For all the sectors, changes in wage-setting behavior since the 1977 and labor market reforms (see Chapters 2 and 7) have increased the attractiveness of labor relative to capital. Therefore, much of the recent investment has been capital augmenting, rather than labor augmenting. To capture this recent slowdown in productivity growth, the equations include a second time trend.

The output variables (*QDN* and *QUP*, below) are designed to capture the behavior of productivity over the business cycle. The source of cyclical fluctuations is straightforward. In the downward part of the cycle firms tend to keep standard hours and retain skilled workers on the payroll (i.e., labor hoarding), despite falling levels of output. In an upswing, output tends to rise faster than hours worked and new hiring. Therefore, productivity increases during an expansion and falls during a contraction. The equation includes two variables in order to estimate the asymmetrical nature of the productivity fluctuations. These variables are formed by subtracting the previous peak level of output, representing potential output, from the current period output. If this difference is positive, meaning that the industry is in an upswing, it becomes the QUP variable and QDN is zero. A negative difference, indicating that the industry is in recession, becomes the QDN variable and QUP is zero. Given the differing signs on QUP and QDN, both the d and e coefficients are expected to be positive. They also must be less than one. A coefficient greater than one would predict declining employment for production increases or increasing employment with production decreases.

Each industry equation is of the form:

$$\ln(Q_{i,t} / H_{i,t}) = a_i + b_i T1_t + c_i T2_t + d_i QDN_{i,t} + e_i QUP_{i,t}$$

where: $Q_{i,t}$ = output of sector i in period t,

$H_{i,t}$ = total hours worked,

$T1_t$ = a time trend covering the entire estimation period,

$T2_t$ = a time trend beginning in 1986,

$QDN_{i,t}$ = $\ln Q_{i,t} - \ln QPK_{i,t-1}$ when $QPK_{i,t-1} > Q_{i,t}$

= 0 when $QPK_{i,t-1} < Q_{i,t}$,

$QUP_{i,t}$ = $\ln Q_{i,t} - \ln QPK_{i,t-1}$ when $QPK_{i,t-1} < Q_{i,t}$

= 0 when $QPK_{i,t-1} > Q_{i,t}$,

$QPK_{i,t}$ = $Q_{i,t}$ when $Q_{i,t} > QPK_{i,t-1} * (1 - s_i)$

= $QPK_{i,t-1} * (1 - s_i)$ when $Q_{i,t} < QPK_{i,t-1} (1 - s_i)$.

The equations are fit for the period 1972 through 1989, except for sectors 36 through 43. For these service sectors, employment data is adequate for equations only from 1976 through 1989. Table 6.6 displays the estimated equation parameters, autocorrelation coefficients and adjusted R-squares of the regressions. Parameter significance statistics are not displayed, since the rather heavy use of soft constraints (explained below) renders them meaningless.

There is ample evidence of productivity growth slowdowns in most of the industries. For some sectors, it is also apparent that the slowdown began before 1986. Rather than embarking on a laborious, and somewhat arbitrary, search for the best breaking point, the second trend begins in 1986, except in one instance. For Communications (Sector 33), the second time trend starts in 1980 where a clear and strong change in the productivity trend occurred. In other sectors, the second time trend adds nothing to the fit of the equation, and, therefore, is not included (signified by a blank line under in the *c* column of Table 6.6). Given the logarithmic structure of the equation, the sum of the two time trend coefficients (*b* and *c*) is the exogenous rate of productivity growth used in the MIDE model. The total trend, in percent, is displayed in the fourth column of Table 6.6. Soft constraints are used where they conserve sensibility in the estimated trends. In every case, these constraints do little harm to the fit of the equation.

Differences between the *d* and *e* parameters of Table 6.6 indicate that asymmetry between the different stages of the business cycle does indeed exist. Unfortunately, for the estimation period of 1972-89, many sectors of the Spanish economy displayed a-cyclical productivity growth. As explained, the scrapping of older and inefficient plant during industrial reconversion led to productivity increases at the same time of production declines. However, the ultimate use of the equations will be for forecasting, when the economy, hopefully, will be experiencing less upheaval. It is reasonable to assume that future productivity growth will respond pro-cyclically to output fluctuations, and it is therefore important to integrate this property into the equations. One way of dealing with this problem is to decrease the peak, or potential output, of a restructuring sector by a constant proportion, shown above as the parameter s_i, each year. Industry equations using a non-zero s_i are noted in Table 6.6. Where this technique does not work (i.e., when unconstrained coefficients are negative or greater than one), soft constraints are used.

Electricity generation (Sector 5) and several service sectors (29, 36, 41-43) experienced stable output increases throughout the estimation period. Therefore, output fluctuation variables add nothing to the equation and are not included. Business services (Sector 35) is the only sector which displays a pervasive downward trend in productivity. While productivity growth in this sector is undoubtably slow, the problem lies with an unreliable

Table 6.6: Summary of Labor Productivity Equation Results

sector	const (a)	time1 (b)	time2 (c)	trend (%)	qup (d)	qdown (e)	rho	rbsq
1. Agric, f & f	-1.80	0.086	-0.026	6.06	0.142	0.053	.70	.99
2. Coal	-0.65	0.098	-0.053	4.50	0.497	0.504	.78	.92
3. Coke	2.21	0.042		4.18	0.849	0.496	.24	.91
4. Petroleum	3.41	0.036		3.64	0.580	0.594	.31	.83
5. Electricity	0.99	0.049	-0.017	3.18			.34	.94
6. Met mng, proc	1.31	0.061	-0.019	4.20	0.366	0.443	.49	.92
7. Nmet mng, proc	0.10	0.038	-0.018	1.93	0.300	0.278	.31	.95
8. Chemicals	0.34	0.063	-0.030	3.31	0.478	0.513	.07	.98
9. Met prod	0.04	0.024	-0.013	1.12	0.095	0.100	.18	.79
10. Ind mach	0.36	0.038	-0.019	1.93	0.267	0.204	.47	.82
11. Off mach	0.14	0.095	-0.037	5.75	0.526	0.592	.32	.91
12. Elect prod	0.05	0.057	-0.018	3.83	0.695	0.542	.47	.93
13. Motor veh	0.56	0.054	-0.010	4.41	0.299	0.731	.21	.97
14. Oth tran eq	0.46	0.020		2.00	0.621	0.841	.47	.94
15. Meat prod	1.60	0.024	-0.013	1.12	0.230	0.262	.63	.86
16. Dairy prod	1.22	0.023	-0.009	1.39	0.445	0.595	.49	.90
17. Oth food	0.14	0.072	-0.033	3.95	0.415	0.505	.75	.96
18. Beverages	0.19	0.070	-0.045	2.55	0.554	0.497	.78	.96
19. Tobacco	0.95	0.056	-0.029	2.71	0.740	0.572	.61	.95
20. Text & app	-0.38	0.032	-0.015	1.69	0.391	0.301	.53	.90
21. Leather prod	-0.60	0.063	-0.036	2.73	0.567	0.592	.69	.90
22. Wood prod	-0.48	0.027	-0.014	1.29	0.417	0.434	.74	.67
23. Pap & publ	-0.20	0.069	-0.059	1.04	0.593	0.096	.47	.93
24. Rub & plas	0.09	0.050	-0.003	4.70	0.722	0.799	.49	.94
25. Oth mfg prod	-0.97	0.109	-0.064	4.48	0.381	0.520	.59	.93
26. Construction	-0.19	0.040	-0.024	1.65	0.428	0.347	.18	.98
27. Rep & reconst	-0.31	0.033		3.32	0.656	0.511	.58	.87
28. Trade	-0.57	0.030	-0.013	1.70	0.151	0.479	.77	.92
29. Rest & hotels	0.07	0.032	-0.025	0.70			.57	.96
30. Int transport	-0.65	0.054	-0.024	3.00	0.499	0.497	.32	.98
31. Marit & air	0.31	0.062	-0.014	4.82	0.362	0.502	.20	.97
32. Transp serv	0.05	0.025		2.45	0.527	0.500	.54	.64
33. Communic	-1.09	0.155	-0.112*	4.00			.23	.99
34. Bank & insur	0.37	0.044	-0.022	2.23	0.563	0.496	.68	.94
35. Bus serv	0.52	0.020	-0.171	-15.11	0.987	-4.076	.32	.81
36. Rents	4.12	0.160	-0.089	7.10			.34	.75
37. Priv educ	-0.51	0.007		0.67	0.400	0.396	.11	.43
38. Priv health	-0.39	0.029	-0.002	2.64	0.563	0.458	.36	.80
39. Oth serv	-0.39	0.016	-0.011	0.57	0.414	0.515	.32	.64
40. Publ Adm	0.80	0.001		0.12			.24	-.05
41. Publ educ	-0.53	0.008		0.83			.21	.57
42. Publ health	-0.40	0.030		2.99			.41	.84
43. Dom serv	-1.72	0.006		0.63			-.34	.62

* - time2 begins in 1980.

Sectors where $s_i > 0$:
(see text)

i = 3	s_i = .025	i = 20	s_i = .05
i = 7	s_i = .03	i = 21	s_i = .05
i = 9	s_i = .05	i = 22	s_i = .05
i = 10	s_i = .05	i = 26	s_i = .05
i = 12	s_i = .02	i = 37	s_i = .01
i = 14	s_i = .03	i = 38	s_i = .01

output series. Continually decreasing productivity leads to a rapidly increasing and unreasonable employment forecast. In the MIDE model, therefore, the projections assume constant productivity equal the 1989 level. For Public administration (sector 40) hours worked are not published. Output over employment for the sector displays no underlying trend, and in fact has been stationary for many years. Therefore, employment in the sector is determined by multiplying the historic mean of the output to employment ratio by output.[9]

Annual Hours Worked per Employee

As in most nations, the number of hours in the average work-year for Spanish workers fell dramatically through the past thirty years. In the period from 1976 to 1989, the average hours worked per year declined from 2244 to 1835, a fall of over 18 percent. One way, then, to project the work year is to use a simple linear time trend. A measure of output fluctuation can be included in the specification to account for work-year fluctuations due to overtime in periods of high production and short-time in periods of low production.

However, the strong downward tendency of the work-year has begun to moderate over the past several years. There are reasons to expect this moderation to continue. Large expansions in participation by female workers and the coming of age of Spain's baby boom have just about been played out. Therefore, labor force growth is expected to slow for the rest of this century and beyond. The tighter labor market will prevent further reductions in the work week. Furthermore, the number of Spanish holidays and length of vacations already meet or exceed the standards in other EC countries. While expansion in the use of

[9] Note that since the output of public administration is exogenous government consumption, this method for determining government employment is equivalent to specifying it exogenously.

part-time labor may act to reduce the work week of the average worker, extrapolating the trends over the past two decades leads to 25-30 hour work weeks in several sectors. This is an implausible result.

The problem is handled by projecting the average work year using an exponential trend. This trend adequately captures the recent deceleration in the tendency of the work-year. It allows for further decreases in the work year by the year 2000, but at a much more reasonable rate. The forecast equations are of the form:

$$\ln HYR_{i,t} = a_i + b_i TREND_{i,t} + c_i DOUT_{i,t}$$

where: $HYR_{i,t}$ = average annual hours per worker in sector i at time t,

$$TREND_{i,t} = \left[\frac{\left(1 - \exp^{time \times \ln(1 - s_i)} \right)}{s_i} \right]$$

$DOUT_{i,t}$ = the first difference of the log of output.

The trend variable is an increasing function of time, and, therefore, the b_i parameter is negative. The higher the s_i parameter, the greater is the deceleration in the decrease of the work-year. The s_i is chosen with a subjective iterative procedure based on which parameter provides the best fit and a reasonable work year by the year 2000, given a change in output of zero. Most of the sectors reach 1600 to 1700 hours per year. These figures correspond to a 35 to 37 hour work week for a 46 week work year (52 weeks minus 4 weeks vacation and 2 weeks of holidays). For several service sectors, the s_i is considerably low. The low value results because increased use of part time labor in the sectors produces only a small deceleration of the downward trend. The equation includes the change in output variable to explain cyclical changes in the average work-year. It is not used for equations where the estimated parameter is negative or in those for which output has never, or rarely, declined in the estimation period (1975 through 1989).

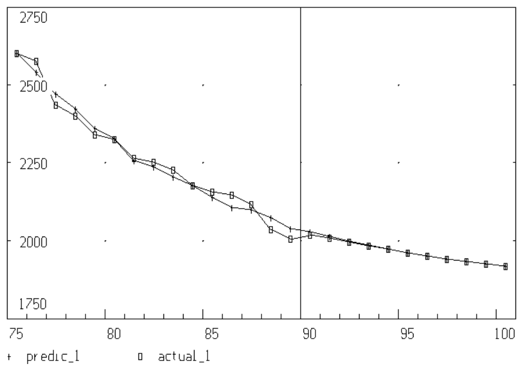
Table 6.7 summarizes the estimation results. The s_i parameter is displayed in the first column. A close examination of the table reveals that several sectors have identical or nearly identical parameter estimates (sectors 31 and 32 for example). This is because they are the same data series under our adaptation of the wage survey data. (Slight differences arise because the 1989 figure may be different because they are linked on to the previous series using the revised, more disaggregated, wage survey.) Figure 6.5 provides graphs showing examples of fits and forecasts for six of the most important sectors (by share of employment). The lines with the "+" are predicted values; those with the "■" are actual values. The projections through the year 2000 assume that the change in output is zero. The plots clearly show the desirability of using the exponential approach both for estimation and forecasting purposes.

Table 6.7: Summary of Hours per Worker-year Equations.

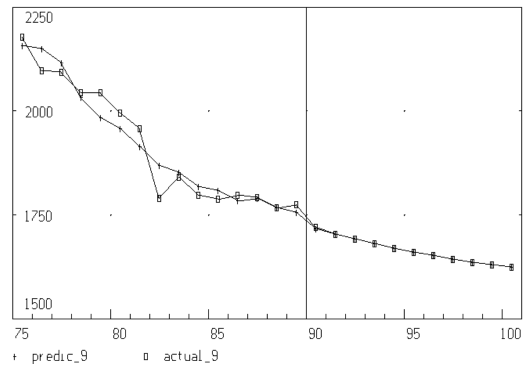
sector	s	const (a)	trend (b)	dq (c)	rho	rbsq
1. Agric, f & f	0.08	1.941	-0.107	0.082	.38	.98
2. Coal	0.03	0.487	-0.002	0.454	.13	.83
3. Coke	0.10	1.940	-0.158	0.059	.38	.88
4. Petroleum	0.08	1.781	-0.112	0.096	.39	.93
5. Electricity	0.12	1.889	-0.164	0.077	.38	.96
6. Met mng, proc	0.10	1.719	-0.122	0.041	.03	.97
7. Nmet mng, proc	0.08	1.596	-0.089		.52	.96
8. Chemicals	0.09	1.713	-0.109		.12	.95
9. Met prod	0.08	1.752	-0.105	0.150	.14	.93
10. Ind mach	0.09	1.911	-0.130	0.064	.15	.91
11. Off mach	0.10	2.014	-0.151		.43	.93
12. Elect prod	0.09	1.820	-0.120	0.007	.42	.93
13. Motor veh	0.10	1.348	-0.082	0.021	.41	.78
14. Oth tran eq	0.10	1.385	-0.086	0.026	.49	.79
15. Meat prod	0.10	2.228	-0.173	0.265	-.19	.99
16. Dairy prod	0.10	2.205	-0.170	0.094	.12	.98
17. Oth food	0.10	2.191	-0.168	0.058	.12	.98
18. Beverages	0.10	2.200	-0.169	0.005	.19	.97
19. Tobacco	0.10	2.195	-0.169	0.074	.39	.98
20. Text & app	0.08	1.640	-0.094		.44	.93
21. Leather prod	0.10	2.109	-0.161		-.01	.92
22. Wood prod	0.06	1.414	-0.059	0.085	.51	.83
23. Pap & publ	0.06	1.289	-0.052	0.053	.04	.95
24. Rub & plas	0.06	1.300	-0.053	0.051	.43	.89
25. Oth mfg prod	0.05	1.215	-0.042		.46	.90
26. Construction	0.08	1.720	-0.100	0.171	.37	.92
27. Rep & reconst	0.03	1.138	-0.027		.39	.97
28. Trade	0.03	1.140	-0.027		.36	.98
29. Rest & hotels	0.05	1.211	-0.036		.46	.98
30. Int transport	0.03	1.134	-0.026		.35	.97
31. Marit & air	0.03	1.134	-0.026		.35	.97
32. Transp serv	0.03	1.136	-0.026		.33	.97
33. Communic	0.03	1.140	-0.027		.36	.98
34. Bank & insur	0.05	0.936	-0.022		-.44	.97
35. Bus serv	0.10	1.262	-0.071		.19	.89
36. Rent	0.10	1.262	-0.071		.19	.89
37. Priv educ	0.03	0.870	-0.014		-.44	.95
38. Priv health	0.03	1.140	-0.027		.36	.98
39. Oth serv	0.03	1.138	-0.027		.39	.97
41. Publ educ	0.03	0.870	-0.014		-.44	.95
42. Publ health	0.03	1.140	-0.027		.36	.98
43. Dom serv	0.03	0.870	-0.014		-.44	.95

Figure 6.5: Regression Fits for Hours per Worker-year Equations.

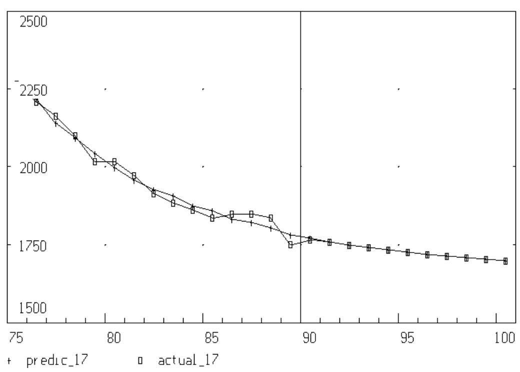
Sector 1: Agriculture, forest & fish., s = .08



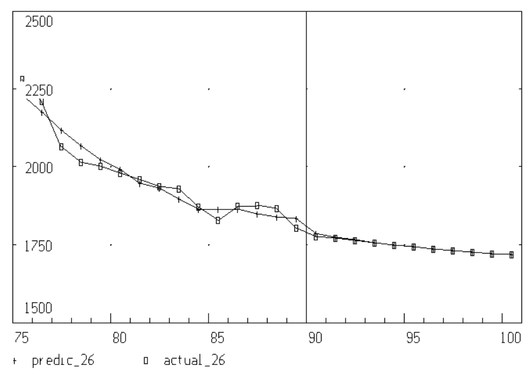
Sector 9: Metal products, s = .08



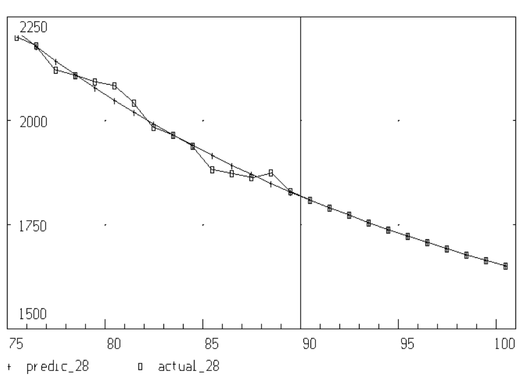
Sector 17: Other food products, s = .10



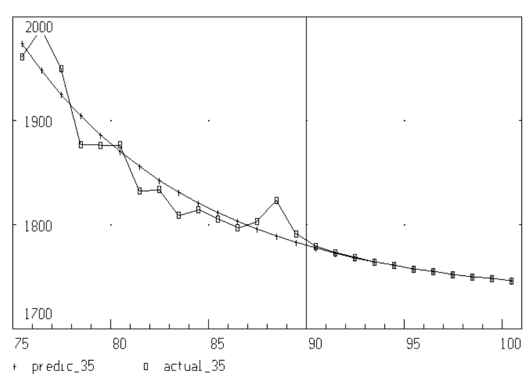
Sector 26: Construction, s = .08



Sector 28: Wholesale & retail trade, s = .03



Sector 35: Business services, s = .10



CHAPTER 7:

EQUATION SPECIFICATION AND ESTIMATION:

EMPLOYMENT AND CAPITAL INCOME

This chapter describes the determination of sectoral level, nominal labor and capital income of the MIDE model. The sum of this income, together with net indirect, import and value added taxes, yields the Gross Domestic Product in current prices. Moreover, sectoral labor and capital income are leading determinants of production prices.

Several different approaches have been used to determine industry level prices and incomes in macroeconomic multisectoral models. For example, the Cambridge multisectoral model (CMDM) of the United Kingdom projects industry wages, net taxes and price indices using behavioral functions. Once these quantities are determined, capital income (profits, capital consumption, interest) can then be computed using the input-output price equation, solved for the capital portion of value added (see Barker and Williamson 1987). The INFORUM group of models, however, predict each component of value added and then solve for industry prices using the input-output price equation in its familiar form (see Chapter 4). With this scheme, value added equations, especially gross profit equations, include many variables often found in price functions, such as changes in output or capital utilization. In comparison to models of other nations, the price-income block of MIDE is relatively simple. This simplicity was mandated by data constraints.

At the outset of this project, lack of data introduced serious problems for specification and estimation of the value added equations of the MIDE model. The 1980 Spanish input-output table distinguishes six types of value added for each sector: wages and salaries, social security taxes, capital income, indirect taxes and subsidies. However, the national accounts provide time series data for only three types of value added: gross wages (including social security taxes), capital income, and net indirect taxes (taxes minus subsidies). While attempts could be made to divide gross wages and net taxes over time, such procedures would necessitate an allocation which assumes that the proportion of each component, per sector, changed at the same rate as the aggregate (macroeconomic) component proportion. There is no reason to believe, especially in the case of taxes and subsidies, that this is a valid assumption. Therefore, the combined series for wages and net taxes, as published, are used in the MIDE model.

A second problem was that the value added series for wages and profits started only in 1980. The previous version of the national accounts (Base 1970) published the sum of wages and profits (value added at factor cost) and the total value added (value added at market prices) for each sector. More importantly, this data was at a substantially different aggregation than the 1980 table (Sanz 1989). Several attempts were made to homogenize the sectoral data at the level of value added at factor cost. However, complications due to overlapping sectoral definitions between the two versions of the national accounts could not be solved. The resulting series displayed peculiar behavior which led to serious problems for estimation. This approach was abandoned. Therefore, the available data for equation estimations spans the short period of 1980 through 1987, and the specifications are severely constrained by the lack of observations. Particularly, it is difficult to include the lagged effects of explanatory variables under this constraint. Distributed lags, for example, entail lost degrees of freedom. The profit equations cannot include the past values of labor costs because this also entails a reduction of equation observations.

Because of these problems, I have taken an approach designed to capture the most important influences on wages, profits and prices in the Spanish economy, while leaving other factors aside. For example, wage bargains between industry and labor in Spain are relatively centralized. Therefore, a simple Phillips curve equation for aggregate wages does much of the work to determine sectoral wages. With the opening of the Spanish economy to international trade, domestic price setting has become much more responsive to foreign competition. In the MIDE model, profit margins for tradeable goods depend to a large extent on the international prices of the goods. Despite the parsimonious nature of the price-income block of MIDE, it successfully accounts for the crucial determinants of prices in the economy.

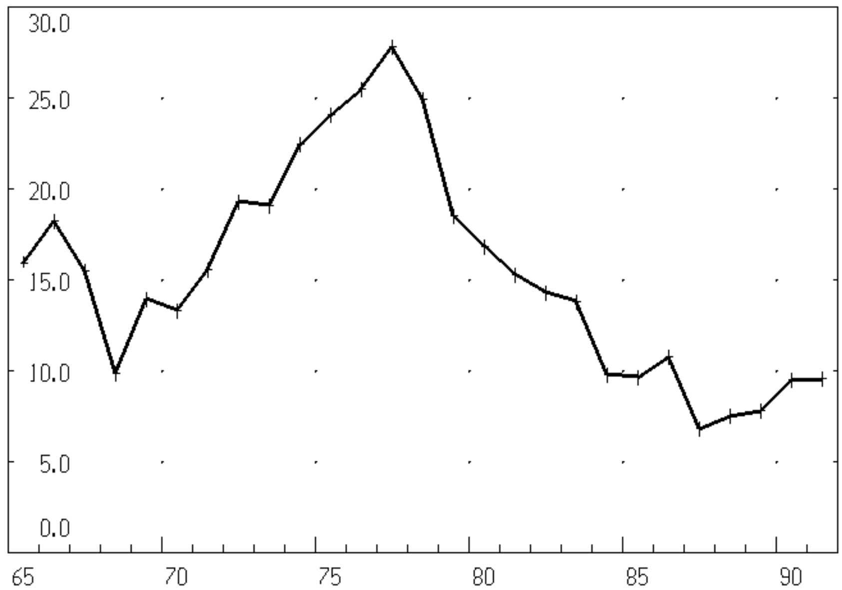
7.1 Employment Income

Before elaborating on the aggregate and industry wage functions, a brief comment covering wage setting institutions of the Spanish economy is in order. Under the Franco dictatorship, wages and working conditions were set by a process of collective bargaining dominated by government intervention (Toharia 1988; Jimeno and Meixide 1991). Officially, all employees were part of vertical unions comprising both labor and management. Even though unemployment was very low, real wage increases during this period tended to follow the growth of labor productivity. This system broke down in the early 1970's with the political turmoil surrounding the illness and death of Franco and the economic crisis following the oil price increase of 1973. Because of political upheaval, the monetary authorities attempted to avoid the real adjustments made necessary by the oil price shock and accommodated the ensuing inflation. Workers were able to demand, and receive, their traditional increases in real wages. However, since the oil price shock adversely effected productivity, the wage increases led to excess demand and more inflation.

As noted in Chapter 2, this inflationary spiral led to a severe crisis by 1977. Inflation was at an all time high, while GDP and employment growth were stagnant. The current account balance was in serious disequilibrium. The Moncloa Pacts of that year initiated a more tranquil transition to democracy which, among other things, resulted in a tremendous change in the system of labor relations. One major and immediate outcome of the Moncloa accord was the inclusion of wage setting guidelines intended to break with the tradition of full wage indexation. According to these guidelines, nominal wages should be increased along a forecasted (or expected) inflation rate set by the government. In 1978, nominal wage growth dropped sharply, a trend that continued for several years (Figure 7.1). By 1979, real wage growth was below average labor productivity growth, a feature which continued throughout the 1980's.

Currently, the main process for the determination of wages and employment conditions is collective bargaining. This dialogue is relatively centralized and takes place between representatives of the two major unions, the socialist Unión General de Trabajadores (UGT) and the Communist Comisiones Obereras (CCOO), and the main employers organization, the Confederación Española de Organizaciones Empresariales (CEOE). Wage negotiations throughout the early 1980's were characterized by a "social partnership" initiated by the Moncloa pacts. In this partnership, both management and labor representatives (always with the encouragement and sometimes with the cooperation of government) participated in economy wide agreements that set wage increase recommendations to be used for settlements at more decentralized levels. Wage settlements were generally in line with established recommendations, a fact that undoubtably influenced the wage moderation through 1986. Settlements were highly centralized according to industry (Jimeno and

Figure 7.1: Average Nominal Wage Growth, 1965-1991.
(Annual percentage change, total wages over total employment.)



Meixide 1991, p.16), and, the dispersion of wage increases across sectors was limited (Viñals 1989, p.170-71).

In recent years this system has broken down. As the 80's wore on, the unions became disenchanted with the economic policies of the Socialist government. Moreover, the resumption of growth in output and employment increased their bargaining power. The last year of an economy wide agreement between management and labor was 1986. Since 1978, annual aggregate nominal wage growth have been successively increased, and, in 1990, aggregate real wages outpaced average labor productivity for the first time since 1976.

In an attempt to reverse these trends, the national government attempted to reinstate the economy wide cooperation by concluding a Competitive Pact (Pacto de Competitividad) between itself, the trade unions and the employer organizations. However, in July of 1991 the trade unions withdrew from the negotiations. This short history of wage developments in the Spanish economy must be considered for the estimation of aggregate and sectoral wage functions for the MIDE model.

The Aggregate Wage Equation

The aggregate wage equation of the MIDE model computes the percentage change in the average wage, where the average wage is defined as total wage income, including social security taxes, over total employment.[1] In forecasting, however, the equation does not directly determine wage growth or total employment income. Rather, the average wage as predicted by the equation the primary explanatory variable in each of the sectoral wage equations. Therefore, while the current wage index implied by the aggregate equation drives the forecasts of sectoral wages, the total wage growth forecasted by the model will generally differ from the wage growth predicted by the aggregate equation. Nevertheless, because of its role in sectoral wage equations, the aggregate equation plays a key role for the determination of wages and prices.

The traditional explanation of wages is the Phillips curve approach, which relates wage inflation to unemployment, the expected value of price inflation, and productivity growth. A negative relationship with unemployment accounts for the fact that a slack labor market exerts downward pressure on wages. The inflation term describes the amount of indexation or "real wage resistance" in the labor market. An indexation term close to one signifies that workers consistently are able to resist decreases in real wages. Productivity growth is

[1] Normally, the dependent variable in wage equations is defined as the change in private sector wage income divided by the number of private sector workers. However, for Spain there is no data distinguishing government employment previous to 1976. Therefore, regressions using the conventional dependent variable could not be run if for periods previous to 1977. Therefore, the equations presented here use total wages over total employment.

included under the assumption that real wage growth should follow labor productivity increases. This specification should not include a constant term, since this would imply that there is some exogenous trend in wage growth. On the other hand, the equation could exclude productivity growth, and include an intercept. The intercept would then represent the long-run trend in real wages, which, presumably, would approximate the long-run trend in productivity growth.

There are myriad forms for this equation. I attempted several possibilities, testing each one for reasonability and robustness over several time periods. The specification of the unemployment variable was the most interesting problem. The use of the unemployment rate itself as the variable implies a linear relation between wage inflation and unemployment. Then, the effect on wage inflation is the same when unemployment decreases from 20 to 19 percent as it is when it changes from 2 to 1 percent. Since this linear relation seems improbable, early equation forms used the inverse of the employment rate. With this non-linear specification, the impact on wages is very strong at low rates of unemployment, but weak at unemployment rates above ten percent (Coe and Gagliardi 1985). I found neither of these variables plausible or very useful for explaining Spanish wage growth. Lags and moving averages of various measures were similarly useless.

Many modern estimations of the Phillips curve use the deviation of the unemployment rate from its "natural rate." Under this hypothesis, if actual unemployment exceeds the natural rate of unemployment the rate of growth of wages will decline, if unemployment is less than the natural rate, wage growth accelerates. Unfortunately, the quantitative determination of the natural rate is a subjective exercise. Many theories imply that the natural rate should follow past unemployment rates, including (Schultze 1986; Blanchard et al. 1985; Coe and Gagliardi 1985, Olson 1982):

1) Chronically high unemployment destroys human capital. Once this deterioration of skills of the "outsiders" begins, employed workers obtain more bargaining power. These "insiders" demand and receive real wages in excess of market clearing levels. The unemployed are priced out of the market. In response to the excessive wages, employers substitute capital for labor and the natural rate of unemployment rises.

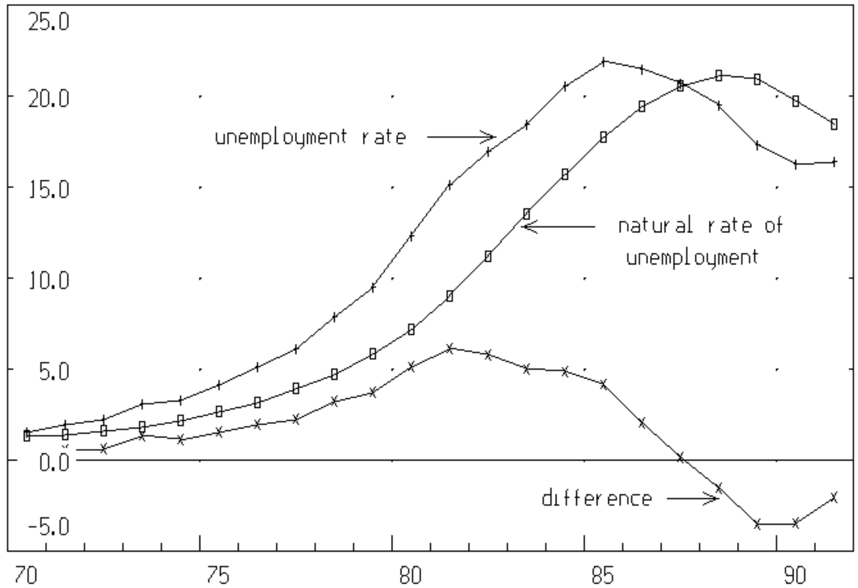
2) Normally, unemployment is accompanied by low aggregate demand. This low demand suppresses investment in capital, decreasing the ability of the economy to create jobs for a growing labor force. The natural rate rises.

3) High unemployment increase political pressure for more generous unemployment benefits, increasing the reservation wage of unemployed persons. This decrease in the labor supply increases the market clearing wage. Progressively higher rates of unemployment are needed to suppress the wage inflation.

The implication of this hypothesis of "hysteresis" is that as the natural rate catches up to the actual rate of unemployment, the deflationary (inflationary) impact of a given gap between the two rates will disappear. This possibility is consistent with the Spanish experience in the late 1970's and early 80's. While unemployment dramatically increased from around 5 percent in 1977 to over 22 in 1985, wage inflation decreased equally impressively from 28 percent to 9.6 percent. Consumer inflation decreased from 24 percent to 8.2 percent in the same period. In 1986 and 1987, the economy experienced both decreases in employment and inflation. However, by 1988 when the unemployment rate was down less than 4 points from its peak, to 19.5 percent, both wage and consumer inflation started rising again. The acceleration in wage inflation continued through 1990, but decelerated in 1991. Of course, there are many ingredients contributing to these results, but the story is broadly consistent with the hysteresis hypothesis.

Coe and Gagliardi (1985) suggest using the lagged four year moving average of the unemployment rate to proxy the natural rate. Figure 7.2 contains graphs for the natural rate

Figure 7.2: The Unemployment Rate and Its
Lagged Four Year Moving Average, 1970-91.



under this definition, the actual unemployment rate, and the difference between the two for the Spanish economy in the years 1970-91. If the natural rate followed the unemployment rate in the fashion displayed by the figure, the two were equal in 1987 and the unemployment rate was less than the natural rate by 1988. This figure suggests that the natural rate hypothesis applies, because 1988 is the year of renewed wage inflation. Moreover, in 1991 when the unemployment rate did not change, the gap between the unemployment and the natural rate closed. As noted above, wage inflation decelerated in that year.

Techniques for estimating the natural rate of unemployment vary. Recently, Poret (1990) estimated Phillips curve equations for OECD countries. He estimating the natural rate by smoothing passed values of the unemployment using the Hodrick-Prescott filter, a statistical device which attempts to separate the permanent and transitory components of nonstationary time series (Poret 1991, p. 23). Other authors note the importance of adjusting the rate by the growth in capital stock. However, I have chosen the quantity shown in Figure 7.2, the lagged four year moving average of the unemployment. It is a simple variable to interpret and to construct, and it is easily derived from a forecasting model.

The specification for the expected inflation variable is another interesting question. The common approach is to use "adaptive expectations", where the inflation expectation variable is modeled as a distribution of passed and current inflation. The problem with this technique is that it implies that expectations are sub-optimal because workers ignore available information concerning future inflation. Under the hypothesis of rational expectations, several authors have used one-period ahead inflation forecasts for the expectations variable (see, for example, McCallum, 1976). Poret (1990), again using the Hodrick-Prescott filter, integrated both backward and forward inflation rates into the inflation expectation variable. However, the implementation of forward looking techniques in large macroeconomic models, while feasible, requires the adoption of computational algorithms more complicated than those used by the MIDE model (Taylor 1988). The benefits of using forward-looking expectations are not worth the costs. According to Poret (1990, p. 24):

> Although this approach (rational expectations) has proven successful in explaining wage behavior, it has not demonstrated to have significantly greater predictive power than adaptive-expectation models.

Of his own technique, Poret states that the standard errors of most of the equations using the Hodrick-Prescott smoothed inflation were "somewhat smaller" than standard errors from equations using adaptive expectations. He concludes, "... the forward-looking smoothing hypothesis is at least as good as the adaptive approach" (p.25). This conclusion is not exactly a ringing endorsement. The MIDE model, therefore, uses the adaptive expectations approach.

For expected inflation, the MIDE equation uses the current and lagged moving average of inflation. In Spain, wage bargains covering the current year are normally made in the latter half of the previous year. Indexation is often, and especially after 1978, based on the inflation forecasted by the government. Under the "social partnership" system implemented by the Moncloa Pacts, if, by mid year, consumer price inflation exceeds this forecast, wages can be increased to make up the difference (Toharia 1989, p. 134). This "semi-indexation" system makes it important to include current inflation in the expected inflation variable.

The MIDE equation does not include a labor productivity variable. The significance of the variable was low in all cases, and its behavior in the estimations was very spurious. For some regression periods the coefficients were negative, for others they were significantly greater than one. This was also true for several formulations of the equation and when average wages and productivity were defined for only the private sector. Instead, the equation includes a constant term. The coefficient on this term is a proxy for trend productivity. The sectoral wage equations contain sectoral specific labor productivity variables. Here, productivity is more relevant and displays greater explanatory abilities.

In summary, the final aggregate wage equation is:

$$\dot{W}_t = a + b\,(\dot{PC}_t + \dot{PC}_{t-1}) \times \tfrac{1}{2} + c(U_t - U_t^*)$$

where: $\dot{W}_t$ = the percentage change in total wage income (including social taxes) over total employment for period *t*,

$\dot{PC}_t$ = the percentage change in the private consumption price deflator,

U_t = the unemployment rate in percent, and

U_t^* = $\tfrac{1}{4}\sum_{k=1}^{4} U_{t-k}$, the natural unemployment rate.

In order to assure reasonable long-run properties, the coefficient on the inflation expectation term is softly constrained to equal one. Figure 7.3 displays the regression results. The equation provides a reasonable explanation Spanish wages for the period covering the 70's and 80's. However, as one might expect given the history of Spanish wage formation sketched above, the magnitude of the regression coefficients and the goodness of fit are highly sensitive to the estimation period.

The first regression shown in Figure 7.3 covers the period of 1970 through 1990. Indexation dominated wage formation in the 70s, and labor successfully resisted decreases in real wage growth despite decreases in labor productivity growth. Because of this "real wage rigidity" the equation yields an unconstrained coefficient on inflation expectations of 1.25. The intercept parameter of the unconstrained equation is only 2.62, close to the average productivity growth rate of the period, which was 3.08 percent. The constraint required to obtain an inflation coefficient equal to one in this equation was very hard, and the intercept receives the bulk of the explanatory power. The coefficient on the intercept, 4.7, exceeds the average productivity growth by a large margin. Moreover, the equation fails miserably in explaining wage inflation in the 80's.

As stressed above, the transformation of labor relations, initiated by the transition to democracy and the Moncloa pacts, produced important changes for wage setting in the Spanish economy. This clear break in behavior mandates the use of an equation estimated over a more recent period. The second regression displayed in Figure 7.3 displays the equation estimated from 1980-90. The fit of the equation is much better and the data more readily accepts the constraint on the inflation parameter (the trade-off of the fit to conformity of the constraint is 10 times less). The average productivity growth during the period was 2.27, the coefficient on the intercept is one point below this.

Figure 7.3: Estimation Results for Aggregate Wage Equation.

Equation 1: 1970 - 1990

SEE = 3.77	RSQ = 0.64	RHO = 0.88
SEE+1 = 1.99	RBSQ = 0.60	DW = 0.24
MAPE = 26.73	Obser = 21	DoFree = 18

Variable name	Reg-Coef	Mexval	t-value	Mean
0 Avg. Wage (% change)	- - - - - - - - - - - - - - - - -			15.79
1 intercept	4.700	28.9	3.47	1.00
2 Inflation (2yr. ma.)	1.033	*	*	11.90
3 Unrat. - Nat Unrat.	-0.612	8.4	-1.78	1.94

Equation 2: 1980 - 1990, no dummy

SEE = 0.94	RSQ = 0.92	RHO =-0.42
SEE+1 = 0.84	RBSQ = 0.90	DW = 2.83
MAPE = 7.89	Obser = 11	DoFree = 8

Variable name	Reg-Coef	Mexval	t-value	Mean
0 Avg. Wage (% change)	- - - - - - - - - - - - - - - - -			11.05
1 intercept	1.026	8.4	1.19	1.00
2 Inflation (2yr. ma.)	1.031	*	*	10.40
3 Unrat. - Nat Unrat.	-0.318	31.3	-2.42	2.22

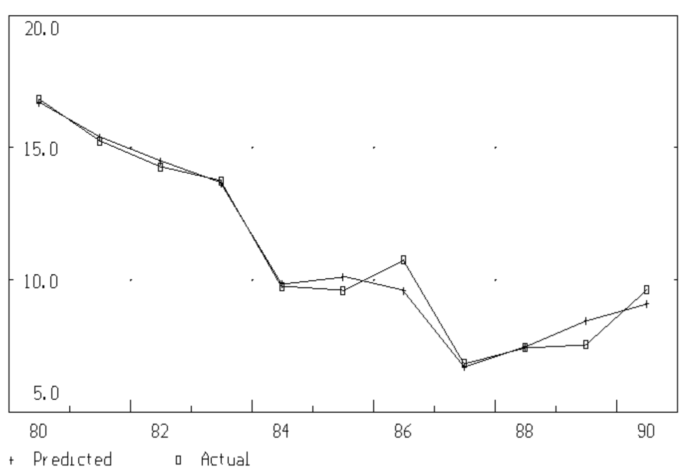
Equation 3: 1980 - 1990, with dummy

SEE = 0.51	RSQ = 0.98	RHO = -0.27
SEE+1 = 0.48	RBSQ = 0.96	DW = 2.54
MAPE = 3.70	Obser = 11	DoFree = 7

Variable name	Reg-Coef	Mexval	t-value	Mean
0 Avg. Wage (% change)	- - - - - - - - - - - - - - - - -			11.05
1 intercept	1.693	57.6	3.22	1.00
2 Inflation (2yr. ma.)	0.995	*	*	10.40
3 Unrat. - Nat Unrat.	-0.274	67.7	-3.56	2.22
4 Dummy 84 & 87	-2.103	85.3	-4.13	0.18

*** - indicates constrained coefficient.**

Predicted vs. Actual, 1980-90 w/dummy



The third equation of Figure 7.3 is the same as the second with one modification, a dummy variable to account for two years where economy-wide wage agreements were not in effect. The first one was 1984. Curiously, nominal wage growth fell precipitously in that year. In mid-1984, an agreement was signed covering 1985-86. Since then, no agreement has been in force. The first year of the latter period, 1987, also saw a steep fall in nominal wages. The inclusion of the dummy variable cuts the mean absolute percentage error (MAPE) by over four points. It also increases the intercept term so that it is now closer to average productivity growth. This is the equation used in the MIDE model.

Sectoral Wage Equations

To determine industry level wages and salaries (gross employment income, including social security taxes paid by the employer), the MIDE model computes an index for wages by employee (1980 = 1.0), converts this index to current price pesetas, and multiplies this amount by the number of employees. The explanatory variables for each of the index equations is the aggregate wage compensation index and the sectoral labor productivity per worker. Specifically:

$$\ln\left(\frac{W_{i,t}/L_{i,t}}{W_{i,80}/L_{i,80}}\right) = a_i + b_i \ln\left(\frac{W_t/L_t}{W_{80}/L_{80}}\right) + c_i \ln\left(\frac{Q_{i,t}}{L_{i,t}}\right)$$

where: $W_{i,t}$ = total employment income for sector *i* and period *t*,

$L_{i,t}$ = employment in persons,

W_t = aggregate employment income,

L_t = aggregate employment in persons,

$Q_{i,t}$ = output of sector *i* in period.

The regression results are displayed in Table 7.1. If the industry level productivity variable yielded a negative coefficient, it was left out of the equation. This occurs for three sectors, Electricity (Sector 5), Beverages (18) and Construction (26). According to the R-squares and t-statistics displayed by these results, the aggregate wage index goes a long way toward explaining the behavior of sectoral wages. This is consistent with the conclusions of Viñals et al. (1989, p. 170).

7.2 Capital Income

The second component of industry value added in the MIDE model is capital income, or gross profits, for both corporations and proprietors. A large portion of capital income is net profits which tends to be cyclically volatile. It also includes more stable items such as capital consumption, net interest payments by business, business transfer payments (pension and severance benefits), and rental income (including the imputed rent from owner-occupied dwellings). Net interest and depreciation move fairly steadily over the business cycle. Profits and proprietor income, on the other hand, are prime indicators of business cycle movement. Therefore, it is normally appropriate to model these components separately (Monaco 1991). However, since the available data does not provide the allocation of these parts at a sectoral level, the MIDE model includes industry level equations for total capital income. Capital consumption, interest and transfer payments are then modeled at the aggregate level.

Unlike labor compensation, profit movements are not uniform across branches of activity. Moreover, the factors affecting profits vary across industries. This fact emphasizes the vital role that profits play in the MIDE model. Recall that, through the sectoral price identity, the various components of value added are an integral part of price determination.

Table 7.1: Summary of Sectoral Wage Equations.
(t statistics in parentheses)

sector	const (a)	aggreg. wage (b)	labor prod. (c)	rho	rbsq
1. Agric, f & f	-1.938 (112.)	0.721 (13.7)	0.819 (7.5)	-.46	.99
2. Coal	0.137 (1.0)	0.945 (16.1)	0.209 (1.5)	.35	.99
3. Coke	-1.026 (1.2)	0.968 (13.2)	0.430 (1.6)	-.17	.97
4. Petroleum	-1.665 (1.9)	0.776 (7.6)	0.479 (2.3)	.31	.92
5. Electricity	0.376 (21.2)	1.092 (29.9)		.20	.99
6. Met mng, proc	-1.760 (4.2)	0.694 (13.7)	0.872 (5.3)	.03	.99
7. Nmet prod	-0.783 (1.0)	0.759 (3.4)	0.554 (0.7)	-.31	.99
8. Chemicals	-0.831 (3.7)	0.841 (12.0)	0.504 (3.5)	-.19	.99
9. Met prod	-1.030 (12.7)	0.788 (72.9)	0.840 (9.8)	-.38	.99
10. Ind mach	-0.927 (6.0)	0.717 (13.3)	0.713 (6.1)	.48	.99
11. Off mach	-0.657 (1.9)	0.452 (1.3)	0.486 (2.0)	.23	.90
12. Elect prod	-0.661 (2.5)	0.846 (8.3)	0.559 (2.5)	.41	.98
13. Motor veh	-0.524 (2.4)	0.773 (10.1)	0.423 (3.0)	-.13	.99
14. Oth tran eq	-0.558 (4.3)	0.318 (3.6)	0.631 (4.4)	.41	.94
15. Meat prod	-1.767 (1.4)	0.859 (17.0)	0.736 (1.4)	.16	.98
16. Dairy prod	-0.868 (1.1)	0.663 (15.9)	0.423 (1.2)	.30	.97
17. Oth food	-1.150 (3.3)	0.891 (13.4)	0.401 (1.8)	-.67	.99
18. Beverages	-0.068 (4.9)	1.090 (38.4)		.10	.99
19. Tobacco	-4.339 (1.2)	0.707 (1.1)	1.976 (1.2)	-.04	.82
20. Text & app	-1.448 (10.6)	0.679 (17.0)	1.166 (5.0)	.17	.99
21. Leather prod	-1.056 (21.3)	0.776 (13.9)	0.670 (7.0)	-.20	.99
22. Wood prod	-1.102 (19.3)	0.668 (39.0)	0.732 (7.0)	-.13	.99
23. Pap & publ	-0.817 (4.4)	0.917 (13.6)	0.447 (2.7)	-.15	.99
24. Rub & plas	-1.108 (6.5)	0.834 (9.6)	0.843 (5.5)	-.44	.99
25. Oth mfg prod	-1.288 (10.9)	0.782 (4.2)	0.549 (2.7)	.04	.98
26. Construction	-0.150 (9.1)	0.726 (21.6)		.33	.99
27. Rep & reconst	-1.158 (7.4)	0.627 (7.0)	0.791 (3.3)	-.34	.98
28. Trade	-0.940 (6.8)	0.806 (16.1)	0.246 (0.8)	-.22	.99
29. Rest & hotels	-0.941 (2.7)	0.972 (29.4)	0.144 (0.5)	.12	.99
30. Int transport	-1.396 (4.5)	0.411 (1.6)	1.591 (2.7)	.51	.98
31. Marit & air	-1.108 (1.5)	0.539 (3.1)	0.952 (2.1)	.69	.93
32. Transp serv	-0.399 (3.6)	1.037 (15.7)	0.273 (2.2)	.00	.99
33. Communic	-0.446 (4.7)	0.703 (19.6)	0.708 (6.7)	.06	.99
34. Bank & insur	-0.252 (0.4)	1.130 (13.6)	0.525 (1.1)	-.17	.99
35. Bus serv	-1.335 (39.8)	1.031 (107.)	0.786 (40.5)	-.60	.99
36. Rents	-4.987 (57.3)	0.927 (54.4)	1.028 (76.5)	-.04	.99
37. Priv educ	0.170 (2.7)	0.859 (21.4)	0.641 (2.1)	.29	.99
38. Priv health	-1.214 (14.5)	1.111 (46.1)	1.052 (8.4)	-.50	.99
39. Oth serv	-0.683 (4.4)	1.485 (44.4)	0.551 (1.7)	-.17	.99
40. Publ adm	-0.348 (3.2)	0.693 (37.5)	0.962 (7.1)	-.34	.99
41. Publ educ	-0.010 (0.2)	0.985 (22.9)	0.296 (0.9)	.25	.99
42. Publ health	0.023 (0.1)	0.836 (13.5)	0.636 (2.0)	.04	.96
43. Dom serv	-0.286 (1.0)	0.818 (57.1)	0.839 (3.0)	.05	.99

In the Spanish economy, uniformity of wage growth across sectors suggests that, to a great extent, wages determine the general price level. The heterogeneity of profit movements, on the other hand, means that sectoral level profit margins help to define relative prices.

Monaco (1991) presents recent work describing the specification of profit equations for a macroeconomic, multisectoral model of the United States. Her approach is to depict profit behavior as a "mark-up" over unit costs. Monaco explains that several other multisectoral and macroeconomic models use such an approach to model prices, and, therefore it is a useful context to model profits. In her work, sectoral, real profit margins are functions of material input prices, labor costs and demand. For various reasons, I had tremendous difficulties with implementing this approach here. First of all, degrees of freedom limitations prohibited the full use of Monaco's specification. It was difficult to incorporate lags representing the pass-through of labor costs, since sectoral employment compensation was available only since 1980. Also, the equations here do not contain material input explanatory variables (except in one special case).

Secondly, Monaco's dependent variable for the equations is deflated profits over output. To form this variable, the nominal profits are deflated by an industry-specific price index. Since profits are a partial determinant of prices, however, deflating profits by the current year's price index raises a simultaneity issue in the overall model specification. Consequently, profits are deflated with the previous period's output deflator. However, the use of this technique for the Spanish equations yielded very unsatisfactory results. Ignoring the simultaneity in estimation problem, I attempted to construct the dependent variable using the current period industry level price deflator, as well as the GDP deflator, for deflating the profits. The equations generated by this approach were generally very good. However, the use of the current year's deflator introduced severe convergence problems inside the price-income block.

The final solution is to estimate the profit margin not as a proportion of output, but as a proportion of value added at factor cost (gross profits plus gross employment income).[2] This approach eliminates the need for profit deflation. However, it limits the interpretation of the profit margin as a mark-up over labor costs, rather than all of intermediate costs. Specifically, the definition of the dependent variable is:

$$PSHVA_{i,t} = \frac{PROF_{i,t}}{PROF_{i,t} + WAG_{i,t}} \times 100$$

where: $PSHVA_{i,t}$ = profit share of value added at factor cost for sector i in period t,

$PROF_{i,t}$ = nominal gross profits,

$WAG_{i,t}$ = nominal gross wages and salaries.

Obviously, one determinate of industry profits is growth in the level of demand. Like prices, profits are sensitive to demand changes and normally exhibit strongly pro-cyclical behavior. The profit equations of the MIDE model use either the current or a two period moving average of the percentage change in output, depending on which provides the better results. Specifically, the cyclical variable is defined as:

$$PCQ_{i,t} = \left(s_i \times \frac{(Q_{i,t} - Q_{i,t-1})}{Q_{i,t-1}} + (1 - s_i) \times \frac{(Q_{i,t-1} - Q_{i,t-2})}{Q_{i,t-2}} \right) \times 100$$

where: $Q_{i,t}$ = constant price output, and

[2] This idea was borrowed from Shackleton (1992), who experienced very similar problems for the construction of the INFORUM United Kingdom model.

s_i = is either .5 or 1.0.

Another explanatory factor significant in each sector is the real unit labor cost. An increase in labor costs may temporarily squeeze profit shares if the increase cannot be passed on through a price increase. The strength of the effect on profits in an individual industry will depend on its competitive structure, openness to international trade, as well as demand conditions. In an oligopolistic industry, for instance, individual firms may be unwilling to pass cost increases on to consumers for fear of losing market share. Instead, and for a time, the oligopolist absorbs part of the increase by decreasing profit margins. Therefore, higher unit wage costs lead to lower shares of value added in the short run. On the other hand, labor productivity increases which reduce the unit labor cost lead to larger profit shares until the productivity increases are compensated with equivalent wage increases. To form current price unit wage cost, the gross employment income of each sector is divided by real output. For non-tradeable goods sectors, an appropriate deflator for this quantity is the GDP deflator. (Use of the sectoral own price deflator introduces estimation and convergence simultaneity problems similar to those discussed above.) Therefore, the real unit labor cost is essentially:

$$RLC_{i,t} = \frac{(WAG_{i,t}/Q_{i,t})}{PGDP_t}$$

where: $RLC_{i,t}$ = the real unit wage cost of sector i in period t,

$WAG_{i,t}$ = nominal gross wages and salaries.

$Q_{i,t}$ = constant price output, and

$PGDP_t$ = the GDP deflator.

For tradable sectors, however, we can integrate another important determinate of profit shares into a single explanatory variable.

In a small open economy, often the most important determinate or relative prices is whether a good is tradeable or non-tradeable. In most theoretical and many empirical models, the price of tradeable goods is assumed equal to the world price of these goods. Current developments in the Spanish economy, as discussed in Chapter 2, illustrate that the tradeable/non-tradable distinction is indeed important. Over the past several years, manufacturing industries, open to world trade, have experienced substantially less price inflation than the non-tradable service sectors. Schultz (1986) found that the ratio of the import price to unit wage costs, the real exchange rate, are very important for explaining profit margins for European countries. Therefore, in the MIDE model, profit share equations for several of the tradable goods industries include a real exchange rate, defined as:

$$RER_{i,t} = \frac{(PM_{i,t}(1+TM_{i,t})}{(WAG_{i,t}/Q_{i,t})}$$

$RER_{i,t}$	=	the real exchange rate for sector i at period t,
$PM_{i,t}$	=	the import price at the border,
$TM_{i,t}$	=	the import tax rate, and
$WAG_{i,t}$	=	nominal gross wages and salaries, and
$Q_{i,t}$	=	constant price output.

This coefficient on this variable is expected to be positive, since higher foreign prices (or tariff rates) imply greater accommodation for domestic (or export) price increases and, therefore, higher profit shares. An increase in unit labor costs reduces the magnitude of the real exchange rate, acting to reduce the profit share. As displayed below, for most of the

Spanish manufacturing industries, the real exchange rate is indeed a powerful explanatory variable.

In summary, the specification for the profit equations is:

$$PVASH_{i,t} \; = \; a_i \; + \; b_i PCQ_{i,t} \; + \; c_i \begin{bmatrix} RLC_{i,t} \\ RER_{i,t} \end{bmatrix} + \; d_i OTH_{i,t}$$

where $OTH_{i,t}$ represents other independent variables included in the specification. Table 7.2 displays the results for the 38 sectors estimated with this form. Examination of the individual equations reveals that the real exchange rate is included for the majority of manufactured sectors. However, for energy (2, 3 and 5) and food (15, 16, 17 and 18) sectors the real labor cost explains profit share movements much better. In each of these cases, imports shares of demand are either zero or trivial.

Dummy variables for obvious outliers in the series are included for equations that yield unreasonable parameter values without the dummy. (In Table 7.2 the range of years where the dummy is equal to one is shown. For all other years, the dummy variable is equal to zero.) For several sectors (1, 3, 6, 8, 13 and 18), the dummy starts in 1985 or 1986 and continues to assume the value of one for forecasting. The significance of the parameter in these cases could be due to a number of reasons. First, changes in tax and subsidy regimes as a result of EC integration could have had an impact. Possibly, the elimination of the cascade tax (see Chapter 5) improve the profit shares of intermediate goods industries such as Coke products (Sector 3), Base metals (6) and Chemicals (8). Profits in agriculture apparently benefitted from the introduction of the Common Agriculture Policy (CAP). On the other hand, the change in the national accounts data from the 1980 base to the 1986 base affected value added data substantially (see Appendix). These dummies may be signalling inconsistencies in the profits data resulting from this problem.

In Spain, the Petroleum products industry (Sector 4) is essentially refining and distribution. Domestic prices for its products are highly regulated by the government. Therefore, its profits should be sensitive to the relative price of imported petroleum. Including this variable (price imports for sector 4 over the GDP deflator) in the profit share equation does not add significantly to the explanatory power of the equation, bad in any case, but does help explain a wiggle in 1986-87.

Soft constraints were used on the equations for sectors 8 and 25 to give positive parameters on the change of output term. For sectors 7, 23 and 24 constraints are used to yield coefficients on output growth to be less than one. While there is no a-priori reason to believe that a parameter greater than one would be inappropriate, model simulations revealed that such a value resulted in excess volatility in the profit share. For similar stability reasons, a soft constraint on the equation for sector 25 reduces the magnitude of the real exchange rate parameter. A constraint on the equation for sector 29 reduces the real labor cost parameter. A final manipulation required to reach reasonable fits and parameter results for various equations (sectors 3, 5, 9, 23) was to start the estimation period in 1981 rather than 1980. For Hotels, bars and restaurants (sector 29) the final estimation period is 1983 through 1987. Since this equation also contains a dummy variable and soft constraints, it is evident that the final result is highly administered. In fact, it was very difficult to estimate an equation for this sector which behaved well in the full model. Since profits of this sector constitute close to ten percent of total economy-wide profits, the high-handed treatment of the sector is essential for satisfactory overall behavior of the model.

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services.

1. Agriculture, forestry & fisheries

SEE = 0.53 RSQ = 0.8804 RHO = -0.43 Obser = 8 from 1980
SEE+1 = 0.47 RBSQ = 0.7907 DW = 2.86 DoFree = 4 to 1987
MAPE = 0.60

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva1	- -				73.35
1 intercept	65.07905	1183.0	25.581	0.89	1.00
2 pcq1 (s=1.0)	0.11062	38.8	1.924	0.00	2.03
3 rer1	6.52036	77.3	2.927	0.10	1.12
4 dum86_87	3.06146	158.4	4.765	0.01	0.25

2. Coal & radioactive material

SEE = 3.43 RSQ = 0.4755 RHO = 0.22 Obser = 8 from 1980
SEE+1 = 3.49 RBSQ = 0.2657 DW = 1.55 DoFree = 5 to 1987
MAPE = 14.76

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva2	- -				23.03
1 intercept	38.73000	31.9	1.923	1.68	1.00
2 pcq2 (s=0.5)	0.38313	37.6	2.114	0.12	7.21
3 rlc2	-22.29840	7.6	-0.890	-0.80	0.83

3. Coke products

SEE = 1.70 RSQ = 0.8656 RHO = 0.06 Obser = 7 from 1981
SEE+1 = 1.70 RBSQ = 0.7985 DW = 1.88 DoFree = 4 to 1987
MAPE = 1.65

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva3	- -				82.66
1 intercept	110.11061	267.8	7.079	1.33	1.00
2 rlc3	-30.90491	39.0	-1.931	-0.36	0.97
3 dum86_87	8.35429	142.4	4.415	0.03	0.29

4. Petroleum extraction & refining

SEE = 7.74 RSQ = 0.1563 RHO = -0.19 Obser = 8 from 1980
SEE+1 = 7.56 RBSQ =-0.1812 DW = 2.38 DoFree = 5 to 1987
MAPE = 8.76

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva4	- -				74.88
1 intercept	80.42492	223.0	6.867	1.07	1.00
2 pcq4 (s=1.0)	0.41867	4.4	0.674	0.00	0.82
3 rpmoil	-5.50427	2.8	-0.532	-0.08	1.07

5. Electricity, gas transmission & water utilities

SEE = 1.39 RSQ = 0.8835 RHO = -0.68 Obser = 7 from 1981
SEE+1 = 0.92 RBSQ = 0.8252 DW = 3.36 DoFree = 4 to 1987
MAPE = 1.78

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva5	- -				68.15
1 intercept	110.28468	470.9	11.242	1.62	1.00
2 pcq5 (s=1.0)	0.61594	19.7	1.316	0.03	2.84
3 rlc5	-42.17133	156.1	-4.715	-0.64	1.04

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

6. Metal mining & initial processing

SEE = 0.98 RSQ = 0.9029 RHO = -0.08 Obser = 8 from 1980
SEE+1 = 0.97 RBSQ = 0.8301 DW = 2.17 DoFree = 4 to 1987
MAPE = 1.72

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva6	- -				48.42
1 intercept	14.53856	61.4	2.534	0.30	1.00
2 pcq6 (s=1.0)	0.37642	46.6	2.145	0.00	0.30
3 rer6	29.45589	206.7	5.799	0.64	1.06
4 dum86_87	10.39647	153.0	4.647	0.05	0.25

7. Nonmetallic minerals & products

SEE = 2.46 RSQ = 0.5621 RHO = 0.74 Obser = 8 from 1980
SEE+1 = 1.78 RBSQ = 0.3869 DW = 0.52 DoFree = 5 to 1987
MAPE = 4.99

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva7	- -				47.20
1 intercept	34.85188	70.5	3.219	0.74	1.00
2 pcq7 (s=0.5)	0.72936	****	****	-0.02	-1.48
3 rer7	11.17776	13.3	1.240	0.28	1.20

8. Chemicals

SEE = 1.20 RSQ = 0.5558 RHO = -0.07 Obser = 8 from 1980
SEE+1 = 1.19 RBSQ = 0.2226 DW = 2.14 DoFree = 4 to 1987
MAPE = 1.81

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva8	- -				52.67
1 intercept	42.90134	142.2	4.724	0.81	1.00
2 pcq8 (s=1.0)	0.04125	****	*****	0.00	1.77
3 rer8	7.69272	10.0	0.980	0.18	1.20
4 dum86_87	1.72323	15.2	1.225	0.01	0.25

9. Metal products

SEE = 0.32 RSQ = 0.4101 RHO = -0.03 Obser = 7 from 1981
SEE+1 = 0.32 RBSQ = 0.1151 DW = 2.05 DoFree = 4 to 1987
MAPE = 0.82

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva9	- -				33.32
1 intercept	29.73391	487.5	11.578	0.89	1.00
2 pcq9 (s=0.5)	0.15842	29.7	1.652	-0.00	-0.99
3 rer9	3.32951	22.6	1.419	0.11	1.12

10. Industrial & agricultural machinery

SEE = 1.68 RSQ = 0.8372 RHO = -0.13 Obser = 8 from 1980
SEE+1 = 1.61 RBSQ = 0.7721 DW = 2.26 DoFree = 5 to 1987
MAPE = 3.66

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva10	- -				36.75
1 intercept	12.31251	30.4	1.870	0.34	1.00
2 pcq10 (s=0.5)	0.73323	87.8	3.555	0.01	0.29
3 rer10	18.73155	93.5	3.705	0.66	1.29

*** - soft constraints

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

11. Office machines, computers and precision instruments

SEE = 5.49	RSQ = 0.8974	RHO = 0.28	Obser = 8 from 1980	
SEE+1 = 5.58	RBSQ = 0.8803	DW = 1.45	DoFree = 6 to 1987	
MAPE = 9.86				

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva11	- -				50.81
1 intercept	-1.08028	0.2	-0.144	-0.02	1.00
2 rer11	32.34795	212.2	7.244	1.02	1.60

12. Electrical & electronic equip.

SEE = 1.85	RSQ = 0.6395	RHO = 0.27	Obser = 8 from 1980
SEE+1 = 1.79	RBSQ = 0.4952	DW = 1.47	DoFree = 5 to 1987
MAPE = 4.28			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva12	- -				34.02
1 intercept	28.94247	56.5	2.692	0.85	1.00
2 pcq12 (s=1.0)	0.39576	64.9	2.932	0.04	3.37
3 rer12	3.36551	1.2	0.349	0.11	1.11

13. Motor vehicles & engines

SEE = 1.20	RSQ = 0.9844	RHO = -0.25	Obser = 8 from 1980
SEE+1 = 1.13	RBSQ = 0.9727	DW = 2.49	DoFree = 4 to 1987
MAPE = 3.56			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva13	- -				31.69
1 intercept	15.02306	69.6	2.739	0.47	1.00
2 pcq13 (s=1.0)	0.34312	101.3	3.494	0.05	5.04
3 rer13	7.07049	25.3	1.510	0.28	1.28
4 dum85_87	15.76600	451.6	10.849	0.19	0.37

14. Other transport equipment

SEE = 3.76	RSQ = 0.9205	RHO = 0.32	Obser = 8 from 1980
SEE+1 = 3.83	RBSQ = 0.9072	DW = 1.35	DoFree = 6 to 1987
MAPE =13.43			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva14	- -				33.41
1 intercept	-11.68143	31.1	-2.077	-0.35	1.00
2 rer14	22.10257	254.6	8.334	1.35	2.04

15. Meat & other animal products

SEE = 0.45	RSQ = 0.9782	RHO = 0.06	Obser = 8 from 1980
SEE+1 = 0.45	RBSQ = 0.9619	DW = 1.87	DoFree = 4 to 1987
MAPE = 0.67			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva15	- -				57.55
1 intercept	106.42729	328.7	8.337	1.85	1.00
2 pcq15 (s=1.0)	0.33648	37.6	1.890	0.01	1.24
3 rlc15	-48.14732	115.4	-3.816	-0.83	-1.00
4 dum80_81	-4.98239	377.9	-9.346	-0.02	0.25

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

```
                         16. Dairy products
  SEE   = 0.33   RSQ  = 0.9865   RHO =  0.39   Obser  = 8 from 1980
  SEE+1 = 0.31   RBSQ = 0.9763   DW  =  1.22   DoFree = 4 to   1987
  MAPE  = 0.49
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva16           - - - - - - - - - - - - - - - - - - - - -  57.12
1 intercept          61.02141     385.0     9.491     1.07      1.00
2 pcq16 (s=1.0)       0.16581      39.9     1.958     0.00      1.65
3 rlc16              -1.76308       0.7    -0.243    -0.03     -0.92
4 dum80_83           -5.09292     221.4    -6.108    -0.04      0.50

                       17. Other food products
  SEE   = 0.58   RSQ  = 0.9221   RHO = -0.39   Obser  = 8 from 1980
  SEE+1 = 0.52   RBSQ = 0.8910   DW  =  2.77   DoFree = 5 to   1987
  MAPE  = 0.94
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva17          - - - - - - - - - - - - - - - - - - - - -   52.34
1 intercept          85.36600     426.1    11.550     1.63      1.00
2 pcq17 (s=0.5)       0.07396       1.3     0.359     0.00      2.22
3 rlc17             -35.53297     133.5    -4.719    -0.63     -0.93

                            18. Beverages
  SEE   = 1.20   RSQ  = 0.8185   RHO =  0.32   Obser  = 8 from 1980
  SEE+1 = 1.15   RBSQ = 0.6824   DW  =  1.36   DoFree = 4 to   1987
  MAPE  = 2.11
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva18           - - - - - - - - - - - - - - - - - - - - -  49.85
1 intercept          57.78435      34.6     1.801     1.16      1.00
2 pcq18 (s=1.0)       0.41575      15.1     1.141     0.02      2.64
3 rlc18              -8.44212       0.8    -0.259    -0.16     -0.96
4 dum85_87           -7.26408      97.4    -3.404    -0.02      0.12

                        19. Tobacco products
  SEE   = 4.28   RSQ  = 0.7999   RHO = -0.04   Obser  = 8 from 1980
  SEE+1 = 4.25   RBSQ = 0.7198   DW  =  2.09   DoFree = 5 to   1987
  MAPE  =10.21
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva19           - - - - - - - - - - - - - - - - - - - - -  39.21
1 intercept          -1.97793       0.4    -0.210    -0.05      1.00
2 pcq19 (s=1.0)       0.78194      40.0     2.190     0.10      5.19
3 rer19              33.40319     116.9     4.305     0.95      1.11

                       20. Textiles & apparel
  SEE   = 0.64   RSQ  = 0.8196   RHO =  0.17   Obser  = 8 from 1980
  SEE+1 = 0.65   RBSQ = 0.7475   DW  =  1.65   DoFree = 5 to   1987
  MAPE  = 1.37
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva20           - - - - - - - - - - - - - - - - - - - - -  42.86
1 intercept          35.97056     547.6    14.308     0.84      1.00
2 pcq20 (s=1.0)       0.28311     104.7     3.993    -0.01     -2.06
3 rer20               6.30163      66.7     2.981     0.17      1.19
```

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

```
                    21. Leather products, shoes
  SEE   = 2.33   RSQ  = 0.8729   RHO =  0.04   Obser  = 8 from 1980
  SEE+1 = 2.33   RBSQ = 0.8221   DW  =  1.92   DoFree = 5 to   1987
  MAPE  = 4.73
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva21          - - - - - - - - - - - - - - - - - - - - -   34.31
1 intercept         -6.84146       7.7    -0.894    -0.20      1.00
2 pcq21 (s=1.0)      0.03803       1.1     0.326    -0.00     -0.82
3 rer21             34.42906     163.7     5.457     1.20      1.20


                      22. Wood & wood products
  SEE   = 1.01   RSQ  = 0.8336   RHO = -0.47   Obser  = 8 from 1980
  SEE+1 = 0.84   RBSQ = 0.7088   DW  =  2.94   DoFree = 4 to   1987
  MAPE  = 2.20
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva22          - - - - - - - - - - - - - - - - - - - - -   36.37
1 intercept         16.01307      40.4     1.971     0.44      1.00
2 pcq22 (s=1.0)      0.60030     140.8     4.380    -0.03     -2.02
3 rer22             20.39403      65.4     2.634     0.61      1.09
4 dum83             -4.64428      58.6    -2.462    -0.02      0.12


                       23. Paper & publishing
  SEE   = 3.01   RSQ  = 0.5781   RHO =  0.58   Obser  = 7 from 1981
  SEE+1 = 2.75   RBSQ = 0.3672   DW  =  0.84   DoFree = 4 to   1987
  MAPE  = 6.06
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva23          - - - - - - - - - - - - - - - - - - - - -   47.57
1 intercept         33.35450      43.2     2.236     0.70      1.00
2 pcq23 (s=1.0)      0.91223      ****     *****     0.03      1.63
3 rer23             13.53652       7.7     0.871     0.27      0.94


                   24. Rubber & plastic products
  SEE   = 2.45   RSQ  = 0.6743   RHO =  0.64   Obser  = 8 from 1980
  SEE+1 = 1.91   RBSQ = 0.5440   DW  =  0.71   DoFree = 5 to   1987
  MAPE  = 5.47
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva24          - - - - - - - - - - - - - - - - - - - - -   41.54
1 intercept         24.16420      61.7     3.121     0.58      1.00
2 pcq24 (s=0.5)      0.85112      ****     *****     0.05      2.39
3 rer24             10.63420      29.8     2.033     0.37      1.44


                  25. Other manufactured products
  SEE   = 1.75   RSQ  = 0.7450   RHO =  0.74   Obser  = 8 from 1980
  SEE+1 = 1.26   RBSQ = 0.5537   DW  =  0.52   DoFree = 4 to   1987
  MAPE  = 4.04
Variable name        Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva25          - - - - - - - - - - - - - - - - - - - - -   39.54
1 intercept         35.87389     765.7    24.595     0.91      1.00
2 pcq25 (s=1.0)      0.09995      ****     *****     0.02      6.50
3 rer25              0.48103      ****     *****     0.02      1.88
4 dum83_84           8.43718      59.0     3.536     0.05      0.25

   *** - soft constraints
```

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

```
                       26. Construction
  SEE   = 1.11   RSQ  = 0.9508   RHO = -0.12   Obser  = 8 from 1980
  SEE+1 = 1.09   RBSQ = 0.9311   DW  =  2.23   DoFree = 5 to   1987
  MAPE  = 2.61
Variable name         Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva26           - - - - - - - - - - - - - - - - - - - - -   33.50
1 intercept           70.00210     531.0    13.932     2.09      1.00
2 pcq26 (s=1.0)        0.00180       0.0     0.016     0.00      1.20
3 rlc26              -42.93546     247.1    -7.431    -1.09     -0.85


                 27. Repairs & reconstruction
  SEE   = 0.88   RSQ  = 0.9052   RHO =  0.32   Obser  = 8 from 1980
  SEE+1 = 0.89   RBSQ = 0.8894   DW  =  1.35   DoFree = 6 to   1987
  MAPE  = 1.33
Variable name         Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva27           - - - - - - - - - - - - - - - - - - - - -   58.88
1 intercept           86.53998     867.2    23.566     1.47      1.00
2 rlc27              -31.41135     224.7    -7.568    -0.47      0.88


                 28. Wholesale & retail trade
  SEE   = 0.48   RSQ  = 0.9519   RHO = -0.27   Obser  = 8 from 1980
  SEE+1 = 0.43   RBSQ = 0.9327   DW  =  2.54   DoFree = 5 to   1987
  MAPE  = 0.58
Variable name         Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva28           - - - - - - - - - - - - - - - - - - - - -   67.39
1 intercept           99.40415     774.7    19.430     1.48      1.00
2 pcq28 (s=0.5)        0.15751       4.2     0.652     0.00      1.13
3 rlc28              -35.37196     209.5    -6.551    -0.48     -0.91


                29. Restaurants, cafes & hotels
  SEE   = 0.26   RSQ  = 0.9527   RHO =  0.03   Obser  = 5 from 1983
  SEE+1 = 0.26   RBSQ = 0.8107   DW  =  1.95   DoFree = 1 to   1987
  MAPE  = 0.27
Variable name         Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva29           - - - - - - - - - - - - - - - - - - - - -   73.37
1 intercept           95.54283   12176.3   122.760     1.30      1.00
2 pcq29 (s=0.5)        0.66185     259.0     3.448     0.03      3.59
3 rlc29              -25.00043      ****     *****    -0.34      0.99
4 dum86                1.48798     143.9     2.225     0.00      0.20


                    30. Interior transport
  SEE   = 1.47   RSQ  = 0.4503   RHO =  0.32   Obser  = 8 from 1980
  SEE+1 = 1.40   RBSQ = 0.2305   DW  =  1.35   DoFree = 5 to   1987
  MAPE  = 2.19
Variable name         Reg-Coef    Mexval   t-value     Elas      Mean
0 pshva30           - - - - - - - - - - - - - - - - - - - - -   53.79
1 intercept           53.31562      47.4     2.422     0.99      1.00
2 pcq30 (s=1.0)        0.65658       6.0     0.783     0.04      3.55
3 rlc30               -1.94788       0.1    -0.096    -0.03     -0.95

   *** - soft constraints
```

Table 7.2: Estimation results for sectoral gross profit equations:
Manufacturing and private services (cont.).

31. Maritime & air transport

SEE = 2.74	RSQ = 0.8980	RHO = 0.23	Obser = 8 from 1980
SEE+1 = 2.73	RBSQ = 0.8572	DW = 1.55	DoFree = 5 to 1987
MAPE = 6.62			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva31	- - - - - - -	- - - -	- - - - -	- - - -	40.38
1 intercept	106.71412	177.0	5.777	2.64	1.00
2 pcq31 (s=0.5)	0.66414	1.9	0.440	0.03	1.60
3 rlc31	-73.64387	107.7	-4.069	-1.67	-0.92

32. Transport related services

SEE = 2.66	RSQ = 0.1543	RHO = 0.63	Obser = 8 from 1980
SEE+1 = 2.28	RBSQ =-0.1839	DW = 0.74	DoFree = 5 to 1987
MAPE = 3.58			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva32	- - - - - - -	- - - -	- - - - -	- - - -	60.91
1 intercept	60.22619	35.6	2.047	0.99	1.00
2 pcq32 (s=1.0)	0.95988	2.5	0.501	0.03	1.81
3 rlc32	-1.05110	0.0	-0.040	-0.02	-1.00

33. Communications

SEE = 1.12	RSQ = 0.8513	RHO = -0.14	Obser = 8 from 1980
SEE+1 = 1.10	RBSQ = 0.7918	DW = 2.29	DoFree = 5 to 1987
MAPE = 2.11			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva33	- - - - - - -	- - - -	- - - - -	- - - -	45.75
1 intercept	78.40181	395.5	10.851	1.71	1.00
2 pcq33 (s=1.0)	0.05902	0.9	0.301	0.01	6.03
3 rlc33	-35.86864	141.5	-4.915	-0.72	-0.92

34. Banking & insurance

SEE = 4.81	RSQ = 0.0802	RHO = -0.14	Obser = 8 from 1980
SEE+1 = 4.76	RBSQ =-0.2877	DW = 2.28	DoFree = 5 to 1987
MAPE = 8.99			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva34	- - - - - - -	- - - -	- - - - -	- - - -	45.49
1 intercept	45.55954	34.4	2.006	1.00	1.00
2 pcq34 (s=0.5)	0.74164	4.2	0.657	0.05	3.13
3 rlc	-2.09293	0.1	-0.106	-0.05	1.14

35. Business services

SEE = 0.24	RSQ = 0.9426	RHO = 0.07	Obser = 8 from 1980
SEE+1 = 0.24	RBSQ = 0.9196	DW = 1.86	DoFree = 5 to 1987
MAPE = 0.26			

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva35	- - - - - - -	- - - -	- - - - -	- - - -	70.13
1 intercept	90.88642	1605.2	38.063	1.30	1.00
2 pcq35 (s=0.5)	0.13420	84.9	3.479	0.01	3.23
3 rlc35	-19.70422	306.9	-8.820	-0.30	1.08

Table 7.2: Estimation results for sectoral gross profit equations: Manufacturing and private services (cont.).

37. Private education & research

SEE = 2.14	RSQ = 0.5253	RHO = 0.27	Obser = 8 from 1980	
SEE+1 = 2.07	RBSQ = 0.3354	DW = 1.46	DoFree = 5 to 1987	
MAPE = 9.88				

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva37	- -				19.01
1 intercept	48.69381	13.2	1.187	2.56	1.00
2 pcq37 (s=0.5)	0.87418	8.1	0.919	0.02	0.50
3 rlc37	-29.66983	5.3	-0.741	-1.58	-1.02

38. Private health services

SEE = 0.87	RSQ = 0.0334	RHO = -0.40	Obser = 8 from 1980	
SEE+1 = 0.79	RBSQ =-0.3532	DW = 2.80	DoFree = 5 to 1987	
MAPE = 1.20				

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva38	- -				59.84
1 intercept	63.22332	195.6	6.221	1.06	1.00
2 pcq38 (s=0.5)	0.11835	1.5	0.386	0.00	0.15
3 rlc38	-3.11858	1.1	-0.334	-0.06	1.09

39. Recreation, personal & other services

SEE = 1.47	RSQ = 0.5071	RHO = 0.25	Obser = 8 from 1980	
SEE+1 = 1.47	RBSQ = 0.4250	DW = 1.49	DoFree = 6 to 1987	
MAPE = 3.27				

Variable name	Reg-Coef	Mexval	t-value	Elas	Mean
0 pshva39	- -				40.10
1 intercept	51.48626	365.7	11.142	1.28	1.00
2 rlc39	-8.83220	42.4	-2.485	-0.28	1.29

Profits for Commercial and housing rents (Sector 36) and public services (sectors 40, 41 and 42) are of a different nature than the profits of manufacturing and private services. Therefore, the above specification proved unsatisfactory for explaining profits in these sectors. I adopted a very simple approach by regressing the nominal level of profits on output of the respective sector inflated with the current period GDP deflator. The GDP deflator was used to avoid the simultaneity problem of using the sector's own price. The results for these regressions are illustrated by Table 7.3. Finally, the national accounts data indicate that for Domestic services (sector 43) the profits are a constant, and small (1.3 percent), proportion of value added at factor cost. Therefore, the MIDE model determines sectoral profits with this ratio for each year.

It would be preferable to apply a more eclectic approach to estimating sectoral profits. In particular, we would like to incorporate different explanatory factors that could reflect market structure in different sectors or varying lags of labor and other intermediate costs. The poor results displayed by several of the profit equations presented here attest to this fact. However, given the limited availability of data on sectoral profits in the Spanish economy this is not possible. Instead, I have taken an approach designed around a generic specification in order to account for the most determinants of profit behavior: the level of production, labor costs and international prices.

Table 7.3: Estimation results for sectoral gross profit equations:
Commercial and residential rents and Public services.

```
                 36. Commercial and residential rents
  SEE   = 27.72  RSQ  = 0.9928  RHO =  0.42  Obser  = 8 from 1980
  SEE+1 = 27.41  RBSQ = 0.9916  DW  =  1.15  DoFree = 6 to   1987
  MAPE  = 1.66
Variable name         Reg-Coef   Mexval  t-value    Elas      Mean
0 ebe36              - - - - - - - - - - - - - - - - - - - - 1600.09
1 intercept          344.15093    227.3    7.635    0.22      1.00
2 q36 x pgdp           0.53027   1079.4   28.784    0.78   2368.51


                      40. Public administration
  SEE   = 3.69  RSQ  = 0.9831  RHO =  0.43  Obser  = 8 from 1980
  SEE+1 = 3.65  RBSQ = 0.9803  DW  =  1.15  DoFree = 6 to   1987
  MAPE  = 3.54
Variable name         Reg-Coef   Mexval  t-value    Elas      Mean
0 ebe40              - - - - - - - - - - - - - - - - - - - -   92.85
1 intercept            5.25947      9.1    1.068    0.06      1.00
2 q40 x pgdp           0.03648    668.9   18.674    0.94   2401.30


                    41. Public education services
  SEE   = 1.44  RSQ  = 0.9890  RHO = 0.15  Obser  = 8 from 1980
  SEE+1 = 1.44  RBSQ = 0.9872  DW  = 1.69  DoFree = 6 to   1987
  MAPE  = 4.45
Variable name         Reg-Coef   Mexval  t-value   Elas      Mean
0 ebe41             - - - - - - - - - - - - - - - - - - - -  33.02
1 intercept          -6.60095     80.0   -3.665   -0.20      1.00
2 q41 x pgdp          0.06621    855.2   23.268    1.20    598.42


                      42. Public health services
  SEE   = 0.39  RSQ  = 0.9909  RHO = 0.34  Obser  = 8 from 1980
  SEE+1 = 0.37  RBSQ = 0.9894  DW  = 1.31  DoFree = 6 to   1987
  MAPE  = 2.36
Variable name         Reg-Coef   Mexval  t-value   Elas      Mean
0 ebe42              - - - - - - - - - - - - - - - - - - - -  14.33
1 intercept            2.72925    152.5    5.679   0.19      1.00
2 q42 x pgdp           0.01736    951.1   25.629   0.81    668.58
```

CHAPTER 8:

A FORECAST FOR THE SPANISH ECONOMY TO THE YEAR 2000: THE IMPACT OF EUROPEAN COMMUNITY INTEGRATION

The previous chapters described the structure and equations of the MIDE model. A principle use of the model is to provide medium to long term forecasts for up to ten years. In this chapter, I develop an illustrative forecast of the model to the year 2000. To a large extent, the results of a MIDE forecast depend on the values assumed for the exogenous variables of the model. Therefore, the first section of the chapter presents and explains several exogenous assumptions used for the forecast.

The most important influence on the Spanish economy for the next decade will be the economic integration of the European Community. As described previously, the specification of the MIDE model considers several factors related to the 1986 Spanish admission to the EC. However, the greatest impacts of EC integration are yet to come. The *Europe 1992* program (beginning on January 1, 1993) will eliminate all barriers to trade, capital and labor movements among EC countries. In order to formulate forecasts, the model must incorporate various policy and behavioral changes implied by the European single market program and appraise their impacts on economy. This exercise is the subject of the second section of the chapter.

The third part of the chapter presents an outlook for the Spanish economy to the year 2000. A current debate surrounding the Spanish economy concerns whether the economy will attain nominal convergence within the EC by the end of 1996. Under the Maastricht treaty, convergence is necessary to allow Spain to join the common currency in 1997. It is hoped that the forecast presented here can shed some light on the prospects for convergence.

8.1 Exogenous Assumptions for the Forecast to 2000

Table 8.1 displays several key assumptions used for the current forecast of the MIDE model. For population and labor force, MIDE uses projections formulated by the Instituto Nacional de Estadística (INE 1987). The population projection contains a steady slowdown of growth through 2000. The labor force figures for 1992 through 1996 are based on a recent projection supplied by the Ministry of Economics which accompanied the "Convergence Plan" (Plan de Convergencia)[1] (*Cinco Dias*, April 6, 1992). This forecast corrects the original INE projection for the sharp, unexpected decline of participation rates which occurred in 1991. By 1993 the Ministry of Economics' figure reverts to the trend of the INE 1987 projection. The 1997 to 2000 MIDE assumptions use the INE trend to extend the Ministry's 1996 projection. Table 8.1 shows a gradual decrease in labor force growth from 1.0 percent in 1994 to 0.8 percent in 2000. This decrease is due to the ageing of the general population and a deceleration in the growth of the female participation rate (Instituto Nacional de Estadística 1987).

The second group of assumptions shown in Table 8.1 concerns the growth of monetary aggregates. The forecasts for M2 and M4 assume that the authorities will target a corresponding growth of nominal GDP. Implicit in the projections is an assumption of progressively declining inflation from current levels. Government consumption spending, in real terms, is borrowed from the Convergence Plan objective to keep growth to 2.0 percent per year starting in 1993. Also, the Plan projects that the government will stabilize

[1] The *Plan de Convergencia*, put forward by the government in early April 1992, is a package of economic policies intended to accommodate the requirements for nominal convergence as outlined in the Maastricht treaty. Requirements for convergence and the Convergence Plan are outlined in Chapter 2. Accompanying the plan, the Ministry of Economics provided a forecast of macroeconomic aggregates through the year 1996. The projection demonstrated that nominal convergence was possible if the plan was adopted.

Table 8.1: Assumptions for Exogenous Variables of the MIDE Model, 1990-2000. (a)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demographic Projections (millions of persons):											
Population	38.96	39.03	39.08	39.14	39.19	39.24	39.28	39.32	39.35	39.37	39.39
percent change	0.18	0.17	0.15	0.14	0.13	0.12	0.11	0.09	0.08	0.06	0.04
Labor Force	15.02	15.07	15.16	15.32	15.47	15.61	15.75	15.89	16.02	16.15	16.28
percent change	1.36	0.35	0.60	1.00	1.00	0.90	0.90	0.90	0.85	0.80	0.80
Money Supply (current prices, trillions of pesetas):											
M2	22.27	24.94	27.68	30.45	33.04	35.68	38.36	41.14	44.02	46.99	50.04
percent change	17.77	12.00	11.00	10.00	8.50	8.00	7.50	7.25	7.00	6.75	6.50
M4	46.38	52.41	58.17	63.99	69.43	74.98	80.60	86.45	92.50	98.74	105.16
percent change	11.85	13.00	11.00	10.00	8.50	8.00	7.50	7.25	7.00	6.75	6.50
Government Spending (trillions of pesetas, 1980 prices):											
Consumption	3.12	3.26	3.39	3.46	3.53	3.60	3.67	3.74	3.82	3.89	3.97
percent change	4.24	4.53	4.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Investment	1.09	1.18	1.23	1.28	1.32	1.36	1.40	1.44	1.49	1.53	1.58
percent change	14.51	8.00	4.00	4.00	3.50	3.00	3.00	3.00	3.00	3.00	3.00
Exchange Rates:											
Pesetas/German Mark	63.09	62.56	63.00	64.00	64.50	65.00	65.00	65.00	65.00	65.00	65.00
percent change	-1.43	-0.83	0.70	1.59	0.78	0.78	0.00	0.00	0.00	0.00	0.00
Pesetas/U.S. Dollar	101.93	104.30	101.43	101.76	101.26	100.75	100.75	100.75	102.70	104.00	105.30
percent change	-13.91	2.33	-2.75	0.33	-0.49	-0.50	0.00	0.00	1.94	1.27	1.25
Foreign Demand and Prices (1980 = 100):											
Foreign Demand	151.77	154.45	159.65	168.88	175.62	181.98	188.16	193.73	201.27	208.01	214.42
percent change	5.56	1.77	3.37	5.78	3.99	3.62	3.39	2.96	3.90	3.35	3.08
Foreign Prices	178.09	179.30	180.48	184.51	189.18	194.91	198.99	203.60	209.81	218.34	227.05
percent change	-1.16	0.68	0.66	2.23	2.53	3.03	2.09	2.32	3.05	4.06	3.99

(a) - Values for demographic, money supply, government spending, and exchange rate variables are actual for 1990-91.

investment at the current level of five percent of nominal GDP. The growth figures displayed on Table 8.1, 4.0 percent for 1992 and 1993, 3.5 percent for 1994, and 3.0 percent thereafter, roughly accommodate this wish in the forecast.

The exchange rates projections assume a slight depreciation of the peseta relative to the German Mark and the other European currencies between 1992 and 1995. Presumably, the peseta will enter the narrow band of the EC exchange rate mechanism sometime during this period, and the government will take that opportunity to depreciate. After 1995, the peseta should stabilize with the Mark. The peseta appreciates modestly against the U.S. dollar through 1995, is steady in 1996 and 1997, then depreciates from 1998 to 2000.

The exogenous foreign price and demand variables for the forecast are based on an INFORUM international modeling system scenario which simulates the effects of the European single market (Christou and Nyhus 1992). While the following section will describe the specific circumstances of this study, Table 8.1 summarizes its implications on the foreign environment which will be faced by Spanish importers and exporters. The aggregate price and demand indices shown in Table 8.1 are not strictly exogenous. They are a weighted average of the exogenous sectoral indices, where the weights depend on the forecasted outcomes of sectoral exports (for the demand index) and imports (for the price index). The foreign price index is the weighted price for imports, adjusted for exchange rates. (The projected growth rates for the competing price of exports are very similar and their addition to the table would have added little information.) The foreign price outlook anticipates a competitive environment brought about by the European single market. Prices grow in the two to four percent range through 2000. Similarly, once the world economy recovers from the doldrums of 1991 and 1992, European integration stimulates demand increases at a brisk rate of three to four percent for the rest of the decade.

8.2 The Impact of the European Single Market on the Spanish Economy

Europeans have discussed the idea of creating a fully integrated European market since the formation of the original common market of six nations in 1957.[2] Integration and expansion of the Community proceeded gradually, with fits and starts, through the following twenty years. However, widespread economic problems caused by the oil price shocks and high inflation of the 1970's slowed attempts to deepen European integration. Plagued by domestic problems of economic stagnation and high unemployment, European nations were unable and unwilling to focus on EC issues such as trade liberalization. By the mid-80's, market unification was far from being realized. Eventually, however, the miserable economic conditions and fear of Japanese and American competition prompted the EC members to move dramatically forward.

In 1985, the European heads of state (the European Council) signed the Single European Act. Among other items, the Act committed the EC members to the goal of "progressively establishing the internal market over a period expiring on 31 December 1992," where "the internal market shall comprise an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured."

The detailed measures intended to achieve the single market were outlined in a European Commission White Paper entitled *Completing the Internal Market* (EC Commission 1985). This paper identified existing barriers to the free movement of goods, services, capital and labor between EC nations. The barriers were classified under three categories: physical, technical and fiscal. To remove these barriers, the White Paper listed

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[2] The original six signatories to the initial document of the EC, the Treaty of Rome, were the Federal Republic of Germany, France, Italy, Belgium, the Netherlands and Luxembourg. Denmark, Ireland and the United Kingdom joined the EC in 1973, Greece in 1981, Spain and Portugal in 1986.

a legislative agenda of 300 directives. The Commission's legislative directives, often summarized by the terms *"Europe without borders"*, involve a large number of changes in national law pertaining the way European economies are going to operate after 1992. In summary, the directives mandated:

1) The removal of border controls to the physical movement of goods and people.

2) The removal of non-tariff barriers, especially technical standards, to the movement of goods. To accomplish this objective, the principle of "mutual recognition" will apply. This principle requires that each member state must accept the goods which meet the standards of any other member.

3) The opening up of all public procurement contracts to any EC firm.

4) The deregulation of financial, business and transport services to eliminate extensive licensing and rate-setting practices which impede foreign competition in the domestic markets for these services.

5) The extension of the mutual recognition approach to the professions. In other words, doctors, lawyers and other professionals who meet the licensing requirements in any one member state can practice in any member state.

6) Approximate harmonization of value-added and excise tax rates.

7) The elimination of all controls over capital movements within the EC.

The Europe 1992 program, as it has become known, will result in unambiguous benefits for European consumers. The removal of barriers and regulations will result in a decrease in consumer prices and an increase in product variety and quality. On the other hand, producers, traditionally operating in smaller, often protected, markets, will face stiff new competition. Many firms will suffer short-run profit losses and others will find their viability threatened. Successful firms will take advantage of new market opportunities and benefit from expansion of real incomes brought about by the program. Increased competition will induce firms to adjust their behavior and exploit economies of scale in production, reduce X-inefficiencies[3] and internalize externalities in learning and innovation. At the macroeconomic level, reductions in production costs and increases in productivity growth will result in greater price stability. Therefore, the long-run competiveness of European firms, vis-á-vis the rest of the world, will increase. Greater export activity, the expansion in consumer real income and price stability will stimulate investment. This virtuous circle should eventually reduce Europe's long-standing unemployment problems.

Since the Single European Act, the pending completion of the internal market has dominated economic discussion in Europe. A large number of studies estimate the potential effects of the integration. The best known study was undertaken by the Commission of the European Communities, the so-called Cecchini Report (Cecchini et al. 1988). This report was the summary of a large research effort, occupying two volumes of EC Commission studies, which investigated and quantified both the potential microeconomic and macroeconomic consequences of European market integration. Table 8.2 displays a summary of the benefits of the single market estimated by this research. The table illustrates the Cecchini Report's conclusion that the benefits of removing trade barriers in the EC are enormous, estimating potential gains from the single market to be as high as Ecu 216 billion ($270 billion) (Cecchini et al. 1988, Table 9.2).

Alternative estimates reach more subdued appraisals of the benefits of the integrated market. While the Cecchini Report projects a gain of 3.2 to 5.7 percent for total Community GDP, other studies report a gain of only 1.5 to 2.5 percent (Peck 1989). On the other hand,

[3] One often encounters the term "X-inefficiencies" in discussions concerning EC integration. This term refers to management inefficiencies promoted by a non-competitive environment which lead, for example, to excessive administrative overhead costs, over-manning at all levels, or the inefficient management of inventories.

Table 8.2: Potential Economic Gains for EC from Completing the Internal Market.

Item	Range of Potential Effect
Microeconomic Gains: partial equilibrium analysis (Welfare gain as a % of Community GDP)	
1. Gains from removal of barriers affecting trade and production	2.2 - 2.7
2. Gains from market integration	2.1 - 3.7
2a. Gains from exploiting economies of scale	(a) 2.1
2b. Gains from intensified competition reducing business inefficiencies and monopoly profits	(a) 1.6
Total	4.3 - 6.4
Macroeconomic Gains: macroeconometric models (After 6 years)	
1. Increase in GDP (%)	3.2 - 5.7
2. Reduction in consumer prices	4.5 - 7.7
3. Increase in employment (millions)	1.3 - 2.3
4. Improvement in govt. budget balance (% of GDP)	1.5 - 3.0
5. External balance (% of GDP)	0.7 - 1.3

Source: Cecchini et al (1988), Tables 9.2 and 10.1
(a) - Lower range cannot be broken down between the two elements.

Baldwin (1989) argues that the gains in capital stock and economy-wide returns to scale stimulated by the 1992 program would add another 1.7 to 2.6 percent to the GDP gains estimated by the Cecchini Report. Of course, each study uses different techniques and assumptions, and it is premature to judge which study provides the most accurate case for the growth effects of the internal market program.

Most quantitative studies of Europe 1992 use either partial equilibrium analysis of individual industries (see, for example Smith and Venables 1988) or macroeconometric models which estimate the aggregate impacts of integration. None of the early papers studied the dynamic, sectoral implications within a general equilibrium framework. For example, the macroeconomic results of the Cecchini Report are derived from macroeconometric model simulations of the Commission's HERMES and OECD Interlink systems of models (see Catinat and Italianer 1988 and Catinat et al. 1988). Neither of these systems contain models with substantial disaggregation. This deficiency has been remedied by the work of Christou and Nyhus (1992 - also referred to below as CN). Their objective was to shed some additional light to the potential effects of Europe 1992 by means of a the INFORUM trade-linked system of macroeconomic, multisectoral models.

The CN study of the Europe 1992 program applied to only four of the twelve European Community countries: Germany, France, Italy and Belgium.[4] Therefore, the results of the study exhibit a relative downward bias. The lack of feed-back effects from the other European economies limits the favorable results expected by the integration. Nevertheless, according to the CN results, the integration process will boost the European economies substantially. CN conclude that, by 1998, the Europe 1992 program will increase GDP by 5.35 percent in Belgium, 4.84 percent in France, 4.99 percent in Germany and 3.47 percent in Italy (pp. 17-20).[5] The corresponding percentage increases in exports will be 9.46, 8.68, 6.28 and 4.27. Also by 1998, the integration programs boosts employment by 0.81 percent in Belgium, .60 percent in France, and 0.23 percent in Germany. For Italy, however, the number of jobs eliminated by higher rates of productivity growth is greater than those created by demand expansion. Therefore, employment is lower by 1.28 percent.

Beyond Germany, France, Italy and the United Kingdom, all the studies, including that of Catinat et al. (1988 - referred to below as simply Catinat), have very little to say about

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[4] At the time of the CN study, the MIDE model was part of the system, but not fully operational. While it was included in the inter-linked projections of the system, the model did not incorporate the Europe 1992 shocks. Also, the model of Belgium does not have a price side, and, thus, it does not produce forecasts for prices.

[5] CN present figures up to the year 2010. I chose the year 1998 in this case, because it corresponds to the six year horizon used by Catinat et al. (1988). The increases in GDP computed in that study were 4.20 percent for Germany, 5.05 percent for France and 5.46 percent for Italy and 4.00 percent for the United Kingdom (pp. 621-22). Complete results for Belgium were not available.

the impact of integration on the Spanish economy. For instance, Spain is included in only one of the four macroeconomic simulations (financial liberalization) used by Catinat for estimating the impacts of various single market measures. Only Polo and Sancho (1989) have attempted a specific study of the integration effects of 1992 for the Spanish economy, and their study is a strictly comparative static exercise.

This section provides a dynamic assessment, both at the macroeconomic and industry level, of the impacts of the single market program on the Spanish economy. The initial stage of the work consisted of the development of a base forecast of the MIDE model that assumes that Spain does not implement the EC directives for the 1993-2000 period. This base scenario, which is labelled *Spain with Borders*, does assume that the Spain fulfills its original EC agreements with respect to the reduction to zero of all intra-EC tariff rates. Also, in order to eliminate the need to run full INFORUM system simulations, the exogenous foreign demand and competing price of export variables used for the base case are derived from the CN simulation of *Europe without Borders*. In other words, the base scenario assumes that the rest of the EC goes happily along with the internal market program, but that Spain does not.

The next stage of the analysis formulates various modifications to the base scenario which correspond to the implementation of the various Europe 1992 directives. Drawing upon the work of Catinat and Christou and Nyhus, a number of assumptions were made, quantified and introduced into the MIDE model. The changes to the model can be regarded as a sequence of major exogenous price and supply-side shocks which simulate the effects of market integration. There are five scenarios; each one corresponds to a different, separable aspect of the single market program. The scenarios address:

1) The elimination of customs controls over flows of goods.

2) The opening of domestic public procurement to all EC firms.

3) The liberalization of financial services.

4) The supply effects of firm's strategic reactions when faced with the change in competitive environment as a result of the internal market.

5) The harmonization of value added and excise taxes.

The first four alternatives are the same as those distinguished in the Catinat and CN studies. A fifth scenario for fiscal harmonization is added because present Spanish value added and excise tax rates for certain goods are substantially different than the EC average. While the fiscal harmonization aspect of the single market program has been pushed ahead by two to three years, presumably the Spanish government will have to revise several tax rates by 1995 or 1996. Finally, a sixth scenario is presented where all of the shocks are loaded into the model to quantify the impact of the entire single market program on the Spanish economy. This scenario, called *Spain in the Single Market*, is also the forecast for the Spanish economy presented in the next section of this chapter.

The application of each of the shocks in the model is conservative in that the full effects are spread over eight years (1993-2000). This is done for two reasons. First, the simulations describe the impacts of phenomena identified in various studies as logical outcomes of market integration. However, it is difficult to know how long it will require for these phenomena, such as a greater exploitation of economies of scale, to manifest themselves fully. Therefore, a conservative approach is warranted. Second, the insertion of the shocks into the model assumes that the EC member governments, and especially the Spanish government, adopt all of the directives mandated by the program. However, it is probable that foot-dragging among member governments will delay the full implementation of various measures.

The scenarios do not consider other implications of the single market which are difficult to quantify. Most important are the dynamic effects identified by Baldwin (1989), among others, which could substantially increase the potential growth of the EC economies. Examples include the competition effects on innovation and a change in the long-run productivity growth rate generated by a more favorable savings and investment climate. For example, since sectoral productivity growth is essentially exogenous in the MIDE model, it cannot endogenously predict enhancements to the potential output of the economy which may be brought about by greater levels of investment stimulated by EC integration. Thus, the model does not provide a solution to Dornbusch's recent lament that:

> "The margin of error (of studies assessing the quantitative impacts of EC integration) is large simply because there are no available models with which to evaluate multicountry, multisectoral supply-side economics both in terms of long-run growth and short-run macroeconomics (1989, p. 348-9).

Nevertheless, the scenarios do contribute a useful estimation for predicting the relative impacts of the various aspects of the Europe 1992 program on the Spanish economy. Moreover, despite the identified shortcomings, the model does provide practical information for evaluating the prospects waiting, and for identifying possible problems confronting, the Spanish economy.

The Elimination of Customs Controls

Imagine a truck driver hauling a consignment of goods from Chicago to Washington, D.C., a distance of approximately 600 miles, or 12 hours. Suppose that for each of the five state border crossings required by this journey, the driver had to stop and satisfy customs formalities for each individual state. Moreover, each crossing requires a different set of paperwork and could entail a delay of anywhere from 20 minutes to 2 hours. It is easy for one to imagine that such a situation would add substantially to the transport cost of the consignment. This is precisely the situation in the EC today.

Despite the fact that there is no tariffs or quota restrictions on trade between the fully-integrated EC nations, the costs associated with border controls and customs formalities continues to hamper trade among the members. A number of the single market directives mandate the elimination of all border controls and the reduction and standardization of administrative formalities by the end of 1992. Implementation of the measures will reduce two types of costs. First, government employment will be reduced by the number of customs officers made redundant by the measures. This cost reduction was implemented in the MIDE model by reducing public employment by 8000 jobs at the beginning of 1993.

The second cost reduction will be in the price of the intra-Community trade, since the costs of border delays and administrative formalities are paid either directly or indirectly by importing firms. Catinat and Italianer (1988) estimated the proportion of the cost of the administrative formalities in the total value of the bilateral trade flows for several EC countries. The shares, displayed in Table 8.3, are based on estimates of the administrative costs for per consignment, for both exporters and importers, and for different products. The entries the Table 8.3 represent the proportion of the prices which can be attributed to customs delays and formalities, for exports from the row country to the column country.

Table 8.3: Share of the Cost of the Administrative Formalities Borne by Firms in the Value of Bilateral Trade Flows - All Products Taken Together (percent).

Importer: Exporter	Belgium	Germany	France	Italy	Nethlnds	UK	Oth. EC
Belgium	.	0.84	1.21	1.42	0.94	0.84	1.01
Germany	1.45	.	2.10	2.17	1.82	1.67	1.85
France	1.64	1.72	.	2.25	1.84	1.72	1.69
Italy	1.76	2.25	2.30	.	1.95	1.83	1.80
Netherlands	1.05	1.22	1.40	1.59	.	1.27	1.35
UK	1.87	1.20	1.55	1.91	1.33	.	1.76
Oth. EC	1.49	2.02	2.10	2.14	1.73	1.79	1.82

Source: Catinat and Italianer (1988).

To simulate the elimination of these costs in bilateral trade, Christou and Nyhus assumed that the elimination of customs controls would result in a reduction of each country's sectoral export prices. To compute the appropriate sectoral export price reductions for each country, they combined the destination shares of each country's exports with the information of Table 8.3. For any given exporting country, define $s_{i,k}$ as the share of that country's exports of sector *i* to country *k* in the total value of the country's exports to country *k*. Then, define the price reduction factors for exports to country *k*, RF_k, to be the appropriate values across the row of Table 8.3 for the exporting country. The sectoral export prices are then reduced with *weighted-average reduction factors* ($WARF_i$) calculated according to the formula:

$$WARF_i = \sum_k (s_{i,k} \times RF_k)$$

where $\sum_i s_{i,k} = 1$ for all *k*. Sectoral export prices for each exporting country are reduced by the weighted reduction factors starting in 1993.

The Spain with Borders base case assumes that since Spain did not adopt the single market program, border controls to Spanish exports in the rest of Europe remained. To simulate the impact of the elimination of these controls, Spanish export prices were reduced with the above formula. The shares for each of the importing countries depend on the 1987 values of Spanish exports to each of these countries. Since the figures supplied by Catinat and Italianer did not include specific reduction factors for Spain, I used the final row for the other EC countries (Table 8.3).

Additionally, because Spain removes its customs delays and formalities, sectoral import prices fall. Recall from Chapter 6 that import prices are projected with a foreign price index determined by the equation:

$$FPI_{i,t} = \sum_k (w_{i,k,87}\ p_{k,i,t}\ r_{k,t})$$

where: $FPI_{i,t}$ = the foreign price index for imports of commodity *i* in year *t*,

$w_{i,k,87}$ = the share of Spanish imports for commodity *i* from country *k* in 1987,

$p_{i,k,t}$ = the export price index (1980 = 1.0) for commodity *i* and country *k* in year *t*, and

$r_{k,t}$ = the exchange rate index (1980 = 1.0) of country *k* in year *t*.

The Spain *with Borders* case assumed that the $p_{i,k,t}$'s were the same as the Christou and Nyhus Europe *with Borders* case. In the present simulation, the sectoral export prices of each of Spain's European partners ($p_{i,k,t}$'s) are marked down with their respective weighted reduction factors, as computed in the CN Europe *without Borders* alternative.

Table 8.4: Elimination of Border Controls - Comparison to Spain With Borders Case. (1980 prices, except where otherwise indicated.)

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Gross domestic product	0.06	0.22	0.26	0.23	0.24	0.26	0.29	0.32
Private national consumption	0.15	0.48	0.47	0.34	0.56	0.76	0.85	0.82
Fixed capital investment	0.12	0.46	0.52	0.41	0.41	0.41	0.52	0.53
Exports	0.45	1.03	1.21	1.27	1.40	1.60	1.83	1.77
Imports	0.53	1.38	1.41	1.28	1.74	2.14	2.41	2.20
GDP deflator	-0.47	-0.32	-0.12	-0.40	-0.41	-0.45	-0.52	-0.35
Private consumption deflator	-0.52	-0.50	-0.42	-0.65	-0.74	-0.94	-1.06	-0.81
Fixed investment deflator	-0.63	-0.56	-0.50	-0.69	-0.73	-1.14	-1.18	-0.90
Export deflator	-1.27	-1.25	-1.21	-1.34	-1.45	-1.79	-1.85	-1.54
Import deflator	-1.48	-1.83	-1.64	-1.62	-2.37	-3.28	-3.28	-2.41
Real disp. income per capita	0.16	0.45	0.57	0.49	0.65	0.82	0.92	0.84
Aggregate labor productivity	0.06	0.06	0.06	0.11	0.06	0.06	0.11	0.11
Real wage rate	0.20	-0.05	-0.05	0.21	0.19	0.14	0.16	0.15
Employment	0.00	0.16	0.18	0.14	0.18	0.19	0.20	0.20
Absolute deviations								
Current account deficit (% of GDP, current prices)	-0.03	-0.06	-0.05	-0.05	-0.13	-0.20	-0.19	-0.08
Government deficit (% of GDP, current prices)	-0.05	-0.17	-0.22	-0.20	-0.27	-0.35	-0.41	-0.43
Employment (thousands)	0.09	20.34	23.76	17.99	23.86	25.69	27.02	27.83
Unemployment rate (%)	-0.00	-0.13	-0.15	-0.11	-0.15	-0.16	-0.17	-0.17
Long term interest rate (%)	-0.38	-0.24	0.09	-0.18	-0.33	-0.35	-0.38	-0.09

The results of removing the border restrictions, as simulated by the MIDE model, are shown in Table 8.4. The first part of the table presents the deviations for macroeconomic variables as a percent of the figure generated under the Spain with Borders alternative. The second part of the table displays the absolute deviations for various indicators. All of the macroeconomic variables are improved in the scenario. By 1998, the GDP expands by .26 percent, the GDP deflator decreases by .45 percent, and the consumption price declines by .94 percent.[6] Employment increases by more than 25 thousand jobs. The combination of lower relative import prices and increases in real income lead to real import growth that

[6] While projections in the tables extend to the year 2000, in general, figures quoted in the text will be for 1998 to facilitate comparisons with the Cecchini report. It defines a six-year "medium-term" horizon (Catinat et al. 1988). Another consideration is that deviations from the base run tend to grow sharply in 1999 and 2000. Therefore, the 1998 figures present a preferable summary, since they better reflect the tendencies in the earlier years.

exceeds export growth. Despite this deterioration of the real trade balance, a more favorable terms of trade position (export prices over import prices) improves the nominal current account deficit by .20 percent of GDP in 1998. Stronger growth also bodes well for the government deficit, which declines by .35 percent of GDP by 1998. The conclusion one could make from this story is that a good dose of free trade will be beneficial to the Spanish economy.

Opening of Public Procurement to Foreign Suppliers

In 1986, public-sector contractual procurement was estimated to be 7 to 10 percent of European Community GDP (Cecchini 1988, p.16). Currently, only a tiny fraction of these purchases are awarded to non-national suppliers. This entrenched protectionism is rarely codified by law, but it is sustained by official and un-official policy. Not only does the protection extend to goods bought by the public administration, health and defense sectors, but also to the telecommunications, transportation and energy industries dominated by government enterprises.

The costs produced by sealed procurement markets are major and various. The most obvious cost is that government agencies and public enterprises pay more for equipment goods and infrastructure projects than they would under open competition. Additionally, private market prices are inflated because of the dominant market positions held by national champions, positions which might be unsustainable without guaranteed public procurement contracts. Finally, the non-competitive environment stifles incentives for attaining greater efficiency and innovation in the protected industries.

The single market program aims to end these practices by mandating that national procurement rules be applied equally to all firms located in EC member countries. The Cecchini Report identifies three effects of these measures (p. 17):

1) A "static trade effect" where public authorities will be buying from the cheapest supplier. This will lead to import penetration for the relevant supply sectors and a reduction in the price inflation of publically supplied services.

2) A dynamic "competition effect" leading to a downward pressure on prices as the domestic firms in the previously protected industries attempt to compete with the foreign entrants.

3) A dynamic "restructuring effect," where domestic firms in the affected industries reorganize under the competitive conditions. Cost savings will be realized from the exploitation of economies of scale and the reduction of X-inefficiencies and monopoly profits.

In order to simulate these effects in the HERMES national models, Catinat et al. (1988, p. 379) used quantitative information supplied by WS Atkins Management Consultants (1988). This study was sponsored by the EC Commission to assess the microeconomic implications of open public procurement. With this information, Catinat estimated import penetration and price shocks for insertion into each of the country models (Table 8.5). The shocks were applied to the investment goods industries according to the proportion of public sector purchases from the industry. The scenario assumed that all enterprises in the transport, telecommunications and energy sectors were public enterprises.

The figures of Table 8.5 were used to introduce similar shocks into the MIDE model.[7] Specific shocks were not available for Spain. One option was to use the average value of

[7] Open public procurement will also apply to public sector purchases of intermediate goods. However, examinations of the import coefficients of several Spanish input-output tables did not reveal any marked pattern of discrimination against imports for intermediate consumption. Therefore, the current scenario concerns public procurement for investment only.

Table 8.5: Shocks Introduced into the HERMES Model for Opening up of Public Procurement.

	Belgium	Germany	France	Italy	UK
Static Effects Increase in level of import penetration in public markets (%)	8.2	8.5	5.5	4.1	3.6
Competition & Restructuring Effects Fall in prices of equipment goods on public markets (%)					
- public administration	0.03	0.13	0.03	0.07	0.12
- public enterprises					
* energy	1.6	1.5	1.7	1.1	1.1
* transport and telecom	8.5	7.8	7.6	11.4	7.2
- public health and education (a)					

Source: Catinat et al. (1988).
(a) - Price reductions for these sectors were not identified by Catinat et al. A 10 percent reduction was assumed.

the shocks provided in Table 8.5. However, since closed government procurement is especially pervasive in Spain, I chose, instead to use the largest shock from each row of Table 8.5 (underlined values). Also, I assumed a competition and restructuring price reduction factor of 10 percent for the investment purchases of the public education and health sectors (not distinguished by Catinat). To facilitate the following explanation of the implementation of the shocks, the capital goods industries and the public sectors of the MIDE model effected by the direct impacts of the shocks are displayed in Table 8.6.

The import penetration shock increases the imports for the capital goods industries (there are no construction imports) which are otherwise estimated in the model. The amount of the increase is computed in the model by the formula:

$$\delta IMP_{i,t} = \sum_{j} (b_{i,j} \times INV_{i,t} \times PF_{t})$$

where: $\delta IMP_{i,t}$ = increase in the imports which were predicted by the equations of the model for capital goods industry i (see Table 8.6) for time t,

$b_{i,j}$ = the share of investment purchases from industry i bought by public sector j (see Table 8.6),

Table 8.6: MIDE Model Sectors Effected by the Direct Impacts of the Open Public Procurement Simulation.

Capital goods suppliers (i sectors):
- **9. Metal products, except machinery and transport**
- **10. Industrial and agricultural machinery**
- **11. Office machinery, computers, prec. instruments**
- **12. Electrical and electronic material and accessories**
- **13. Motor vehicles and engines**
- **14. Other transport material**
- **26. Construction and civil engineering**

Public Administration and Enterprises (j sectors):

Energy
- **2. Coal, lignite, and radioactive material**
- **3. Coke products**
- **4. Crude petroleum, natural gas and refining**
- **5. Electrical, gas, steam and water utilities**

Transport and Communications
- **30. Interior transport (not including highway transportation)**
- **31. Maritime and air transport (not including air transport)**
- **32. Transport services**
- **33. Communications**

Public Services
- **40. Public administration**
- **41. Public education services**
- **42. Public health services**

$INV_{i,t}$ = total investment sales of capital goods industry *i*, and

PF_t = the import penetration factor.

The $b_{i,j}$ coefficients, which are constant through time, come from Antón and Escribano (1988) and are identical to those used for the computation of the investment demand indices of the investment equations (see Chapter 5). The import penetration factor increases linearly from .011 in 1993 until it reaches its maximum value of .085 (the German figure from Table 8.5) in 2000. This lagged realization of the shock reflects an assumption that foreign firms will only gradually attain market share in public procurement.

The dynamic competitive and restructuring price reductions for the capital goods industries result from the elimination of monopoly rents and improvements in labor productivity. The price decreases are implemented in the model through gradual reductions in gross profits and improvements in productivity. To insure that the reductions in labor requirements implied by the productivity shocks result in equivalent decreases in labor costs, the exogenous productivity shocks are not permitted to feed back into the wage rate.[8] The profit and wage decreases are computed with the formula:

$$\delta VA_{i,t} = \sum_{j} (b_{i,j} \times PRF_{j,t})$$

where: $\delta VA_{i,t}$ = decrease in the profits and wages which were predicted by the equations of the model for capital goods industry *i* for time *t*,

$b_{i,j}$ = the share of investment purchases from industry *i* bought by public sector *j*, and

$PRF_{j,t}$ = the price reduction factor for public procurement sector *j*.

The price reduction coefficients increase linearly from one eighth of their total value indicated in Table 8.5 to the full impact in 2000.

Reductions in procurement supply prices are complemented with direct reductions in the prices of public enterprise production and public services. Since, investment purchases are paid from gross profits, through retained earnings and interest payments, expenditure savings for public procurement are deducted from the gross profits of the purchasing sectors. The expenditure savings are realized in the MIDE model by the formula:

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[8] Recall from Chapter 7 that sectoral level wage rates depend on labor productivity. Allowing the exogenous productivity shocks to feed back into the wage rate through the wage equations would result in much of the productivity gain accruing to labor. Since the object of this exercise is to decrease the costs of production, a compensating negative shock is applied to total wages so that the employment reducing effects of productivity increases translates into an equal decrease in wages. This assumption does not mean that the sectoral wage rate is the same as in the base scenario. Endogenous increases in the wage rates are permitted. For example, cyclical increases in productivity will increase the rate through the wage equations in the normal way.

$$\delta PROF_{j,t} = \sum_i (b_{i,j} \times INV_{i,t} \times PV_{i,t} \times PRF_{j,t})$$

where:

$\delta PROF_{j,t}$	=	decrease in gross profits otherwise predicted by the equations of the model for public sector *j*,
$b_{i,j}$	=	the share of investment purchases from industry *i* bought by public sector *j*,
$INV_{i,t}$	=	total investment sales of capital goods industry *i*,
$PV_{i,t}$	=	the price of capital goods sold by industry *i*.
$PRF_{j,t}$	=	the price reduction factor for public procurement sector *j*.

Reductions in gross profits, in turn, lead to reductions in producer prices for the public sectors through the input-output price equation.

The scenario results appear in Table 8.7. The general price level is down significantly, registering decreases of 1.7 percent for the GDP deflator and 1.4 percent for the consumption deflator by 1998. The lower prices stimulate domestic demand and exports, but the higher growth is not significant until 1995-96. In fact, the initial impact of restructuring results in a net loss of jobs in 1993. Throughout the forecast horizon, jobs are lost in the capital goods industries and, until 1996, in construction. Since these are relatively high paid positions, the short-run loss in tax revenues offsets the government savings in purchasing, resulting in a larger budget deficit through 1994. The most notable effects occur in the production prices of the public enterprise sectors. Table 8.7 reports significant price reductions for energy and transport, and especially, communications. These price decreases account for the large decline in the consumption price deflator. Ironically, the opening of public procurement may bring the greatest benefit to Spanish consumers.

Table 8.7: Opening of Public Procurement - Comparison to Spain With Borders Case.
(1980 prices, except where otherwise indicated.)

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Gross domestic product	0.01	0.08	0.20	0.33	0.48	0.65	0.83	1.02
Private national consumption	0.01	0.11	0.23	0.33	0.48	0.62	0.75	0.93
Fixed capital investment	0.02	0.16	0.35	0.55	0.76	0.94	1.10	1.28
Exports	0.07	0.21	0.36	0.54	0.76	0.96	1.20	1.45
Imports	0.06	0.24	0.41	0.54	0.71	0.77	0.83	0.99
GDP deflator	-0.27	-0.45	-0.70	-1.01	-1.35	-1.70	-2.09	-2.59
Private consumption deflator	-0.17	-0.37	-0.55	-0.80	-1.10	-1.37	-1.69	-2.04
Govt. consumption deflator	-0.15	-0.34	-0.53	-0.75	-0.95	-1.22	-1.47	-1.82
Fixed investment deflator	-0.24	-0.38	-0.58	-0.83	-1.06	-1.37	-1.64	-1.97
Export deflator	-0.24	-0.39	-0.56	-0.77	-1.01	-1.27	-1.54	-1.84
Import deflator	0.01	0.04	0.06	0.08	0.10	0.12	0.13	0.14
Real disp. income per capita	-0.07	-0.03	0.04	0.13	0.23	0.29	0.38	0.48
Aggregate labor productivity	0.06	0.12	0.11	0.17	0.17	0.22	0.27	0.27
Real wage rate	0.14	0.12	0.20	0.31	0.42	0.52	0.66	0.90
Employment	-0.03	0.01	0.09	0.18	0.31	0.44	0.58	0.73
Absolute deviations								
Current account deficit (% of GDP, current prices)	0.07	0.11	0.16	0.21	0.26	0.32	0.36	0.38
Government deficit (% of GDP, current prices)	0.02	0.02	-0.01	-0.04	-0.08	-0.12	-0.16	-0.22
Employment (thousands)	-3.52	1.15	11.54	24.46	41.03	59.99	79.73	102.28
Unemployment rate (%)	0.02	-0.01	-0.07	-0.15	-0.26	-0.38	-0.49	-0.63
Long term interest rate (%)	-0.13	-0.23	-0.22	-0.28	-0.35	-0.40	-0.50	-0.64
Employment in the capital goods industries: Absolute deviation in thousands								
9. Metal products	-1.12	-2.10	-2.93	-3.70	-4.45	-5.16	-5.86	-6.51
10. Industrial machinery	-0.56	-1.24	-1.90	-2.59	-3.25	-3.93	-4.63	-5.34
11. Office mach. & computers	-0.06	-0.13	-0.16	-0.16	-0.15	-0.15	-0.15	-0.14
12. Elect. mach. & material	-1.11	-1.57	-2.02	-2.51	-2.94	-2.82	-1.80	-1.35
13. Motor vehicles & engines	-0.42	-0.56	-0.73	-1.00	-1.12	-1.24	-1.39	-1.44
14. Other transport equip.	-0.38	-0.76	-1.07	-1.31	-1.41	-1.61	-1.80	-1.97
26. Construction	-1.09	-1.74	-1.44	-0.47	0.73	1.81	2.76	3.69
Public administration and enterprise production prices Percentage deviation								
2. Coal and lignite	-0.19	-0.49	-0.84	-1.22	-1.56	-1.95	-2.36	-2.91
3. Coke products	-0.31	-0.58	-0.90	-1.32	-1.69	-2.08	-2.53	-3.09
4. Petrol. products	-0.19	-0.30	-0.40	-0.55	-0.79	-1.00	-1.14	-1.32
5. Electric & water util.	-0.46	-0.64	-0.97	-1.41	-1.95	-2.47	-3.11	-3.81
30. Interior transport	-0.17	-0.28	-0.45	-0.72	-0.93	-1.22	-1.54	-1.76
31. Maritime & air transport	-0.32	-0.57	-0.88	-1.24	-1.60	-1.96	-2.37	-2.80
32. Oth. transport services	-0.34	-0.58	-0.89	-1.25	-1.68	-2.09	-2.47	-2.79
33. Communications	-0.82	-1.63	-2.46	-3.30	-4.11	-5.02	-5.92	-6.80
40. Public administration	-0.11	-0.29	-0.45	-0.63	-0.82	-1.02	-1.25	-1.54
41. Public education	-0.22	-0.50	-0.76	-1.06	-1.40	-1.71	-2.06	-2.52
42. Public health services	-0.18	-0.38	-0.59	-0.81	-1.06	-1.32	-1.60	-1.96

Deregulation of Financial Services

Financial market regulation is pervasive in EC countries. Standards and controls have restricted market entry in many financial sectors, abolishing free competition. As a result, there are large differences in the prices of standard financial products across the EC. Price differentials between nations range from 46 percent for obtaining travellers cheques to 254 percent for insurance against commercial fire and theft (Cecchini 1988, Table 6.1). Commission directives for the deregulation of financial services envisions the elimination of regulations discriminating against foreign entities in the domestic market and a gradual harmonization of regulations. Most of the EC nations, Spain included, have started to move toward this ideal. By 1993 the large majority of regulations restricting foreign entry into the Spanish financial markets should be swept away.

The increased competition in financial services brought about by deregulation will result in lower profit margins and increased productivity for the domestic industries. Gradually, domestic prices for these services will converge with the EC average. The Cecchini Report's (Table 6.2) mid-range estimates of potential price reductions in financial services are 11 percent for Belgium, 12 percent for France, 10 percent for Germany, 14 percent for Italy and 7 percent for the United Kingdom. The corresponding figure for Spain is a whopping 21 percent. For the MIDE model simulation, I gradually introduce this 21 percent price reduction over the course of 1993-2000 (Table 8.8). Half of the decrease in the price is administrated through an increase in labor productivity compensated, as discussed for the public procurement scenario, with an equivalent wage shock. The other half of the price reduction comes through a reduction in profits. Table 8.8 reports that the impact on the economy is dramatic.

Table 8.8: Financial Liberalization - Comparison to Spain With Borders Case.
(1980 prices, except where otherwise indicated.)

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Price of financial services	-2.09	-4.32	-6.75	-9.21	-11.89	-14.56	-17.42	-20.44
Gross domestic product	0.04	0.15	0.38	0.73	1.17	1.73	2.38	3.20
Private national consumption	0.04	0.14	0.36	0.66	1.02	1.54	2.06	2.75
Fixed capital investment	0.03	0.16	0.44	0.86	1.37	1.99	2.63	3.38
Exports	0.04	0.18	0.40	0.71	1.17	1.72	2.39	3.16
Imports	0.01	0.08	0.23	0.48	0.68	0.98	1.17	1.42
GDP deflator	-0.13	-0.45	-0.91	-1.53	-2.45	-3.43	-4.73	-6.36
Private consumption deflator	-0.14	-0.44	-0.80	-1.30	-2.05	-2.79	-3.88	-5.14
Fixed investment deflator	-0.16	-0.41	-0.76	-1.25	-1.86	-2.57	-3.46	-4.60
Export deflator	-0.17	-0.44	-0.79	-1.22	-1.83	-2.47	-3.35	-4.46
Import deflator	0.00	0.01	0.03	0.04	0.06	0.09	0.11	0.13
Real disp. income per capita	0.06	0.14	0.27	0.49	0.77	1.08	1.46	1.78
Aggregate labor productivity	0.06	0.12	0.17	0.28	0.34	0.33	0.44	0.54
Real wage rate	-0.06	-0.16	-0.28	-0.40	-0.41	-0.50	-0.46	-0.38
Employment	-0.01	0.04	0.20	0.47	0.85	1.35	1.93	2.65
Absolute deviations								
Current account deficit (% of GDP, current prices)	0.03	0.08	0.15	0.24	0.35	0.48	0.61	0.73
Government deficit (% of GDP, current prices)	-0.00	-0.01	-0.06	-0.15	-0.27	-0.43	-0.61	-0.80
Employment (thousands)	-1.74	5.06	26.15	62.73	113.80	184.09	265.75	369.29
Unemployment rate (%)	0.01	-0.03	-0.17	-0.40	-0.72	-1.15	-1.64	-2.27
Long term interest rate (%)	-0.05	-0.21	-0.36	-0.50	-0.78	-0.98	-1.33	-1.91

In 1988, the value added of financial services accounted for approximately 6.5 percent of the GDP in the Spanish economy. The consumer budget share for financial services hovers around .5 percent. A large reduction in the costs of these services, then, would have an important direct impact on price inflation in the economy. More important, however, is that virtually every industry of the economy purchases a non-trivial amount of intermediate financial services (margins on loans, for instance). Therefore, a 20 percent price reduction in financial services stimulates a huge indirect reduction of price inflation for all other goods and services. This indirect price effect contributes to a 3.4 percent reduction in the GDP deflator by the year 1998. The reduction in prices stimulates increase in exports and real incomes which translate into a 1.7 percent increase in real GDP. Also notably, is the that fixed investment is up 2.0 percent by 1998. The only bad news is on the foreign account. Greater domestic growth and a deterioration in the terms of trade causes the current account deficit to increase by .43 percent of GDP. The results leave little doubt that, of all the Europe 1992 measures, the deregulation of financial services will have the greatest impact of on the Spanish economy.

Supply Effects

The generic term "supply effects" refers to changes in producer behavior which will be prompted by the integration of the single European market. The single market will boost competition, reducing monopoly rents and management inefficiencies (X-inefficiencies). Moreover, the abolition of technical standards and other non-tariff barriers places EC firms in a market the size of the entire community. A larger, homogeneous market will provide the opportunity to exploit economies of scale in production, marketing and distribution. Whatever the nature of the supply effects, they will be manifested by falling costs of production.

Much of the impact of competition-induced improvements in management efficiency and the reduction of monopoly rents will occur as a reduction of profits, the rest as decreases in wage costs. Reductions in wage costs are implemented in the model as labor productivity increases, where, once again, the exogenous productivity shock is not permitted to feed back into the wage rate. Therefore, reductions in labor requirements result in equal reductions in labor costs. The magnitude of the shocks are displayed in Table 8.9. The figures were adapted from Catinat et al. (1988), who derived them by using the differences in prices now observed between member states as an indicator of future competitive pressures. The magnitude of the cost reductions vary according to the type of industry. The

Table 8.9: Decrease in Costs of Production as a Result of Increased Competition and the Exploitation of Economies of Scale (percent total impact).

Sectors of MIDE model:	Energy Prod.	Intermed. Goods	Equip. Goods	Cons. Goods	Priv. Serv.	Ret.& Wh. Trade
Competition effects:						
Fall in profits due to reduction of X-ineff. and monopoly rents	...	1.80	1.50	0.70	1.00	1.00
Increase in labor productivity due to reduction of X-ineff.	...	0.72	0.60	0.28	1.00	1.00
Economies of scale effects:						
Increase in labor productivity	0.42	2.23	2.36	0.48	...	7.00

Source: Catinat et al. (1988) and author's estimates.

exogenous shocks are not implemented all at once, but start in 1993 and increase linearly until reaching the maximum impact shown in Table 8.9 in 2000.

To simulate economy of scale effects, Catinat and Italianer assumed that the average size of establishments will converge towards the minimum efficient technical scale (METS), which differs across the type of industry. The METS figures were derived from engineering estimates provided by Pratten (1988). Estimates of the decrease in costs of production produced by the this convergence are reproduced in Table 8.9.[9] The cost savings are implemented in MIDE through positive labor productivity shocks. Again, the shocks are not permitted to feed back into the wage rate. As usual, the cost savings are applied gradually from 1993 to 2000.

The Wholesale and retail trade sector is treated as a special case. After the removal of the trade barriers and market restrictions, large chains of commercial establishments will find

[9] The potential cost savings are probably underestimates for the Spanish economy, which is characterized by relatively small manufacturing establishments in many sectors.

Table 8.10: Supply Effects - Comparison to Spain With Borders Case.
(1980 prices, except where otherwise indicated.)

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Gross domestic product	0.07	0.29	0.58	0.93	1.28	1.64	1.98	2.31
Private national consumption	0.03	0.25	0.48	0.72	0.99	1.28	1.52	1.77
Fixed capital investment	0.05	0.36	0.75	1.18	1.56	1.83	2.07	2.26
Exports	0.12	0.36	0.67	1.01	1.43	1.83	2.25	2.60
Imports	-0.03	0.18	0.31	0.49	0.61	0.68	0.67	0.68
GDP deflator	-0.44	-0.83	-1.28	-1.82	-2.40	-2.93	-3.51	-3.98
Private consumption deflator	-0.35	-0.67	-1.06	-1.48	-1.96	-2.42	-2.95	-3.32
Fixed investment deflator	-0.31	-0.56	-0.83	-1.18	-1.50	-1.91	-2.28	-2.55
Export deflator	-0.36	-0.64	-0.99	-1.37	-1.76	-2.15	-2.60	-2.95
Import deflator	0.01	0.04	0.06	0.07	0.09	0.10	0.11	0.11
Real disp. income per capita	-0.03	0.11	0.36	0.58	0.84	1.08	1.34	1.58
Aggregate labor productivity	0.29	0.58	0.86	1.19	1.40	1.66	1.91	2.16
Real wage rate	0.24	0.33	0.51	0.76	1.07	1.35	1.71	2.02
Employment	-0.22	-0.29	-0.28	-0.21	-0.11	-0.01	0.06	0.12
Absolute deviations								
Current account deficit (% of GDP, current prices)	0.05	0.12	0.17	0.23	0.28	0.32	0.33	0.37
Government deficit (% of GDP, current prices)	0.05	0.02	-0.04	-0.12	-0.21	-0.30	-0.40	-0.50
Employment (thousands)	-28.89	-38.18	-37.05	-28.13	-15.06	-1.73	8.05	16.75
Unemployment rate (%)	0.19	0.25	0.24	0.18	0.09	0.01	-0.05	-0.10
Long term interest rate (%)	-0.27	-0.42	-0.44	-0.52	-0.63	-0.70	-0.83	-0.81

it easier to enter each domestic market. The average size of the establishments and the efficiency in which they are operated will increase dramatically, especially in Spain. Indeed, as I mentioned in Chapter 2, the phenomena is already noticeable. Commercial margins in Spain have a long way to go toward convergence with those of partner nations with large established chains. Therefore, the expected reduction in costs is projected to be much larger than in the other sectors, reaching 7.0 percent by the year 2000.

Table 8.10 presents the results of introducing these shocks into the MIDE model. The effect on domestic prices is major, the GDP deflator is down almost 3.0 percent by 1998. The productivity shocks produce a predictable decrease in employment by 37 thousand jobs by 1995. After that, increased growth in the economy creates enough jobs so that by 1999 the net effect is positive. Again, the bad news is in the foreign account. Real exports expand at a much higher rate than imports, implying a marked improvement in the real trade balance. However, the large reduction in prices received for exports creates the net effect of increasing the nominal current account balance by .32 percent of GDP by 1998.

Fiscal Harmonization

The Value Added Tax is the major consumption tax for each of the European Community nations. At the present time, however, the applicable tax rates vary significantly from country to country. Large variations are also present for excise taxes on alcoholic beverages and tobacco products. The disparity among tax rates has created fears that the elimination of borders will entice consumers to make extensive purchases in other EC states. In high-tax countries, the fiscal authorities would lose revenue and the producers would be placed at a significant disadvantage. To address this problem, the Europe 1992 program calls for approximate harmonization of VAT and excise tax rates. The present plan is for the establishment of two bands of VAT rates, one from 4 to 9 percent for necessities and the other from 14 to 20 percent for other goods. The deadline for fiscal harmonization has been allowed to slip by a year or two.

Spanish VAT rates on several products are currently outside the bands, and harmonization will have to occur eventually. There are three basic VAT rates in Spain. The lowest rate of 6 percent covers food and other necessities. After a 1 percent increase, effective January 1, 1992,[10] the majority of other products are taxed at 13 percent. This rate is one point below the 14 percent threshold of the proposed European upper band. Another rate of 28 percent is applied to luxury goods, conspicuously including automobiles.

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[10] All of the model alternatives include the changes in the VAT rates which became effective in 1992. In the case of luxury goods, the rate was lowered from 33 percent to 28 percent. When the final forecast is presented in the next section, it will be seen that the net effect of these VAT rate changes is that inflation continues at a stubbornly high rate of 5.7 percent. This is down only half a percentage point from 1991.

This rate will have to come down to at least 20 percent. Also, Spanish excise taxes on alcoholic beverages and tobacco products are well below the EC norm, and it appears that these will be raised eventually.

To simulate the expected harmonization, I changed the VAT rates, starting in 1995, to conform with the current EC proposals. The rate on the middle band of products is increased from 13 to 14 percent in 1995. The present 28 percent rate on luxuries is adjusted downward to the 20 percent threshold, by 4 percentage points in 1995 and 4 points in 1996. Additionally, to simulate increases in excise taxes on alcoholic beverages and tobacco products, the indirect tax rates on these sectors were raised. For the beverage sector the indirect tax rate was increased by a total of 10 percent (that is, 10 percent of the original tax rate, not in percentage points), 5 percent in 1995 and 5 percent in 1996. The indirect tax rate increase in the tobacco sector was 20 percent of the original rate, 10 percent in 1995 and 10 percent in 1996.

The results for fiscal harmonization appear in Table 8.11. The increased tax rates push up prices and have a detrimental effect on growth. The most interesting long-run result is that the government deficit, again as a percentage of GDP, increases slightly starting in 1997. This is because the employment loss, which totals almost 57 thousands jobs by 1998, reduces both consumption, the base of the VAT tax, and income tax receipts. The results call into question the use of VAT rate increases for the purposes of balancing the public accounts.

Table 8.11: Fiscal Harmonization - Comparison to Spain With Borders Case.
(1980 prices, except where otherwise indicated.)

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Gross domestic product	0.00	0.00	-0.11	-0.31	-0.38	-0.40	-0.41	-0.37
Private national consumption	0.00	0.00	-0.17	-0.43	-0.41	-0.43	-0.49	-0.43
Fixed capital investment	0.00	0.00	-0.10	-0.42	-0.50	-0.50	-0.41	-0.26
Exports	0.00	0.00	-0.07	-0.16	-0.23	-0.33	-0.34	-0.34
Imports	0.00	0.00	-0.14	-0.43	-0.25	-0.31	-0.35	-0.24
GDP deflator	0.00	0.00	0.49	0.46	0.52	0.65	0.62	0.64
Private consumption deflator	0.00	0.00	0.42	0.40	0.54	0.63	0.55	0.60
Fixed investment deflator	0.00	0.00	0.43	0.42	0.53	0.48	0.49	0.52
Export deflator	0.00	0.00	0.20	0.14	0.26	0.26	0.24	0.30
Import deflator	0.00	0.00	-0.00	-0.01	0.01	0.01	0.01	0.02
Real disp. income per capita	0.00	0.00	-0.04	-0.30	-0.37	-0.39	-0.37	-0.36
Aggregate labor productivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real wage rate	0.00	0.00	-0.32	-0.19	-0.24	-0.34	-0.34	-0.38
Employment	0.00	0.00	-0.10	-0.29	-0.36	-0.42	-0.44	-0.40
VAT yield (current prices)	0.00	0.00	3.24	1.56	1.74	1.88	1.86	1.96
Absolute deviations								
Average VAT rate (%) (a)	0.00	0.00	0.26	0.14	0.15	0.15	0.17	0.17
Current account deficit (% of GDP, current prices)	0.00	0.00	-0.07	-0.11	-0.08	-0.06	-0.07	-0.05
Government deficit (% of GDP, current prices)	0.00	0.00	-0.13	-0.01	0.01	0.02	0.03	0.02
Employment (thousands)	0.00	0.00	-12.57	-38.18	-48.64	-56.83	-60.21	-55.06
Unemployment rate (%)	0.00	0.00	0.08	0.24	0.31	0.35	0.37	0.34
Long term interest rate (%)	0.00	0.00	0.26	0.08	0.02	0.12	0.04	0.05

(a) - Nominal VAT taxes divided by nominal Private interior consumption.

Spain in the Single Market - The Total Impact

Table 8.12 illustrates the total effects of loading all of the above-described shocks into the MIDE model. The macroeconomic impact is certainly significant. By 1998 the difference in GDP is 4.0 percent, consumption is up 3.9 percent, and investment expands by 4.8 percent. A favorable impact on the real trade balance is also evident: exports are increased by 5.8 percent by 1998 while imports are higher by only 4.4 percent. The difference in employment is 217 thousand jobs (1.6 percent) knocking 1.4 percentage points from the unemployment rate.

Greater impacts are evident on the price side of the ledger. By 1998, the GDP deflator is down by 7.6 percent and consumption prices by 6.7 percent. Lower prices contribute to

Table 8.12: Spain in the European Single Market:
The Total Impact of Europe 1992 - Comparison to Spain With Borders Case. (1980 prices, except where otherwise indicated).

	1993	1994	1995	1996	1997	1998	1999	2000
Percentage deviations								
Gross domestic product	0.15	0.68	1.28	1.93	2.86	3.97	5.21	6.65
Private national consumption	0.22	0.92	1.37	1.69	2.73	3.90	4.93	6.15
Fixed capital investment	0.20	1.04	1.89	2.61	3.68	4.78	6.03	7.34
Exports	0.66	1.72	2.56	3.40	4.51	5.84	7.39	8.68
Imports	0.61	1.83	2.24	2.49	3.48	4.39	4.99	5.35
GDP deflator	-1.05	-1.95	-2.55	-4.27	-5.87	-7.65	-9.88	-11.95
Private consumption deflator	-1.08	-1.84	-2.41	-3.80	-5.15	-6.72	-8.68	-10.18
Fixed investment deflator	-1.18	-1.88	-2.30	-3.49	-4.69	-6.29	-7.86	-9.15
Export deflator	-1.89	-2.65	-3.34	-4.47	-5.70	-7.22	-8.82	-10.09
Import deflator	-1.46	-1.75	-1.51	-1.44	-2.13	-3.00	-2.98	-2.06
Real disp. income per capita	0.19	0.61	1.15	1.47	2.12	2.99	3.83	4.56
Aggregate labor productivity	0.41	0.87	1.20	1.65	1.96	2.32	2.73	3.13
Real wage rate	0.39	0.29	0.12	0.72	0.90	1.17	1.72	2.15
Employment	-0.28	-0.15	0.04	0.31	0.88	1.60	2.39	3.38
Absolute deviations								
Current account deficit (% of GDP, current prices)	0.09	0.23	0.38	0.56	0.72	0.87	1.13	1.54
Government deficit (% of GDP, current prices)	0.02	-0.12	-0.42	-0.51	-0.79	-1.16	-1.52	-1.93
Employment (thousands)	-35.58	-18.88	5.49	40.66	118.40	217.40	329.62	470.30
Unemployment rate (%)	0.23	0.12	-0.04	-0.26	-0.75	-1.36	-2.04	-2.89
Long term interest rate (%)	-0.72	-1.05	-0.76	-1.39	-1.96	-2.27	-2.87	-2.97

a 2.2 point reduction in the interest rate. Stronger growth and lower interest rates have a positive effect on the government balance, decreasing the nominal deficit by 1.52 percent of the GDP. As in several of the individual scenarios, a deterioration of the terms of trade occurs, with export prices declining by 7.2 percent but import prices decreasing by only 3.0 percent. This is a reasonable expectation. If one believes that present price rigidities in the Spanish economy are stronger than those in its EC partners, then market integration will produce greater price reductions on domestic prices than imported prices. Moreover, Spain will still be importing significant quantities of goods, especially crude oil, from third countries. EC integration will have little impact on the export prices from these countries. This development causes a deterioration of the current account deficit of .87 percent of the GDP by 1998.

Table 8.13: Europe 1992: Comparison Among MIDE and Other Studies.

	GDP	Cons. Defl.	Employ.	Govt. Surp.(a)	External Bal.(b)	Real Income(c)
Spain-MIDE (1998)	3.97	-6.72	1.60	1.16	-0.87	2.99
Catinat (6th yr.):						
EC Tot	4.52	-6.16	1.47	2.22	-0.35	2.94
Germany	4.20	-6.16	1.68	1.52	0.15	3.27
France	5.05	-4.89	1.57	2.64	-0.03	2.41
Italy	3.79	-7.07	1.40	3.65	-1.89	3.50
UK	2.91	-7.43	1.39	1.80	-0.21	2.80
Christou & Nyhus (1998):						
Germany	4.99	-8.19	0.23	...	...	6.30
France	4.84	-4.22	0.60	...	...	4.20
Italy	3.47	-5.52	-1.28	...	...	3.94
Belgium	5.66	...	0.81	...	...	4.06

Sources: Catinat et al. (1988, pp.617-623), Christou and Nyhus (1992).

Notes: Percentage deviations of total impact with respect to No-1992 cases for GDP, consumption deflator, employment and real income. Government deficit and external balance are in absolute deviations as percent of GDP.

(a) For MIDE, Govt. surplus is expressed in nominal terms, for Catinat et al., it is in real terms. Results not available for Christou and Nyhus.

(b) Nominal gross operating surplus over nominal GDP. Results not available for Christou and Nyhus.

(c) For Catinat, real household income; for others, real national income per capita.

To place the macroeconomic results in perspective, Table 8.13 presents a comparison of the MIDE generated results for the total impact of the scenarios with comparable figures from Catinat et al. (1988) and Christou and Nyhus (1992). The countries included for each study are the ones for which full results are available. The figures from CN and the present study refer to 1998, and were computed by running the respective models with all of the Europe 1992 shocks incorporated. The Catinat figures refer to the sixth year. Presuming the EC-1992 program begins on time in 1993, this would also be 1998. Also for Catinat, the total impact results represent the summation of the individual scenario results. The row of Catinat corresponding to the total EC-12 effects is their extrapolation of the country results to the entire community (p. 598). The results from this study seem to coincide with the other two.

Tables 8.14 through 8.16 show the sectoral-level, percentage impacts for output, output prices, employment, exports and imports for the total impact of the single market. Each table ranks the sectors according to the magnitude of the effects in 1998. Figure 8.1 contrasts graphs of domestic demand and output for twelve selected sectors. Virtually every sector enjoys a positive impact of the single market program by 1998. The exceptions are Agricultural and industrial machinery (Sector 10), which suffers significant import penetration, and Tobacco products (19), which is hit with tax increases. Several sectors, however, end up lower employment because of the productivity shocks. In general, the industries experiencing the largest positive gains in production tend to be ones that have a large component of consumer durables consumption. The greater levels of real disposable incomes generated in the single market scenario touches of a consumer splurge in durable goods such as electric appliances (affecting Sector 12), furniture (22) and automobiles (13).

The Electric and electronic materials industry (12) also benefits from significant productivity and price shocks in both the Public procurement and Supply effects scenarios. Therefore, its production price falls steeply, further stimulating demand for its products. However, this performance should be set against a negative output growth in both 1990 and 1991 and a pessimistic projection in the Spain with Borders scenario. Even in the more optimistic case of the Single Market alternative the output of the industry does not again reach its 1989 peak level of production until 1995 (Figure 8.1). Moreover, it is clear from the graph that the domestic industry continues to suffer from import penetration through the mid-90’s. Another sector which experiences a reversal of fortune is the Textile and apparel

Table 8.14: Sectoral Real Outputs and the European Single Market - Comparison to Spain With Borders Case.

Percentage deviations of Single Market to Spain with Borders.
Ranked according to figure for 1998.

Rank	No.	Sector	1994	1996	1998	2000
1.	(12)	Elect.& electronic prod.	0.99	4.62	11.00	19.45
2.	(22)	Wood & furniture	1.20	5.11	10.29	19.15
3.	(20)	Textiles & apparel	0.62	3.38	8.27	17.12
4.	(23)	Paper & publishing	0.60	3.71	7.28	13.69
5.	(13)	Automotive vehicles	2.74	3.83	7.21	9.69
6.	(2)	Coal & lignite	0.90	3.53	7.05	11.83
7.	(25)	Other mfg. products	1.73	3.08	6.95	10.65
8.	(11)	Off mach, comput, instr.	0.34	3.63	6.77	11.59
9.	(6)	Metal mining & proc.	1.03	3.47	6.72	11.74
10.	(14)	Other transport equip.	0.73	3.63	6.49	10.31
11.	(27)	Repairs & reconstruct.	1.73	2.97	6.42	9.50
12.	(38)	Priv. health services	1.30	2.79	6.09	9.91
13.	(1)	Agriculture, forest. & fish	1.27	3.02	5.81	9.34
14.	(3)	Coke products	0.75	2.89	5.79	10.14
15.	(21)	Shoes & leather prod.	0.47	2.76	5.76	9.88
16.	(31)	Maritime & air transp.	1.39	3.00	5.61	8.77
17.	(43)	Domest. & oth. services	1.01	2.37	5.60	9.47
18.	(37)	Priv. educ. & research	1.11	2.45	5.46	8.97
19.	(35)	Business services	1.06	2.63	5.40	8.92
20.	(34)	Banking & insurance	0.85	2.74	5.24	8.69
21.	(33)	Communications	1.17	2.38	5.08	8.04
22.	(28)	Wholesale & ret. trade	1.19	2.23	4.95	7.82
23.	(39)	Cult. & oth. services	0.84	2.18	4.75	8.00
24.	(30)	Interior transport	1.00	2.25	4.71	7.56
25.	(17)	Other food products	0.60	2.45	4.63	7.92
		Average	0.72	2.16	4.59	7.92
26.	(9)	Metal products	0.76	2.04	4.25	7.10
27.	(5)	Electric & oth. util.	0.70	1.97	4.14	7.21
28.	(18)	Beverages	0.31	2.03	4.12	7.33
29.	(24)	Rubber & plastic prod.	0.51	1.81	4.02	7.32
30.	(29)	Rest., cafes & hotels	1.13	1.73	3.94	6.02
31.	(26)	Construction	0.57	1.91	3.47	5.62
32.	(7)	Nonmetal mining & prod.	0.31	1.75	3.46	6.16
33.	(32)	Oth. transport serv.	0.80	1.86	3.41	5.52
34.	(8)	Chemicals	0.30	1.37	2.88	4.95
35.	(15)	Meat & oth. animal prod.	0.06	1.39	2.80	5.21
36.	(4)	Petroleum products	0.11	1.29	2.56	4.06
37.	(16)	Dairy Products	-0.07	0.64	1.50	2.81
38.	(36)	Commerc. & resid. rents	-0.78	0.53	0.63	2.43
39.	(41)	Pub. education	0.02	0.05	0.11	0.19
40.	(40)	Pub. administration	0.01	0.03	0.07	0.12
41.	(42)	Pub. health services	0.00	0.01	0.02	0.03
42.	(10)	Agric. & indust. mach.	-0.38	-0.44	-0.07	0.49
43.	(19)	Tobacco products	0.04	-4.14	-3.44	-0.02

Table 8.15: Sectoral Production Prices and the European Single Market - Comparison to Spain With Borders Case.

Percentage deviations of Single Market to Spain with Borders.
Ranked according to figure for 1998.

Rank	No.	Sector	1994	1996	1998	2000
1.	(34)	Banking & insurance	-5.62	-11.07	-17.35	-23.91
2.	(12)	Elect.& electronic prod.	-3.04	-5.11	-10.56	-12.78
3.	(2)	Coal & lignite	-2.52	-5.68	-9.86	-14.82
4.	(33)	Communications	-2.42	-5.49	-8.85	-13.01
5.	(9)	Metal products	-2.63	-5.05	-8.48	-12.01
6.	(13)	Automotive vehicles	-2.57	-4.97	-8.35	-11.07
7.	(8)	Chemicals	-2.58	-4.76	-8.06	-11.19
8.	(11)	Off mach, comput, instr.	-2.75	-4.92	-8.04	-10.77
9.	(36)	Commerc. & resid. rents	-2.06	-4.43	-7.96	-12.38
10.	(23)	Paper & publishing	-2.72	-4.41	-7.84	-10.33
11.	(28)	Wholesale & ret. trade	-1.95	-4.41	-7.83	-12.39
12.	(39)	Cult. & oth. services	-1.98	-4.44	-7.76	-12.06
13.	(25)	Other mfg. products	-2.46	-4.35	-7.69	-10.79
14.	(27)	Repairs & reconstruct.	-1.94	-4.27	-7.51	-11.11
15.	(35)	Business services	-1.86	-4.12	-7.42	-11.69
16.	(3)	Coke products	-1.82	-4.15	-7.37	-11.34
17.	(17)	Other food products	-2.03	-4.12	-7.12	-10.50
18.	(26)	Construction	-2.02	-4.02	-7.10	-10.52
19.	(10)	Agric. & indust. mach.	-2.55	-4.12	-7.06	-9.43
20.	(31)	Maritime & air transp.	-1.84	-4.03	-7.02	-10.70
21.	(1)	Agriculture, forest. & fish	-2.08	-4.14	-6.93	-10.02
22.	(15)	Meat & oth. animal prod.	-1.99	-3.95	-6.89	-10.27
23.	(18)	Beverages	-2.02	-3.30	-6.82	-10.81
24.	(32)	Oth. transport serv.	-1.66	-3.97	-6.80	-10.42
25.	(38)	Priv. health services	-1.87	-3.85	-6.79	-10.61
		Average	-2.07	-3.67	-6.78	-10.15
26.	(41)	Pub. education	-1.81	-3.67	-6.66	-10.25
27.	(7)	Nonmetal mining & prod.	-2.17	-3.60	-6.62	-9.24
28.	(24)	Rubber & plastic prod.	-2.23	-3.75	-6.57	-9.09
29.	(14)	Other transport equip.	-2.34	-3.80	-6.55	-8.10
30.	(16)	Dairy Products	-1.93	-3.71	-6.50	-9.49
31.	(21)	Shoes & leather prod.	-1.95	-3.81	-6.50	-9.55
32.	(29)	Rest., cafes & hotels	-1.44	-3.96	-6.47	-10.70
33.	(5)	Electric & oth. util.	-1.09	-3.50	-6.28	-10.24
34.	(6)	Metal mining & proc.	-2.17	-3.50	-6.25	-8.20
35.	(22)	Wood & furniture	-1.28	-3.76	-6.16	-8.65
36.	(37)	Priv. educ. & research	-1.44	-3.69	-6.14	-10.01
37.	(20)	Textiles & apparel	-1.82	-3.26	-5.92	-8.08
38.	(42)	Pub. health services	-1.64	-3.07	-5.70	-8.67
39.	(40)	Pub. administration	-1.48	-2.74	-5.07	-7.73
40.	(43)	Domest. & oth. services	-1.36	-2.72	-5.06	-7.84
41.	(30)	Interior transport	-0.83	-2.97	-4.93	-7.79
42.	(4)	Petroleum products	-0.95	-1.87	-3.30	-4.77
43.	(19)	Tobacco products	-2.04	16.72	12.71	6.90

Table 8.16: Sectoral Employment and the European Single Market - Comparison to Spain With Borders Case.

Percentage deviations of Single Market to Spain with Borders.
Ranked according to figure for 1998.

Rank	No.	Sector	1994	1996	1998	2000
1.	(20)	Textiles & apparel	0.26	2.56	7.00	14.83
2.	(22)	Wood & furniture	-0.23	2.24	6.36	13.25
3.	(25)	Other mfg. products	1.12	2.52	5.81	9.30
4.	(43)	Domest. & oth. services	1.01	2.37	5.62	9.51
5.	(33)	Communications	1.17	2.38	5.10	8.08
6.	(27)	Repairs & reconstruct.	0.78	2.10	4.73	7.51
7.	(35)	Business services	0.81	2.12	4.63	7.87
8.	(21)	Shoes & leather prod.	0.06	1.51	4.45	7.73
9.	(31)	Maritime & air transp.	0.82	2.19	4.34	7.18
10.	(38)	Priv. health services	0.39	1.88	4.27	7.66
11.	(3)	Coke products	0.31	1.67	4.09	7.60
12.	(37)	Priv. educ. & research	0.50	1.70	4.04	7.19
13.	(5)	Electric & oth. util.	0.56	1.71	3.75	6.66
14.	(23)	Paper & publishing	-0.55	0.98	3.72	8.04
15.	(6)	Metal mining & proc.	-0.14	1.37	3.68	7.42
16.	(17)	Other food products	0.23	1.51	3.51	6.26
17.	(30)	Interior transport	0.37	1.43	3.32	5.76
18.	(39)	Cult. & oth. services	0.26	1.39	3.29	6.20
19.	(29)	Rest., cafes & hotels	0.88	1.22	3.18	5.00
20.	(1)	Agriculture, forest. & fish	0.27	1.17	3.17	5.73
21.	(11)	Off mach, comput, instr.	-0.97	0.61	2.97	5.91
22.	(18)	Beverages	-0.08	0.97	2.87	5.36
23.	(13)	Automotive vehicles	0.82	1.01	2.85	3.98
24.	(26)	Construction	0.12	1.24	2.46	4.36
25.	(2)	Coal & lignite	0.06	0.86	2.32	4.13
26.	(32)	Oth. transport serv.	0.28	1.06	2.21	3.95
27.	(15)	Meat & oth. animal prod.	-0.17	0.62	1.83	3.79
28.	(4)	Petroleum products	-0.02	0.53	1.83	3.12
		Total employment	-0.15	0.31	1.60	3.38
29.	(7)	Nonmetal mining & prod.	-0.54	0.00	0.90	2.64
30.	(24)	Rubber & plastic prod.	-0.59	-0.37	0.89	2.78
31.	(16)	Dairy Products	-0.22	0.06	0.72	1.64
32.	(9)	Metal products	-0.52	-0.37	0.56	2.12
33.	(14)	Other transport equip.	-1.28	-0.95	0.45	1.99
34.	(12)	Elect.& electronic prod.	-2.03	-1.77	0.42	4.65
35.	(8)	Chemicals	-0.56	-0.50	0.23	1.30
36.	(41)	Pub. education	0.02	0.05	0.13	0.22
37.	(42)	Pub. health services	0.00	0.01	0.04	0.06
38.	(36)	Commerc. & resid. rents	-1.05	0.00	-0.18	1.42
39.	(40)	Pub. administration	-0.61	-0.56	-0.51	-0.45
40.	(28)	Wholesale & ret. trade	-1.02	-1.96	-1.61	-1.08
41.	(10)	Agric. & indust. mach.	-1.36	-2.40	-3.03	-3.49
42.	(19)	Tobacco products	-0.15	-4.31	-4.05	-0.89
43.	(34)	Banking & insurance	-2.67	-4.28	-5.51	-6.02

Table 8.17: Real Sectoral Exports and the European Single Market - Comparison to Spain With Borders Case.

Percentage deviations of Single Market to Spain with Borders.
Ranked according to figure for 1998.

Rank	No.	Sector	1994	1996	1998	2000
1.	(9)	Metal products	4.37	10.46	18.78	29.64
2.	(20)	Textiles & apparel	2.66	6.20	10.20	15.42
3.	(1)	Agriculture, forest. & fish	3.58	5.49	8.32	11.71
4.	(6)	Metal mining & proc.	2.59	5.04	7.93	11.79
5.	(17)	Other food products	1.90	4.10	7.19	11.18
6.	(18)	Beverages	1.76	3.43	7.17	13.04
7.	(22)	Wood & furniture	1.13	3.99	6.99	11.36
8.	(23)	Paper & publishing	2.02	3.61	6.34	9.01
9.	(13)	Automotive vehicles	2.34	4.33	6.34	8.88
10.	(10)	Agric. & indust. mach.	2.02	3.89	6.25	9.18
		Total exports	1.72	3.40	5.84	8.68
11.	(28)	Wholesale & ret. trade	1.54	2.97	4.84	7.24
12.	(14)	Other transport equip.	0.98	2.49	4.41	6.26
13.	(32)	Oth. transport serv.	1.32	2.56	4.21	6.36
14.	(12)	Elect.& electronic prod.	1.10	2.20	3.69	5.46
15.	(30)	Interior transport	1.11	2.17	3.61	5.51
16.	(31)	Maritime & air transp.	1.05	2.06	3.43	5.25
17.	(8)	Chemicals	0.92	1.79	2.87	4.16
18.	(25)	Other mfg. products	0.38	0.86	1.63	2.59
19.	(21)	Shoes & leather prod.	0.38	0.76	1.24	1.81
20.	(11)	Off mach, comput, instr.	0.20	0.47	0.74	1.02
21.	(3)	Coke products	0.00	0.00	0.14	0.27
22.	(2)	Coal & lignite	0.00	0.00	0.06	0.12
23.	(41)	Pub. education	0.00	0.00	0.00	0.00
24.	(24)	Rubber & plastic prod.	0.00	-0.04	-0.09	-0.18
25.	(5)	Electric & oth. util.	-0.04	-0.10	-0.12	-0.17
26.	(15)	Meat & oth. animal prod.	-0.04	-0.12	-0.22	-0.36
27.	(16)	Dairy Products	-0.05	-0.14	-0.26	-0.42
28.	(35)	Business services	-0.10	-0.23	-0.41	-0.66
29.	(34)	Banking & insurance	-0.10	-0.23	-0.41	-0.66
30.	(33)	Communications	-0.10	-0.23	-0.41	-0.66
31.	(39)	Cult. & oth. services	-0.11	-0.23	-0.42	-0.65
32.	(4)	Petroleum products	-0.21	-0.59	-0.67	-0.93
33.	(7)	Nonmetal mining & prod.	-0.67	-0.95	-1.41	-1.83
34.	(19)	Tobacco products	0.92	-6.93	-9.79	-6.70

Table 8.18: Real Sectoral Imports and the European Single Market -
Comparison to Spain With Borders Case.

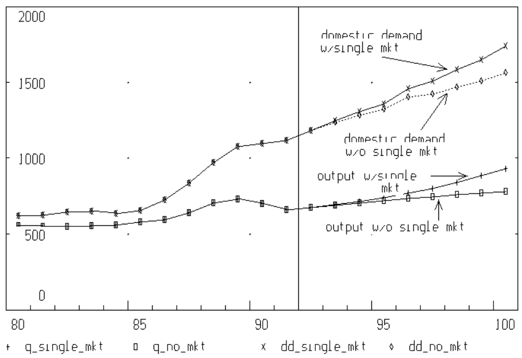
Percentage deviations of Single Market to Spain with Borders.
Ranked according to figure for 1998.

Rank	No.	Sector	1994	1996	1998	2000
1.	(14)	Other transport equip.	7.45	16.14	24.82	35.97
2.	(10)	Agric. & indust. mach.	3.05	6.41	11.20	16.13
3.	(3)	Coke products	2.08	6.02	11.19	18.23
4.	(9)	Metal products	3.13	6.64	11.17	16.29
5.	(13)	Automotive vehicles	4.12	6.21	10.88	14.12
6.	(19)	Tobacco products	-0.48	3.59	8.12	9.12
7.	(8)	Chemicals	1.88	3.39	6.75	10.41
8.	(20)	Textiles & apparel	4.14	3.30	6.17	4.80
9.	(18)	Beverages	4.39	4.36	6.05	4.17
10.	(32)	Oth. transport serv.	1.66	3.03	6.04	9.00
11.	(6)	Metal mining & proc.	2.14	3.45	5.86	7.67
12.	(30)	Interior transport	1.22	2.82	5.73	8.96
13.	(39)	Cult. & oth. services	1.04	2.59	5.55	9.26
14.	(33)	Communications	1.13	2.20	4.81	7.66
15.	(12)	Elect.& electronic prod.	3.06	2.87	4.44	3.69
16.	(5)	Electric & oth. util.	0.92	2.14	4.41	7.60
		Total imports	1.83	2.49	4.78	7.34
17.	(17)	Other food products	2.36	2.30	4.18	4.09
18.	(4)	Petroleum products	0.67	1.68	3.31	5.13
19.	(16)	Dairy Products	1.04	1.24	3.11	3.28
20.	(24)	Rubber & plastic prod.	1.51	1.73	2.95	2.58
21.	(28)	Wholesale & ret. trade	1.38	0.71	1.57	0.38
22.	(7)	Nonmetal mining & prod.	0.86	0.90	1.17	0.19
23.	(25)	Other mfg. products	0.46	-0.08	0.39	-0.09
24.	(2)	Coal & lignite	-0.04	-0.09	0.01	0.26
25.	(41)	Pub. education	0.00	0.00	0.00	0.00
26.	(23)	Paper & publishing	1.12	-0.28	0.00	-2.20
27.	(15)	Meat & oth. animal prod.	1.25	0.34	-0.09	-2.80
28.	(1)	Agriculture, forest. & fish	0.35	-0.24	-0.71	-1.29
29.	(11)	Off mach, comput, instr.	0.47	-0.47	-0.88	-2.05
30.	(22)	Wood & furniture	2.56	-1.27	-2.17	-7.52
31.	(35)	Business services	-0.53	-1.52	-2.99	-5.26
32.	(21)	Shoes & leather prod.	-0.06	-1.71	-3.48	-7.65
33.	(31)	Maritime & air transp.	-2.04	-4.78	-7.87	-12.03
34.	(34)	Banking & insurance	-3.25	-6.08	-9.22	-12.18

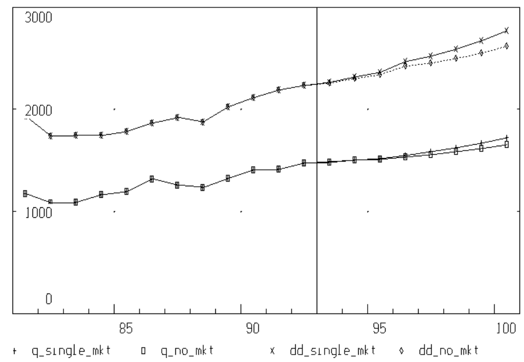
industry (20), because of both stronger consumption and export growth. Whether the Europe-1992 program turns out to be such a large boon to the Spanish economy is yet to be seen. Assuming this story is realistic, let us now turn to examining the economic projection which it produces.

Figure 8.1: Sectoral Impacts of European Single Market.
(Billions of pesetas, 1980 prices.)

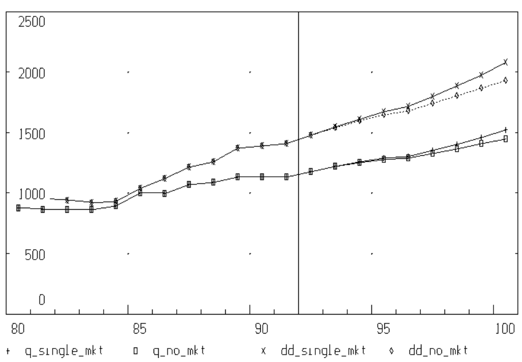
Sector 12: Electric & electronic material



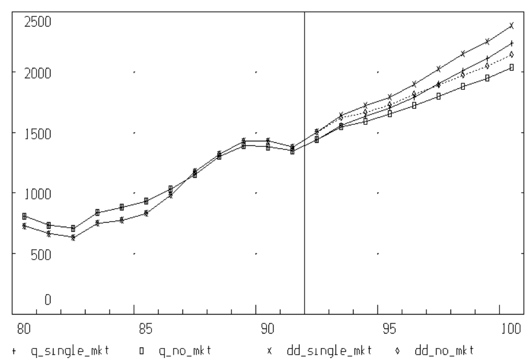
Sector 4: Petroleum products



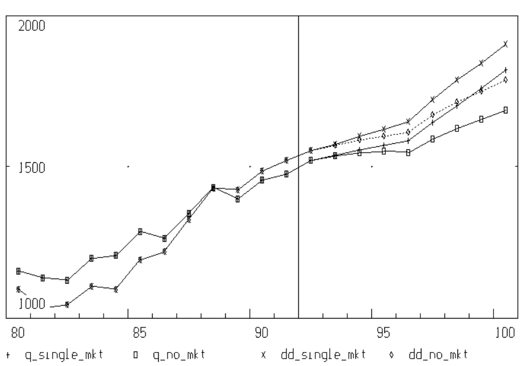
Sector 8: Chemicals



Sector 13: Automotive vehicles



Sector 17: Other food products



Sector 20: Textiles & apparel

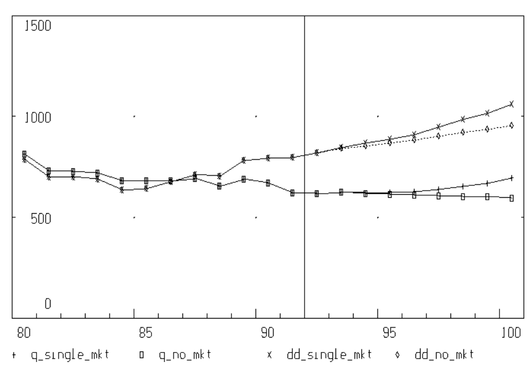
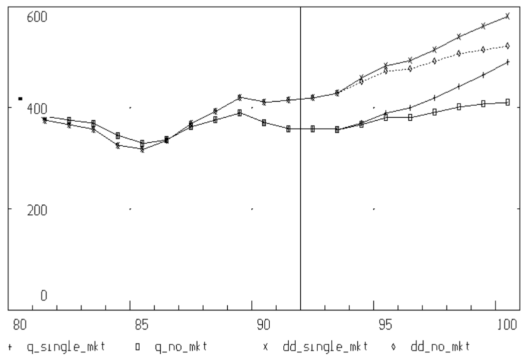
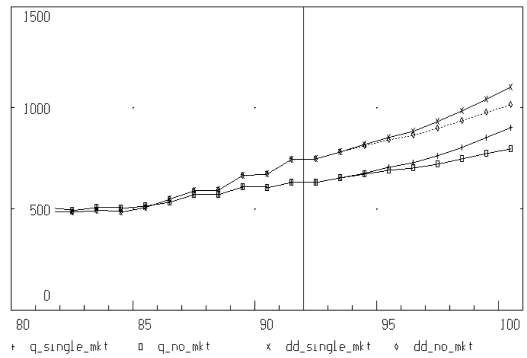


Figure 8.1: Sectoral Impacts of European Single Market (continued).
(Billions of pesetas, 1980 prices.)

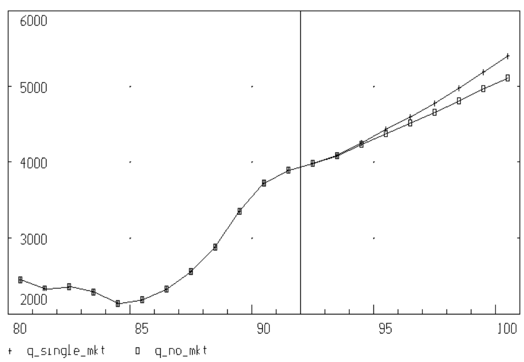
Sector 22: Wood & furniture



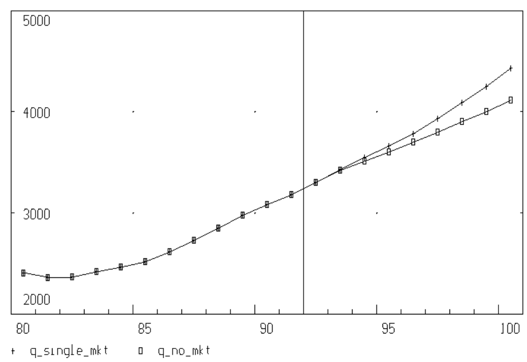
Sector 23: Paper & publishing



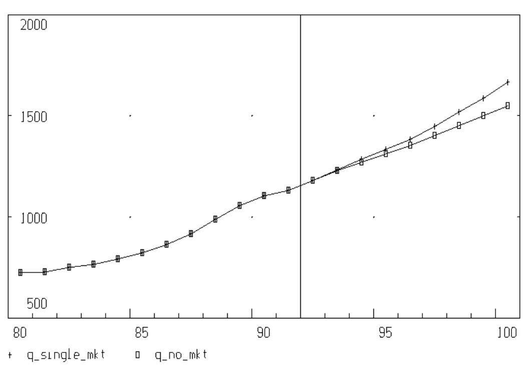
Sector 26: Construction



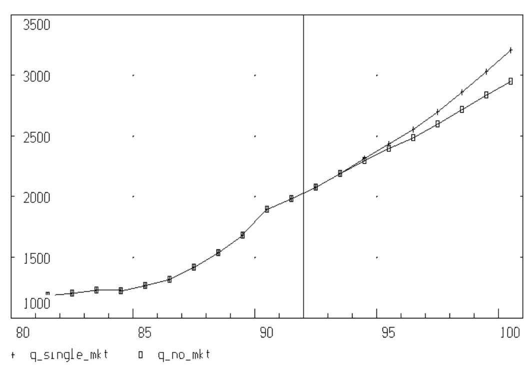
Sector 28: Wholesale & retail trade



Sector 30: Interior transport



Sector 34: Banks & insurance



8.3 A MIDE Forecast to the Year 2000

Table 8.19 displays the macroeconomic results from the total impact scenario. The alternative is entitled *Spain in the Single Market*. The figures are shown in annual growth rates. The table begins in the year 1990 to give the reader the opportunity to compare the recent history with the forecast. This projection was made in April of 1992 and incorporates all information available at that time. The macroeconomic results include the 1991 provisional estimates for GDP and its components made by the Instituto Nacional Estadística. Also, consumer price, industrial production, industrial price and various other indices available for 1991 are used in various ways to guide the projections for that year.

From 1992 through 1996, growth is very stable. The growth rate of GDP, which varies between 2.5 and 3.0 percent in this period, is low compared to recent growth. (Although, it is up from 1991, a recession year in other parts of the world.) The 1992-96 period is also characterized by gradual a reduction in price inflation. The unemployment rate (second page of Table 8.19) continues to decline through the period, albeit at an excruciatingly slow pace. The slower growth, steady decreases in inflation and low rate of job formation are all consequences, at least partly, of integration of the European market. Because of the removal of tariff and non-tariff barriers, import price increases will be moderate and imports will continue to displace domestic production, constraining overall growth. Stiffer competition from abroad will force domestic firms to hold the line on price increases and enhance productivity, moderating both price and employment growth. Finally, while export growth promises to be healthy, it will not compensate for reduced capital formation, as investors take a breather from the recent vigorous activity. The nominal current account deficit as a percentage of GDP increases modestly.

Table 8.19: Spain in the Single Market, MIDE Forecast to 2000.

Gross Domestic Product and Components
Annual percentage rate of growth, constant 1980 prices.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Gross Domestic Product	3.62	2.37	2.76	2.86	2.96	2.84	2.60	3.49	3.70	3.69	3.85
Private National Consumption	3.76	3.13	3.66	4.13	3.98	3.41	3.51	3.94	3.94	3.50	3.63
Government Consumption *	4.24	4.53	3.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98
Gross Fixed Investment	6.91	1.71	3.61	3.16	4.72	4.57	4.31	4.55	4.75	4.55	4.50
Equipment	1.40	-2.40	5.03	3.21	4.86	4.32	4.05	4.71	4.65	4.21	4.53
Residential Construction	7.01	-7.08	-0.30	3.32	4.23	3.05	4.38	4.80	4.71	4.14	3.60
Non-residential Construction	12.72	9.64	3.90	3.06	4.79	5.34	4.50	4.31	4.84	4.99	4.81
Inventory Change (a)	0.16	0.06	-0.60	-0.35	-0.16	-0.24	-0.18	0.08	0.07	-0.00	0.08
Exports	3.23	8.53	7.08	7.00	5.03	5.27	4.90	4.90	5.81	6.03	6.51
Merchandise Exports (fob)	5.44	8.99	7.11	7.37	6.10	6.00	5.41	5.19	6.08	6.03	6.08
Service Exports	8.31	10.16	5.66	8.03	5.20	4.14	4.43	4.34	5.13	5.10	4.71
Interior Cons. by Non-resid.	-8.86	5.00	8.47	4.43	0.29	3.23	3.09	4.18	5.36	7.12	10.59
(Imports)	7.76	9.26	7.08	7.09	6.95	5.93	6.47	5.69	5.86	4.93	5.28
(Merchandise Imports (cif))	7.43	9.51	7.06	6.85	6.78	5.69	6.32	5.48	5.65	4.83	5.30
(Service Imports)	9.85	9.16	6.84	11.44	9.95	9.38	9.28	8.90	8.87	6.27	5.47
(Exterior Cons. of Residents)	13.17	3.10	8.02	6.12	6.10	5.87	5.10	5.00	5.21	4.96	4.28
GDP Deflator	7.30	6.89	6.37	5.73	4.84	4.36	3.40	2.92	3.28	2.64	3.23
Private Consumption Deflator	6.44	6.21	5.73	4.28	3.75	3.44	2.64	2.38	2.70	2.14	2.87
Fixed Investment Deflator	6.08	5.14	4.58	3.93	3.98	3.83	2.84	2.65	3.04	2.91	3.29
Export Deflator	1.67	2.04	3.53	1.91	1.66	1.81	1.34	0.98	1.76	1.66	2.47
Import Deflator	-1.16	0.68	0.66	2.24	2.54	3.03	2.09	2.32	3.04	4.08	4.01
Real Trade Balance (const. prices, % of GDP)	-7.99	-8.68	-9.04	-9.43	-10.24	-10.70	-11.48	-11.92	-12.18	-12.05	-11.90
Current Account Surplus (current prices, % of GDP)	-3.46	-3.08	-2.39	-2.40	-2.85	-3.18	-3.62	-4.05	-4.36	-4.70	-4.89
Government Budget Surplus (current prices, % of GDP)	-3.87	-4.07	-3.65	-3.09	-2.59	-2.05	-1.80	-1.25	-0.55	0.06	0.78

* - exogenous
(a) - percentage change as a proportion of GDP

Table 8.19: Spain in the Single Market, MIDE Forecast to 2000 (continued).

Other macroeconomic variables
Annual percentage rate of growth unless otherwise noted.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Income and savings:											
Net National Disposable Income (current prices)	10.93	9.31	9.64	8.94	8.08	7.33	6.12	6.53	7.19	6.40	7.25
Household Net Disposable Income (current prices)	12.65	8.93	8.55	8.06	7.46	6.82	6.00	6.13	6.71	6.11	6.85
Household Savings Rate (%)	6.60	6.10	5.20	4.70	4.30	4.20	4.00	3.70	3.70	4.10	4.30
Net National Disp. Income per cap (thous. of pts., constant prices)	4.03	2.74	3.54	4.32	4.03	3.64	3.28	3.96	4.30	4.12	4.21
Labor Market:											
Labor force	1.36	0.35	0.60	1.00	1.00	0.90	0.90	0.90	0.85	0.80	0.80
Employment	2.61	0.24	0.68	1.12	1.28	1.29	1.24	1.65	1.99	2.01	2.16
Unemployment rate (%)	16.25	16.34	16.28	16.18	15.95	15.63	15.34	14.71	13.75	12.71	11.53
Nominal wages per worker	9.44	9.59	8.58	6.97	6.11	5.87	5.41	5.28	5.69	5.83	6.07
Aggregate labor productivity	0.94	2.11	2.07	1.73	1.70	1.50	1.36	1.79	1.70	1.62	1.65
Real wages per worker	1.99	2.52	2.09	1.17	1.20	1.45	1.94	2.31	2.33	3.11	2.75
Monetary Sector:											
ALP Broad Money Supply *	11.85	13.00	11.00	10.00	8.50	8.00	7.50	7.25	7.00	6.75	6.50
M2 Narrow Money Supply *	17.77	12.00	11.00	10.00	8.50	8.00	7.50	7.25	7.00	6.75	6.50
Long run interest rate (%) *	14.90	12.80	10.67	9.51	9.12	8.59	7.84	7.38	7.66	7.71	8.18
Exterior Sector:											
Avg. Foreign Dem. for Merch.	5.29	1.39	3.63	5.77	3.90	3.98	3.46	2.98	3.97	3.38	3.37
Avg. Relat. Price of Merch. Exp.	3.86	0.27	-1.72	-1.56	-0.75	-0.85	-1.14	-1.34	-1.56	-2.08	-2.32
Pesetas/German Mark *	-1.43	-0.83	0.70	1.59	0.78	0.78	0.00	0.00	0.00	0.00	0.00
Pesetas/Pounds Sterling *	-6.64	3.79	-0.39	0.09	-0.69	-0.66	-1.40	0.00	-0.00	0.00	-0.00
Pesetas/US Dollar *	-13.91	2.33	-2.75	0.33	-0.49	-0.50	0.00	0.00	1.94	1.27	1.25

* - exogenous

Notes: Values for 1990 are advanced estimates of Instituto Nacional Estadística or actual. For 1991, major components of GDP, price deflators and wages are first estimations of INE; employment, money supply, interest and exchange rates are actual; all other variables are estimated or projected by the model.

Such an economic performance for the Spanish economy should qualify it for membership in the European Economic and Monetary Union (EMU). The 1996 figures for consumer inflation (2.64 percent), interest rates, (7.84 percent) and the government deficit as a proportion of GDP (1.80 percent) would have easily qualified at the beginning of 1992. However, this favorable results must be judged against several factors which underlie the forecast.

First of all, the exogenous growth of government consumption is held to 2 percent per year as proposed in the Convergence Plan. The government has missed its targets before, often by a large margin. The regional governments have been especially profligate lately, and neither the central government, nor the voters, have much control over this spending (see Chapter 2). If spending were to grow by 3 percent of more, there would likely be problems with the deficit target.

Second, the wage growth illustrated by this forecast is moderate, reflecting trend established in the 1980's. (Recall from Chapter 7 that the aggregate wage equation is estimated from 1980-1990.) Real wages move generally in line with productivity and, therefore, inflation is suppressed. However, ominous signs of labor unrest in early 1992 may mark a break with this behavior. If wages were to rise significantly faster than projected here, inflation would reignite, extinguishing the prospects for nominal convergence.

A third outstanding question would be the course of currency movements. The deterioration in the current account is shown as moderate here. If it were to be much worse, downward pressure on the peseta could require a depreciation that would, technically, eliminate EMU membership possibilities. One circumstance that could create such an outcome would be sluggish overall growth in Europe that prevents Spanish exports from expanding as indicated in the Table 3.19. Indeed, this forecast is based on a rosy scenario of European harmony that stimulates European growth. However, if this assumption were not realized, I expect that Spain would be one among a number of EC nations with convergence problems.

The forecast displays a second tendency beginning in 1997. Growth increases sharply to 3.5 to 4.0 percent from 1997 through 2000. One of the developments driving this scenario is a sharp decrease in unemployment resulting from a slower growth rate of the labor force. Also by this time, much of the job-destroying restructuring stimulated by the Europe-1992 program will have been completed. The decreases in the unemployment rate stimulate consumption. Despite the higher rates of growth, price inflation remains moderate. The current account, however, begins to deteriorate sharply.

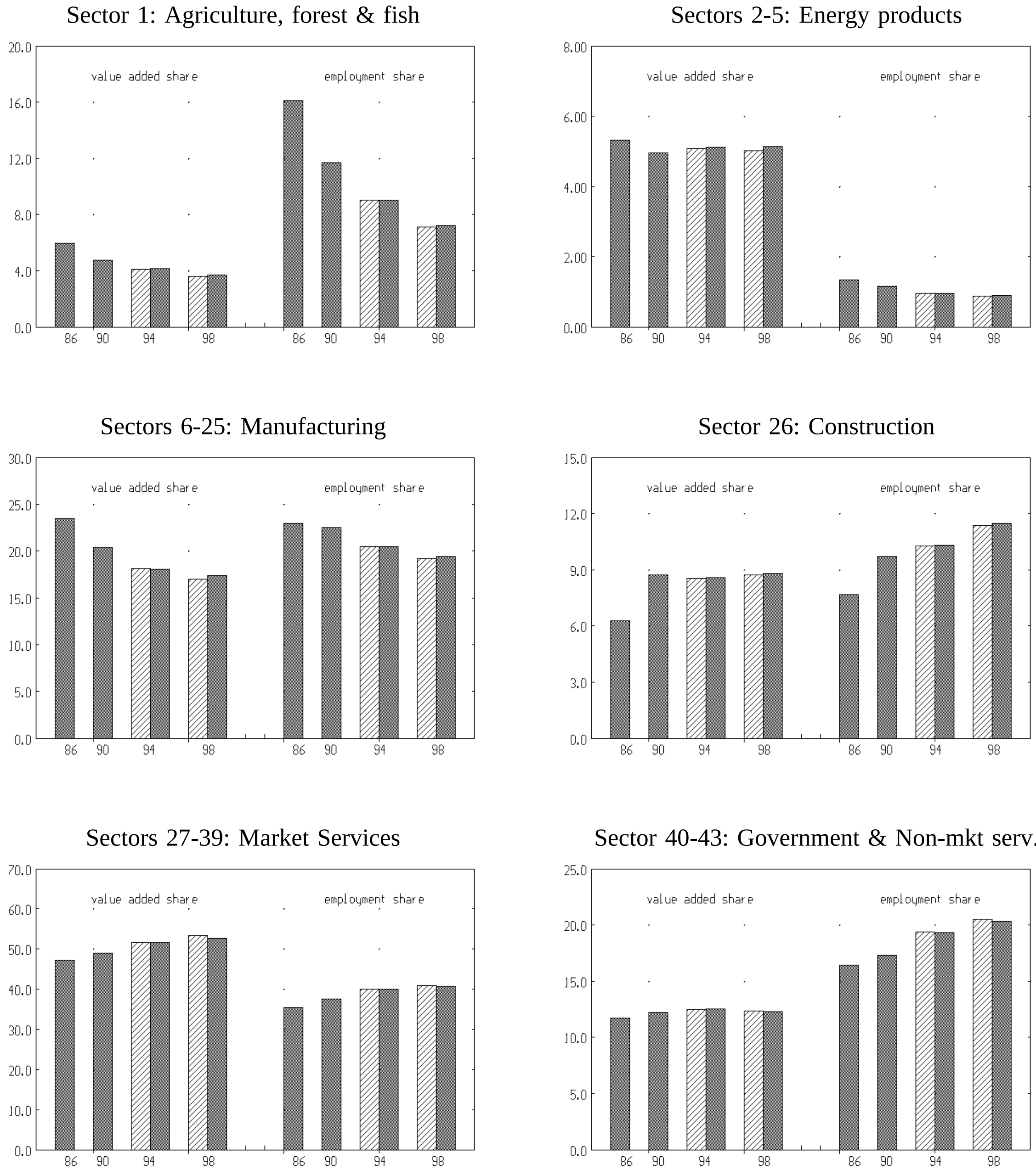
This final point raises and interesting question related to monetary union: If Spain does join the monetary union, which involves a single currency for all of the EC, will the current account be anything to worry about? At the national level the financing problem would disappear. Indebtedness would then become an issue settled in a unified capital market by individual parties. In the long-run, the increase in Spanish deficits may portend a problem for the individual parties who have incurred the debts, be they consumers, corporations, or government. If liquidity problems of this type were to occur, the optimistic growth forecast presented here would probably not be realized.

The advantage of the MIDE model is its level of disaggregation. Therefore, the final aspect of the forecast which deserves attention is its results for the various sectors and industries of the economy. From these projections, we can gain an appreciation of how the structure of the economy will change. Figure 8.2 shows the percentage shares of value added and employment for the six major sectors of the economy for the years 1986, 1990, 1994 and 1998. The MIDE model does not project anything novel here, just a continuation of established trends. The Spanish economy is expected to display the familiar pattern of a maturing economy, an increasing share of production and employment in services at the expense of agriculture and manufacturing. The construction industry appears to do well in the forecast. It is spurred on by a high level of government investment in infrastructure and strong residential construction growth.

Figure 8.3 displays the imports shares of domestic demand and export shares of domestic production for 18 selected manufacturing industries. Again, we see a continuation of many recent trends. Most sectors demonstrate increases in both ratios. The story told by these graphs is of a nation steadily opening to world trade. Other results presented in this chapter illustrate that the opening will be overwhelmingly beneficial for the economic welfare of the people of Spain.

As a final parting shot, I leave the reader with Tables 8.20 through 8.30. These present detailed sectoral level results of the forecast for various variables. These tables are a portion of the standard output of the MIDE model, which can be perused, or not, at the readers leisure.

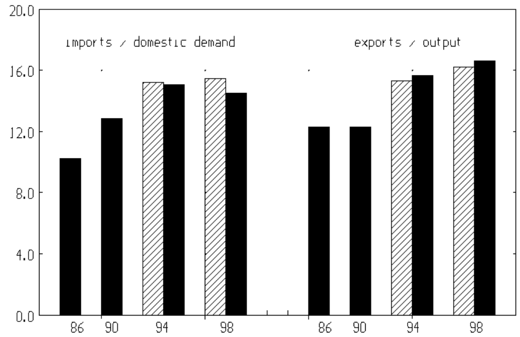
Figure 8.2: Value Added and Employment Shares by Major Sectors, 1986, 1990, 1994, 1998. (Percent)



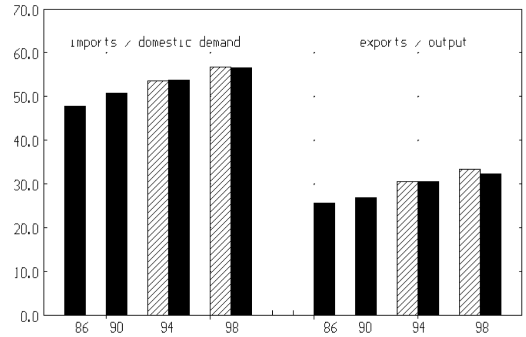
Note: For 1994 and 98, bar with diagonal lines represents Spain with Borders alternative. Solid bar is Spain in Single Market forecast.

Figure 8.3: Imports Percentage of Domestic Demand, Export Percentage of Output, 1986, 1990, 1994, 1998 (Constant prices).

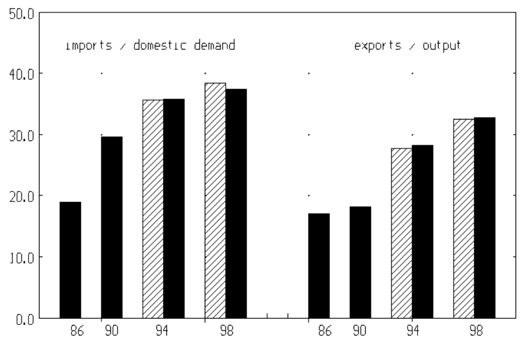
Sector 1: Agriculture



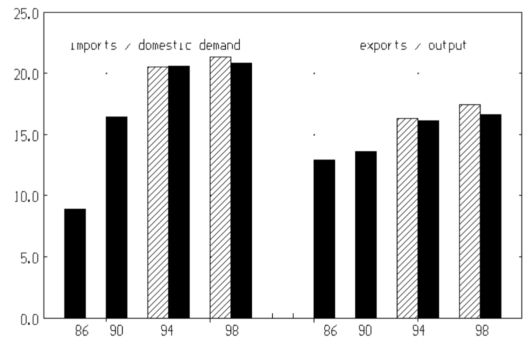
Sector 4: Petroleum products



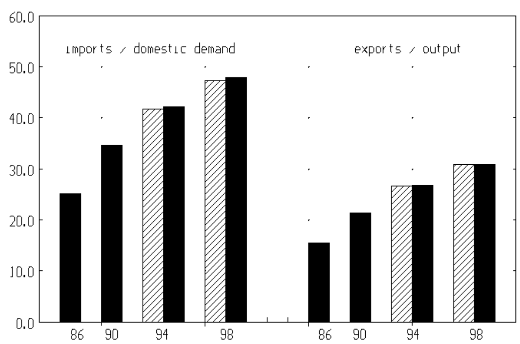
Sector 6: Metal mining & processing



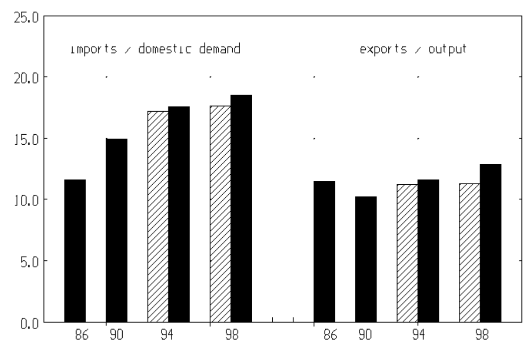
Sector 7: Non-metal products



Sector 8: Chemicals



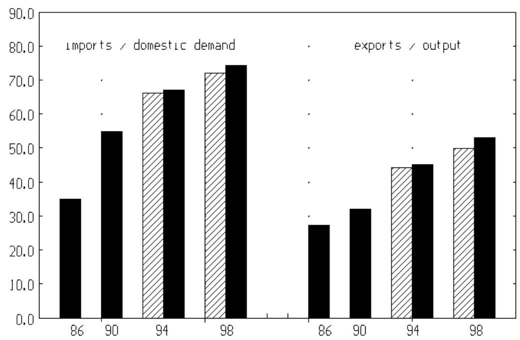
Sector 9: Metal products



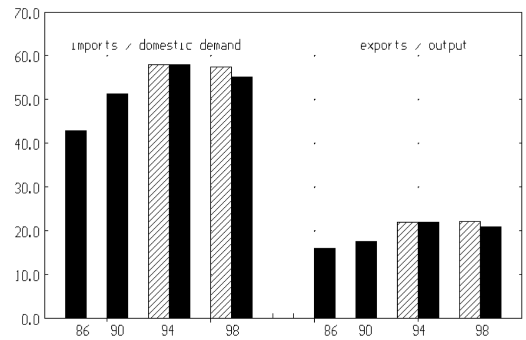
Note: For 1994 and 98, bar with diagonal lines represents Spain with Borders alternative. Solid bar is Spain in Single Market forecast.

Figure 8.3: Imports Percentage of Domestic Demand, Export Percentage of Output, 1986, 1990, 1994, 1998 (Constant prices) (continued).

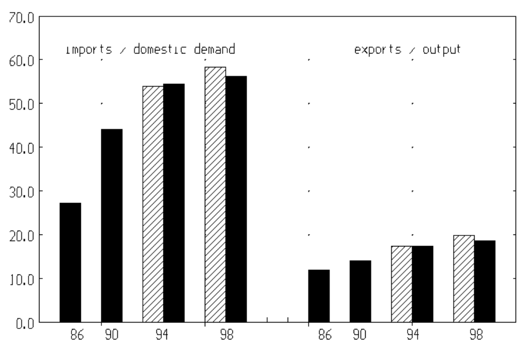
Sector 10: Agricultural & industrial machinery



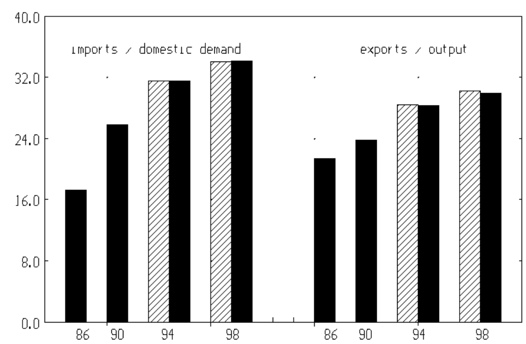
Sector 11: Off. mach., computers & instruments



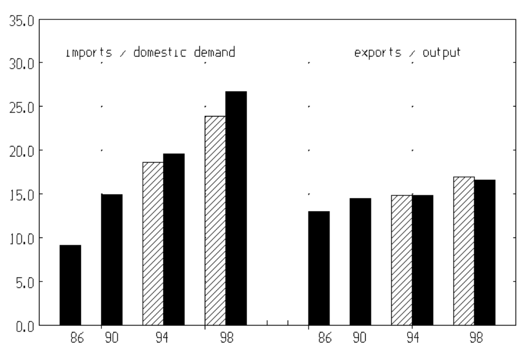
Sector 12: Electric & electronic material



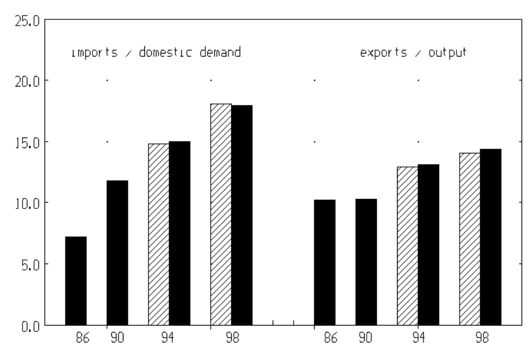
Sector 13: Automotive vehicles



Sector 14: Other transport equipment



Sector 17: Other food products



Note: For 1994 and 98, bar with diagonal lines represents Spain with Borders case. Solid bar is Single Market forecast.

Figure 8.3: Imports Percentage of Domestic Demand, Export Percentage of Output, 1986, 1990, 1994, 1998 (Constant prices) (continued).

Sector 18: Beverages

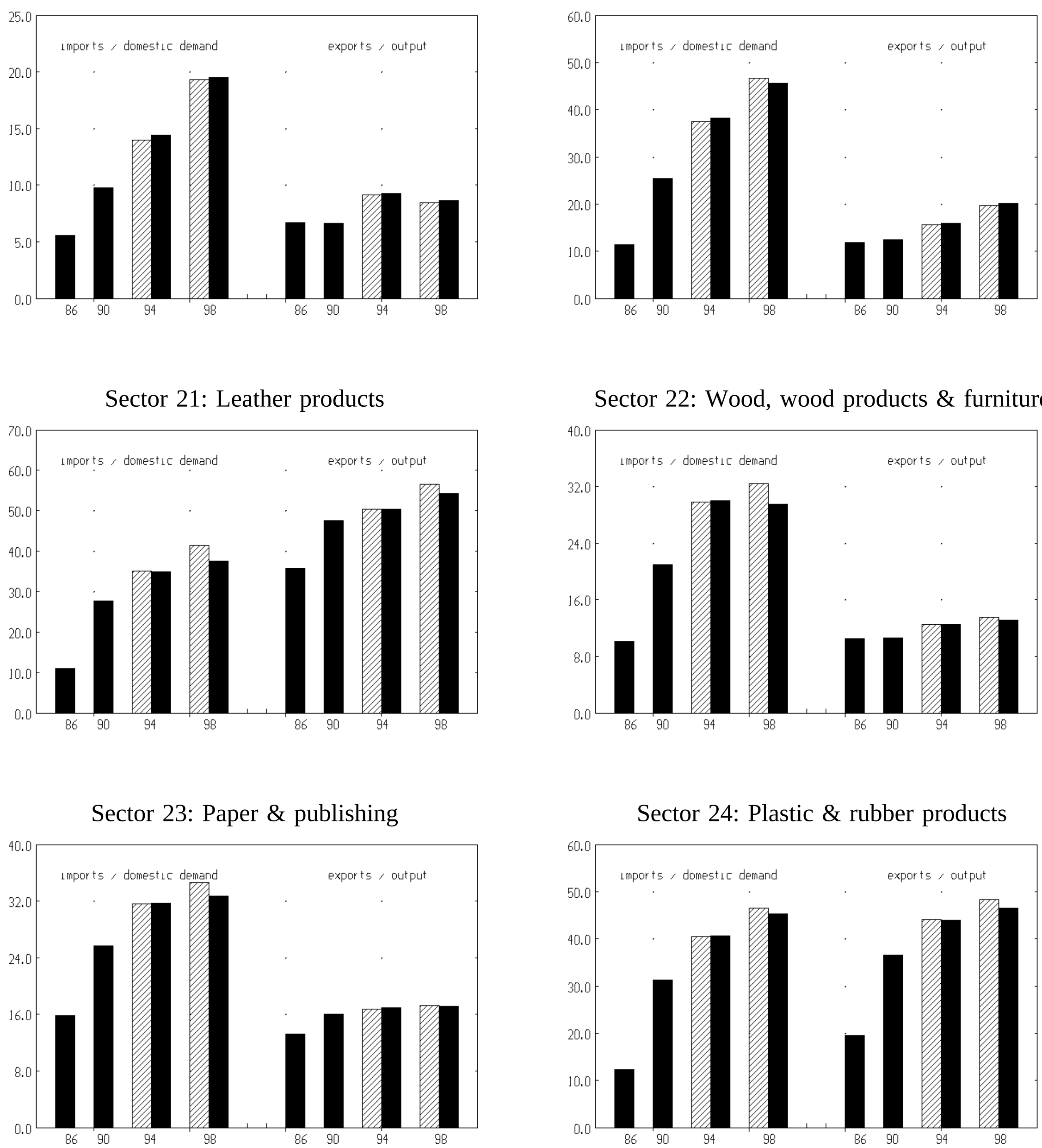
Sector 20: Textiles & apparel

Sector 21: Leather products

Sector 22: Wood, wood products & furniture

Sector 23: Paper & publishing

Sector 24: Plastic & rubber products



Note: For 1994 and 98, bar with diagonal lines represents Spain with Borders alternative. Solid bar is Spain in Single Market forecast.

Table 8.20: MIDE Model Projections - Constant Price Output by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	-1.89	0.30	1.54	1.53	3.89	3.87
ENERGY PRODUCTS	5.73	1.75	1.32	2.15	3.36	3.83
2. Coal and lignite	5.58	-9.07	0.08	1.57	5.93	6.47
3. Coke products	3.93	-3.45	1.20	1.18	2.84	4.09
4. Petroleum products	7.10	2.61	0.88	1.60	2.43	2.93
5. Electric & oth. util.	3.84	2.35	2.14	3.10	4.44	4.78
MANUFACTURING	2.74	0.53	3.03	2.72	4.45	4.72
6. Metal mining & proc.	1.04	0.96	5.10	5.13	6.00	7.50
7. Nonmetal mining & prod.	4.21	-0.81	2.04	2.94	3.37	3.80
8. Chemicals	2.19	1.90	3.32	1.99	3.83	4.10
9. Metal products	5.60	-0.03	3.08	2.78	3.61	3.92
10. Agric. & indust. mach.	3.34	-5.04	0.86	1.57	2.01	2.22
11. Off mach, comput, instr.	18.69	-1.21	5.06	7.24	8.26	8.63
12. Elect.& electronic prod.	-0.40	-1.86	2.84	3.88	4.76	5.44
13. Automotive vehicles	2.76	2.43	6.65	4.81	6.14	5.53
14. Other transport equip.	14.96	-0.22	1.42	0.93	1.92	2.31
15. Meat & oth. animal prod.	1.76	0.88	1.27	0.94	3.35	2.93
16. Dairy Products	5.20	-1.55	1.48	1.00	2.81	2.38
17. Other food products	0.87	2.20	1.15	0.96	3.68	3.47
18. Beverages	3.18	3.48	0.32	2.71	3.46	3.53
19. Tobacco products	-6.94	-0.65	3.04	-8.24	1.61	6.61
20. Textiles & apparel	1.31	-3.95	0.19	0.66	1.92	3.24
21. Shoes & leather prod.	-1.69	0.54	4.51	-6.34	11.36	5.61
22. Wood & furniture	-0.92	-1.63	1.83	4.04	5.25	5.36
23. Paper & publishing	3.06	2.31	3.50	3.72	5.23	6.28
24. Rubber & plastic prod.	-0.63	2.09	3.72	2.97	4.12	4.13
25. Other mfg. products	9.44	6.36	6.49	5.25	5.84	5.38
CONSTRUCTION	14.84	3.48	3.39	4.05	4.10	4.25
MARKET SERVICES	5.18	3.51	4.32	3.79	4.49	4.61
27. Repairs & reconstruct.	4.23	3.70	4.89	4.22	4.98	4.67
28. Wholesale & ret. trade	4.19	3.53	3.80	3.24	4.12	4.15
29. Rest., cafes & hotels	3.47	3.27	3.64	3.45	4.24	4.21
30. Interior transport	5.91	3.39	4.32	3.90	4.88	4.85
31. Maritime & air transp.	4.61	3.93	4.82	3.75	4.21	5.04
32. Oth. transport serv.	3.23	3.04	2.45	1.84	2.31	3.01
33. Communications	9.44	3.57	6.13	4.88	5.72	5.49
34. Banking & insurance	11.65	4.75	5.82	5.13	6.00	6.07
35. Business services	3.95	3.24	4.32	3.53	4.57	4.85
36. Commerc. & resid. rents	2.92	2.53	3.69	3.51	3.17	3.62
37. Priv. educ. & research	3.24	3.74	3.99	3.24	3.92	3.81
38. Priv. health services	6.51	3.36	4.56	3.88	4.65	4.45
39. Cult. & oth. services	4.18	3.95	5.36	4.42	5.03	4.88
NON-MARKET SERVICES	5.74	4.45	2.06	2.03	2.08	2.08
40. Pub. administration	5.90	4.46	2.06	2.05	2.06	2.05
41. Pub. education	6.65	4.73	1.97	1.96	1.98	1.98
42. Pub. health services	5.89	4.93	1.91	1.91	1.92	1.92
43. Domest. & oth. services	0.17	1.22	3.06	2.54	3.38	3.44

Table 8.21: MIDE Model Projections - Output Prices by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	4.64	1.19	3.45	2.38	2.03	1.88
ENERGY PRODUCTS	3.89	6.02	5.69	3.28	4.12	3.02
2. Coal and lignite	0.00	7.68	3.90	5.07	2.22	2.84
3. Coke products	-0.51	3.42	6.78	3.97	3.57	3.40
4. Petroleum products	4.80	2.89	4.70	3.55	4.18	4.22
5. Electric & oth. util.	4.61	8.82	6.21	2.47	3.70	1.65
MANUFACTURING	3.31	2.93	3.36	2.75	2.27	2.65
6. Metal mining & proc.	0.73	-1.47	3.44	2.75	2.50	2.98
7. Nonmetal mining & prod.	3.59	1.91	4.10	3.16	2.58	3.02
8. Chemicals	2.07	1.91	3.08	2.42	1.75	2.27
9. Metal products	5.02	4.83	4.04	3.28	2.90	3.28
10. Agric. & indust. mach.	4.84	3.75	2.81	1.93	2.07	2.55
11. Off mach, comput, instr.	3.56	3.07	0.68	0.93	0.54	1.26
12. Elect.& electronic prod.	3.74	2.32	2.14	2.31	1.21	2.80
13. Automotive vehicles	3.62	4.35	1.31	1.67	0.92	1.62
14. Other transport equip.	3.11	3.78	3.46	2.91	2.91	3.69
15. Meat & oth. animal prod.	3.43	1.97	4.21	2.89	2.59	2.29
16. Dairy Products	6.63	2.67	4.39	3.03	2.89	2.61
17. Other food products	3.36	3.31	4.15	3.00	2.43	2.44
18. Beverages	3.49	3.11	4.00	4.18	2.45	2.20
19. Tobacco products	1.24	4.43	6.87	14.42	6.77	5.48
20. Textiles & apparel	2.58	4.08	3.02	3.00	2.65	3.11
21. Shoes & leather prod.	3.09	3.18	3.52	3.57	1.96	2.99
22. Wood & furniture	5.18	4.27	4.20	2.41	3.27	2.87
23. Paper & publishing	3.62	2.43	3.37	3.41	2.92	3.71
24. Rubber & plastic prod.	2.50	4.95	4.91	2.63	3.64	3.46
25. Other mfg. products	4.80	4.75	5.20	3.14	3.76	4.24
CONSTRUCTION	8.42	5.58	4.39	3.41	2.88	3.03
MARKET SERVICES	7.32	7.54	4.73	3.44	2.84	2.66
27. Repairs & reconstruct.	8.84	7.89	4.25	3.43	2.34	2.33
28. Wholesale & ret. trade	8.85	7.48	4.69	3.31	2.28	1.92
29. Rest., cafes & hotels	9.59	8.65	4.68	3.21	2.80	2.09
30. Interior transport	2.11	5.22	4.55	3.51	3.94	3.46
31. Maritime & air transp.	3.61	5.95	4.41	2.84	2.49	2.72
32. Oth. transport serv.	1.54	6.44	5.28	3.73	4.16	4.17
33. Communications	3.10	7.09	2.28	1.85	1.35	1.34
34. Banking & insurance	5.63	7.52	4.59	3.42	2.57	3.04
35. Business services	7.76	7.91	5.80	3.99	3.55	3.34
36. Commerc. & resid. rents	7.84	5.27	3.00	2.23	1.03	0.92
37. Priv. educ. & research	7.27	8.96	6.89	5.15	5.06	4.86
38. Priv. health services	9.42	10.83	6.19	4.77	4.12	4.25
39. Cult. & oth. services	7.76	9.51	8.08	6.23	5.78	6.08
NON-MARKET SERVICES	7.04	6.52	5.02	4.30	3.83	4.24
40. Pub. administration	6.39	6.12	4.83	4.07	3.65	4.00
41. Pub. education	7.92	7.22	6.09	5.01	4.54	5.03
42. Pub. health services	7.22	6.44	4.60	4.29	3.64	4.13
43. Domest. & oth. services	11.23	9.53	4.75	4.20	3.90	4.43

Table 8.22: MIDE Model Projections - Employment by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	-6.15	-6.02	-4.62	-4.83	-3.05	-2.98
ENERGY PRODUCTS	2.37	-5.52	-1.92	-0.61	0.17	0.65
2. Coal and lignite	-1.86	-12.43	-5.44	-1.63	-1.78	-0.94
3. Coke products	-1.82	-12.25	-2.00	-2.55	-1.21	0.11
4. Petroleum products	-14.04	13.75	1.03	-1.61	-0.91	-0.57
5. Electric & oth. util.	7.42	-4.56	-1.14	-0.11	0.95	1.30
MANUFACTURING	3.15	-2.10	-1.05	-0.15	0.63	1.52
6. Metal mining & proc.	-4.86	-3.06	-1.11	0.64	1.42	2.62
7. Nonmetal mining & prod.	6.09	-3.33	-0.37	0.97	1.30	1.73
8. Chemicals	7.70	-4.75	-1.64	-2.59	-2.27	-1.43
9. Metal products	2.05	0.37	2.14	1.38	2.37	2.68
10. Agric. & indust. mach.	7.59	-3.76	-4.94	-1.11	-1.32	-0.89
11. Off mach, comput, instr.	11.09	-4.74	-2.74	1.13	1.72	2.35
12. Elect.& electronic prod.	8.83	-3.32	-4.59	-1.21	-0.58	0.20
13. Automotive vehicles	6.59	-0.53	-0.70	-1.15	-1.78	-1.96
14. Other transport equip.	-4.74	-6.58	4.92	0.26	-0.60	-0.28
15. Meat & oth. animal prod.	1.92	-2.40	0.84	0.34	1.38	1.47
16. Dairy Products	1.92	-1.80	3.74	1.91	2.40	2.76
17. Other food products	1.92	-2.00	-1.48	-2.07	-0.33	0.00
18. Beverages	1.92	-1.68	1.09	0.59	2.22	1.78
19. Tobacco products	1.92	-4.97	2.11	-8.21	0.03	5.37
20. Textiles & apparel	-0.56	-3.09	-2.73	-1.04	0.15	1.59
21. Shoes & leather prod.	-1.66	-1.79	-2.33	-4.43	-1.85	3.17
22. Wood & furniture	2.76	-2.75	-1.95	2.29	2.74	3.86
23. Paper & publishing	8.66	3.82	-0.89	2.50	2.99	4.67
24. Rubber & plastic prod.	5.89	-0.68	-3.03	-1.24	-2.81	-1.87
25. Other mfg. products	-3.51	-4.64	7.17	0.75	5.19	4.35
CONSTRUCTION	9.81	1.19	3.56	4.38	4.49	4.59
MARKET SERVICES	4.63	2.51	2.20	1.85	2.27	2.39
27. Repairs & reconstruct.	0.82	0.10	3.53	2.62	3.10	2.84
28. Wholesale & ret. trade	3.83	1.39	0.96	0.72	1.50	1.63
29. Rest., cafes & hotels	3.42	3.73	3.22	3.29	2.95	2.93
30. Interior transport	4.32	1.14	1.83	1.04	1.52	1.69
31. Maritime & air transp.	9.73	-1.13	-0.07	-1.12	-1.16	-0.35
32. Oth. transport serv.	3.17	-1.97	1.93	0.36	0.47	1.12
33. Communications	12.85	3.32	0.04	0.47	0.70	0.62
34. Banking & insurance	1.04	5.50	4.95	2.94	2.60	2.53
35. Business services	12.18	5.51	4.43	3.59	4.60	4.86
36. Commerc. & resid. rents	99.83	-15.35	-12.13	-5.61	-5.76	-4.94
37. Priv. educ. & research	4.10	2.99	3.71	3.07	3.45	3.47
38. Priv. health services	6.24	5.61	1.67	1.97	1.42	1.52
39. Cult. & oth. services	6.41	4.11	2.28	3.04	3.15	3.33
NON-MARKET SERVICES	6.12	3.72	3.85	2.87	2.74	2.57
40. Pub. administration	8.83	7.91	6.33	4.11	3.76	3.40
41. Pub. education	8.31	3.16	1.67	1.49	1.47	1.44
42. Pub. health services	8.75	5.11	-1.01	0.23	-0.57	-0.51
43. Domest. & oth. services	-2.99	-7.19	3.80	2.96	3.80	3.66
TOTAL EMPLOYMENT	3.42	0.46	1.21	1.27	1.84	2.11

Table 8.23: MIDE Model Projections - Exports by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	-0.55	8.92	5.95	3.66	4.93	5.14
ENERGY PRODUCTS	4.34	5.74	4.40	2.93	4.19	3.18
2. Coal and lignite	-6.50	-0.71	0.25	0.50	0.53	0.46
3. Coke products	-24.49	2.15	1.25	0.86	0.78	0.69
4. Petroleum products	4.67	5.84	4.41	2.92	4.21	3.18
5. Electric & oth. util.	-6.88	-0.05	5.80	4.88	4.36	3.98
MANUFACTURING	7.25	8.77	7.53	6.63	6.14	6.82
6. Metal mining & proc.	4.80	19.65	12.72	10.37	9.48	10.84
7. Nonmetal mining & prod.	6.27	5.91	4.39	4.34	3.51	3.89
8. Chemicals	7.89	8.28	9.48	6.98	6.65	6.51
9. Metal products	4.00	1.62	8.33	5.62	6.29	9.11
10. Agric. & indust. mach.	9.95	6.86	6.61	6.59	5.74	6.40
11. Off mach, comput, instr.	10.30	9.29	6.45	7.37	5.34	5.28
12. Elect.& electronic prod.	8.86	7.79	5.00	6.34	5.85	5.81
13. Automotive vehicles	10.46	10.54	8.41	7.22	7.01	7.50
14. Other transport equip.	22.22	2.48	0.07	3.87	4.86	4.87
15. Meat & oth. animal prod.	37.85	5.38	7.80	9.06	1.51	1.24
16. Dairy Products	33.24	6.59	13.88	6.19	1.21	1.10
17. Other food products	-0.27	11.25	5.40	4.49	5.12	5.87
18. Beverages	10.15	23.83	0.94	0.52	2.04	3.95
19. Tobacco products	-0.81	7.57	2.29	-1.64	-0.52	2.38
20. Textiles & apparel	-0.33	-1.25	10.64	7.74	7.38	7.83
21. Shoes & leather prod.	2.95	5.42	2.70	3.38	4.00	3.72
22. Wood & furniture	-1.72	6.27	2.41	6.56	5.17	7.11
23. Paper & publishing	3.19	3.63	4.95	5.83	3.68	5.08
24. Rubber & plastic prod.	13.41	7.77	8.30	5.54	4.59	4.65
25. Other mfg. products	11.75	9.90	8.08	5.84	4.30	4.14
MARKET SERVICES	6.83	8.20	6.82	4.38	4.84	5.03
28. Wholesale & ret. trade	6.49	8.48	7.20	5.39	5.48	6.01
30. Interior transport	6.08	7.55	5.64	4.24	4.29	4.72
31. Maritime & air transp.	5.74	7.21	5.36	4.05	4.11	4.53
32. Oth. transport serv.	6.09	8.08	6.50	4.85	4.90	5.36
33. Communications	12.97	13.52	13.35	4.83	7.07	5.90
34. Banking & insurance	6.36	7.16	6.96	2.91	4.33	3.76
35. Business services	13.14	11.63	10.53	3.99	5.97	5.08
39. Cult. & oth. services	4.92	5.66	5.00	2.23	3.24	2.84
EXPORTS OF GOODS & SERVICES	6.12	8.33	6.93	5.57	5.61	6.00
INTERIOR CONSUM. BY NONRES.	-7.71	6.95	2.37	3.21	4.88	9.23
TOTAL EXPORTS	3.25	8.10	6.19	5.21	5.50	6.46

Table 8.24: MIDE Model Projections - Imports by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	9.14	7.26	2.42	1.16	1.31	0.49
ENERGY PRODUCTS	4.15	2.93	3.98	5.15	3.33	3.88
2. Coal and lignite	10.90	5.21	1.03	1.45	1.23	1.40
3. Coke products	18.51	4.00	4.48	4.42	5.13	6.83
4. Petroleum products	3.87	2.83	4.11	5.31	3.41	3.96
5. Electric & oth. util.	7.57	1.04	2.90	4.04	4.49	4.84
MANUFACTURING	16.34	10.38	8.17	6.76	6.53	5.73
6. Metal mining & proc.	20.88	7.15	6.90	5.64	5.74	5.59
7. Nonmetal mining & prod.	39.69	10.48	4.09	3.74	3.17	2.70
8. Chemicals	11.72	9.77	9.21	7.68	7.94	7.44
9. Metal products	19.10	8.07	4.60	4.38	4.73	4.92
10. Agric. & indust. mach.	9.19	6.70	4.50	7.20	6.82	6.96
11. Off mach, comput, instr.	12.94	8.39	7.24	5.03	4.71	3.67
12. Elect.& electronic prod.	19.87	13.18	8.53	7.68	4.17	4.80
13. Automotive vehicles	13.68	11.81	9.93	7.79	8.38	7.23
14. Other transport equip.	-4.19	8.50	10.82	14.77	9.59	9.08
15. Meat & oth. animal prod.	13.64	16.98	8.18	6.04	7.08	3.25
16. Dairy Products	21.88	29.52	6.93	5.13	7.50	4.80
17. Other food products	9.06	8.95	7.80	7.53	7.99	4.81
18. Beverages	17.14	8.51	19.63	17.09	10.76	7.19
19. Tobacco products	-4.97	0.99	9.73	-2.97	8.76	12.92
20. Textiles & apparel	25.47	15.02	12.13	7.64	8.82	6.20
21. Shoes & leather prod.	35.88	15.39	5.68	-1.71	7.55	3.72
22. Wood & furniture	26.82	14.08	12.19	3.81	3.68	0.51
23. Paper & publishing	25.99	14.42	7.81	5.39	5.90	4.87
24. Rubber & plastic prod.	32.87	8.99	12.85	7.36	7.88	7.02
25. Other mfg. products	11.00	9.43	4.40	2.99	3.18	2.82
MARKET SERVICES	11.30	8.32	11.26	9.76	9.28	6.04
28. Wholesale & ret. trade	16.92	17.58	16.68	13.41	12.49	7.53
30. Interior transport	8.18	-2.97	5.15	4.97	5.62	5.42
31. Maritime & air transp.	7.92	4.54	9.04	8.03	7.10	1.82
32. Oth. transport serv.	12.64	8.62	8.85	7.39	7.89	6.93
33. Communications	10.03	-2.61	5.40	4.91	5.43	5.11
34. Banking & insurance	7.62	3.33	8.10	7.19	6.23	4.23
35. Business services	10.51	7.71	12.18	10.90	9.86	5.95
39. Cult. & oth. services	5.03	-2.94	6.38	5.31	5.78	5.54
IMPORTS OF GOODS & SERVICES	12.80	8.60	7.30	6.42	5.96	5.25
INTERIOR CONS. BY RESIDENTS	21.13	5.69	6.29	5.64	5.23	4.73
TOTAL IMPORTS	13.07	8.50	7.27	6.39	5.94	5.24

Table 8.25: MIDE Model Projections - Nominal Labor Compensation by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	4.44	4.69	3.58	2.75	4.75	5.24
ENERGY PRODUCTS	8.71	2.92	5.38	5.96	6.62	7.84
2. Coal and lignite	2.81	-5.21	1.33	4.46	4.52	6.12
3. Coke products	4.51	-1.78	6.01	4.62	5.92	7.96
4. Petroleum products	-5.92	17.45	6.19	3.90	4.43	5.24
5. Electric & oth. util.	13.66	5.01	6.64	6.67	7.48	8.58
MANUFACTURING	11.81	6.09	6.02	5.26	6.34	7.51
6. Metal mining & proc.	6.55	6.39	7.77	7.75	8.52	10.38
7. Nonmetal mining & prod.	12.70	4.74	5.47	5.98	6.18	7.10
8. Chemicals	15.27	5.41	5.43	3.46	4.11	5.37
9. Metal products	13.74	7.38	7.65	6.52	7.18	8.05
10. Agric. & indust. mach.	10.75	0.30	3.46	4.18	4.34	5.01
11. Off mach, comput, instr.	22.02	2.00	3.33	6.36	6.89	7.97
12. Elect.& electronic prod.	10.55	5.06	4.38	5.67	5.35	7.88
13. Automotive vehicles	13.47	7.52	6.13	4.48	4.29	4.40
14. Other transport equip.	11.82	0.35	3.58	1.53	1.80	2.36
15. Meat & oth. animal prod.	10.56	6.17	6.39	5.13	6.44	6.92
16. Dairy Products	13.67	5.20	6.24	5.10	6.84	6.85
17. Other food products	11.68	7.22	4.86	3.37	5.11	6.03
18. Beverages	13.18	8.34	8.41	6.74	8.20	8.43
19. Tobacco products	16.72	7.59	12.19	-1.42	7.67	14.91
20. Textiles & apparel	8.69	3.15	4.01	4.37	5.38	7.24
21. Shoes & leather prod.	5.93	7.03	7.33	-1.97	11.26	9.72
22. Wood & furniture	7.48	4.28	4.46	6.73	8.01	8.61
23. Paper & publishing	16.94	12.67	6.71	8.16	8.82	11.06
24. Rubber & plastic prod.	8.22	9.60	7.98	6.79	7.34	8.07
25. Other mfg. products	10.20	7.92	15.37	8.23	11.78	11.80
CONSTRUCTION	24.07	7.70	8.02	8.29	8.23	8.89
MARKET SERVICES	10.77	12.73	10.46	8.83	9.40	10.14
27. Repairs & reconstruct.	5.75	10.67	10.15	8.45	8.89	9.02
28. Wholesale & ret. trade	7.32	7.24	5.71	4.95	5.97	6.60
29. Rest., cafes & hotels	7.94	9.87	9.87	9.18	9.29	9.93
30. Interior transport	7.44	10.29	8.98	7.82	8.62	8.96
31. Maritime & air transp.	7.52	8.76	7.58	5.79	5.89	7.09
32. Oth. transport serv.	6.66	9.68	8.34	6.32	6.35	7.57
33. Communications	13.65	11.45	8.89	7.54	7.88	8.13
34. Banking & insurance	17.05	17.04	12.33	10.01	10.31	11.03
35. Business services	14.20	16.71	12.93	10.60	11.32	12.38
36. Commerc. & resid. rents	6.21	13.06	11.09	9.60	8.83	9.95
37. Priv. educ. & research	7.27	12.94	10.44	8.59	8.88	9.36
38. Priv. health services	12.58	15.77	12.33	10.41	10.59	11.11
39. Cult. & oth. services	10.89	17.65	16.05	12.81	13.18	13.74
NON-MARKET SERVICES	14.84	12.38	7.36	6.55	6.27	6.78
40. Pub. administration	13.54	11.72	7.17	6.33	6.08	6.51
41. Pub. education	18.57	13.12	8.44	7.30	6.95	7.58
42. Pub. health services	15.77	13.44	6.48	6.18	5.60	6.17
43. Domest. & oth. services	10.24	11.67	8.13	6.96	7.66	8.27
TOTAL LABOR COMPENSATION	13.02	10.04	8.12	7.22	7.69	8.49

Table 8.26: MIDE Model Projections - Nominal Gross Profits
by Production Sector.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURE, FOREST. & FISH	4.14	5.29	3.28	2.26	4.43	3.80
ENERGY PRODUCTS	-1.40	21.14	9.93	4.84	8.63	5.20
2. Coal and lignite	-4.21	-3.18	4.42	4.40	4.69	4.55
3. Coke products	-7.06	1.88	14.41	4.43	7.37	7.73
4. Petroleum products	-10.23	26.64	2.82	2.96	2.17	2.28
5. Electric & oth. util.	-0.54	22.75	10.33	4.94	9.03	5.26
MANUFACTURING	2.21	4.60	5.41	4.49	5.83	6.33
6. Metal mining & proc.	-4.78	7.68	8.49	7.78	7.84	10.85
7. Nonmetal mining & prod.	3.97	-7.94	6.30	5.83	4.36	6.07
8. Chemicals	8.52	5.59	4.58	3.10	3.37	4.53
9. Metal products	11.19	8.44	6.96	5.71	5.61	6.21
10. Agric. & indust. mach.	9.89	-9.17	3.62	-0.20	3.49	4.03
11. Off mach, comput, instr.	19.24	2.42	3.25	6.30	6.09	7.24
12. Elect.& electronic prod.	-18.12	-7.38	0.16	6.72	-2.66	15.17
13. Automotive vehicles	-4.25	13.44	3.71	5.11	4.41	4.60
14. Other transport equip.	10.62	-3.59	3.10	3.83	6.88	9.64
15. Meat & oth. animal prod.	7.68	7.12	7.29	3.94	6.76	4.16
16. Dairy Products	14.43	3.88	6.86	3.81	6.11	3.98
17. Other food products	5.79	11.40	6.40	4.86	6.43	5.14
18. Beverages	8.44	14.98	0.32	8.06	4.33	2.92
19. Tobacco products	-7.58	-18.14	54.48	-87.00	-107.10	69.61
20. Textiles & apparel	8.45	1.08	1.67	3.96	4.58	6.25
21. Shoes & leather prod.	2.72	7.37	7.52	-4.41	13.86	7.02
22. Wood & furniture	-8.26	11.34	9.78	3.18	11.32	6.16
23. Paper & publishing	-0.81	4.12	6.55	6.06	7.35	9.45
24. Rubber & plastic prod.	-20.19	10.03	11.55	-1.82	10.46	5.37
25. Other mfg. products	8.86	9.07	14.64	7.82	10.31	10.19
CONSTRUCTION	29.43	9.60	8.76	7.35	5.64	4.99
MARKET SERVICES	16.60	11.05	8.83	6.55	6.20	5.44
27. Repairs & reconstruct.	21.37	12.77	9.41	7.42	6.42	5.17
28. Wholesale & ret. trade	20.45	12.35	9.56	7.05	6.29	5.47
29. Rest., cafes & hotels	10.52	10.49	8.58	5.99	6.63	4.59
30. Interior transport	5.96	3.43	7.95	6.32	9.67	7.21
31. Maritime & air transp.	22.42	12.08	10.66	6.16	6.07	6.53
32. Oth. transport serv.	8.51	3.71	7.87	5.17	7.28	7.59
33. Communications	17.91	10.35	7.23	5.22	5.33	4.23
34. Banking & insurance	22.77	17.31	8.87	7.00	6.27	6.81
35. Business services	17.05	8.04	8.47	4.77	5.10	3.60
36. Commerc. & resid. rents	14.74	8.74	7.02	6.01	4.07	4.28
37. Priv. educ. & research	26.48	10.35	8.22	3.60	4.75	1.42
38. Priv. health services	20.52	11.89	11.15	8.09	8.30	7.62
39. Cult. & oth. services	16.40	16.11	13.23	9.89	9.69	9.12
NON-MARKET SERVICES	15.48	12.75	6.13	4.75	2.93	2.37
40. Pub. administration	14.42	12.45	6.75	5.50	3.80	3.43
41. Pub. education	17.88	14.39	5.79	4.15	2.07	1.20
42. Pub. health services	13.17	12.09	3.16	1.59	-0.76	-2.32
43. Domest. & oth. services	28.61	-1.80	7.57	6.54	6.27	6.74
TOTAL GROSS PROFITS	11.68	9.26	9.09	6.28	6.18	5.33

Table 8.27: MIDE Model Projections - Real Private Interior Consumption by Commodities.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
FOOD, BEVERAGES & TOBACCO	2.20	2.92	2.39	2.02	2.44	2.47
1. Bread & cereals	0.37	-0.18	0.09	0.03	0.38	0.32
2. Meat	3.31	3.39	2.78	2.48	2.64	2.72
3. Fish	1.08	2.56	1.70	1.31	2.41	2.23
4. Milk, cheese & eggs	2.56	3.59	2.81	2.53	2.62	2.63
5. Oils & fats	1.88	3.37	1.77	1.60	1.63	2.04
6. Fruit & vegetables	0.11	3.48	2.73	2.25	3.04	2.85
7. Potatoes & oth. tubers	-1.98	0.46	0.43	0.01	0.90	0.92
8. Sugar	2.30	1.95	1.55	1.52	0.96	1.21
9. Coffee, tea & cocoa	4.85	2.09	1.93	1.88	1.14	1.67
10. Oth. food products	4.07	4.84	4.08	3.40	4.50	4.21
11. Non-alcoholic beverages	3.19	1.95	2.26	1.84	3.23	3.03
12. Alcoholic beverage	3.38	3.29	3.51	2.89	2.93	3.12
13. Tobacco products	5.20	3.11	2.85	1.11	2.32	2.62
CLOTHING & FOOTWEAR	4.64	4.31	4.30	3.44	4.52	4.29
14. Clothing	4.40	4.45	4.39	3.49	4.73	4.43
15. Footwear	5.48	3.85	3.98	3.25	3.78	3.77
RENT & UTILITIES	3.03	2.27	3.41	3.30	2.99	3.43
16. Rent & water	2.78	2.35	3.57	3.43	2.94	3.44
17. Heat & light	4.26	1.89	2.67	2.68	3.25	3.41
HOME FURNISH. & MAINTEN.	3.91	4.68	4.38	3.44	4.90	4.47
18. Furniture	7.71	4.59	6.03	4.99	4.89	5.06
19. Household textiles	2.98	5.63	4.01	2.93	4.93	4.16
20. Electric appliances	2.16	6.40	4.59	3.18	7.06	5.47
21. Domestic utensils	6.80	4.46	3.87	2.96	3.69	3.72
22. Maint. goods & serv.	3.40	4.91	3.12	2.62	3.80	3.49
23. Domestic services	-0.51	0.91	2.92	2.28	3.51	3.43
HEALTH & MEDIC. EXPENDITURES	8.93	4.84	4.74	3.90	4.83	4.56
24. Drugs	11.38	6.02	4.66	3.71	4.96	4.56
25. Therapeutic apparatus	11.11	7.56	6.78	5.55	5.13	5.33
26. Prof. medical serv.	7.16	2.68	4.14	3.62	4.61	4.37
27. Hospital services	6.24	4.56	5.57	4.49	4.86	4.78
28. Priv. medical insurance	3.41	3.64	4.44	3.75	4.38	4.12
TRANSPORT & COMMUNICATIONS	4.37	3.64	6.08	5.20	5.67	5.04
29. Motor vehicles	1.73	0.97	9.33	7.76	7.91	6.32
30. Private vehicle expenses	5.77	4.51	4.67	4.05	4.45	4.22
31. Transport services	3.23	4.74	5.09	4.22	4.99	4.71
32. Communications	7.88	5.89	6.03	5.03	6.04	5.72
ENTERTAINMENT & EDUCATION	7.67	6.69	5.34	4.21	5.24	4.76
33. Entertainment goods	10.42	8.76	6.09	4.79	6.39	5.52
34. Entertainment services	6.73	5.72	4.99	3.85	4.31	4.11
35. Books & periodicals	8.39	4.55	5.01	3.92	4.02	4.09
36. Education	3.32	4.20	4.18	3.33	3.97	3.81
OTHER GOODS & SERVICES	3.67	3.35	3.70	3.39	4.00	3.91
37. Pers. goods & care prod.	5.11	3.92	3.81	3.23	3.46	3.32
38. Other goods n.e.c.	6.82	4.43	4.91	4.25	4.43	4.41
39. Restaurants & hotels	2.84	2.86	3.19	3.05	3.83	3.77
40. Travel services	0.53	3.23	3.73	3.53	3.64	2.85
41. Financial services	16.78	6.87	8.24	6.92	6.04	6.23
42. Other services	2.77	4.19	4.07	3.69	3.93	3.57
43. Oth. expendit., n.e.c.	3.56	5.01	5.28	4.05	4.78	4.28
PRIVATE INTERIOR CONSUMPTION	3.87	3.60	4.01	3.47	4.04	3.90
(INTER. CONS. BY NON-RESID.	-7.71	6.95	2.37	3.21	4.88	9.23
EXTERIOR CONS. BY RESIDENT	21.13	5.69	6.29	5.64	5.23	4.73
PRIVATE NATIONAL CONSUMPTION	4.88	3.45	4.14	3.52	4.01	3.63

Table 8.28: MIDE Model Projections - Consumption Prices by Commodity.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
FOOD, BEVERAGES & TOBACCO	7.06	4.10	4.08	3.36	2.51	2.39
1. Bread & cereals	8.10	7.52	4.16	2.96	2.29	2.33
2. Meat	4.74	3.21	4.15	2.94	2.41	2.29
3. Fish	6.56	4.72	4.15	2.97	2.29	2.32
4. Milk, cheese & eggs	6.66	2.80	4.19	3.04	2.43	2.40
5. Oils & fats	10.08	-1.70	4.16	2.96	2.29	2.34
6. Fruit & vegetables	11.01	4.35	3.68	2.61	2.22	2.13
7. Potatoes & oth. tubers	15.72	5.89	3.69	2.61	2.22	2.12
8. Sugar	1.66	3.17	4.13	2.98	2.31	2.31
9. Coffee, tea & cocoa	-1.03	2.22	4.14	2.99	2.29	2.31
10. Oth. food products	3.75	4.56	4.16	2.97	2.30	2.32
11. Non-alcoholic beverages	7.59	7.22	3.44	3.34	1.97	1.94
12. Alcoholic beverage	12.18	5.57	3.45	3.34	1.96	1.94
13. Tobacco products	5.26	6.48	5.98	12.40	5.46	4.47
CLOTHING AND FOOTWEAR	5.04	5.17	3.52	3.14	2.25	2.54
14. Clothing	5.22	5.15	3.37	3.06	2.21	2.53
15. Footwear	4.47	5.20	4.13	3.45	2.31	2.57
RENT & UTILITIES	7.37	6.45	3.84	2.53	1.95	1.46
16. Rent and water	7.84	5.45	3.26	2.47	1.34	1.30
17. Heat & light	5.36	9.97	5.84	3.01	3.61	1.90
HOME FURNISH. & MAINTEN.	5.36	5.33	3.77	3.26	2.44	2.86
18. Furniture	5.98	6.05	3.87	3.27	2.85	3.00
19. Household textiles	3.98	4.57	3.42	3.02	2.17	2.44
20. Electric appliances	3.17	4.05	3.36	2.93	2.01	2.55
21. Domestic utensils	3.90	4.92	3.99	3.43	2.56	2.86
22. Maint. goods & serv.	3.85	3.97	3.70	3.14	2.18	2.52
23. Domestic services	11.23	9.53	4.75	4.20	3.90	4.43
HEALTH & MEDIC. EXPENDITURES	4.53	7.00	4.95	3.99	3.19	3.46
24. Drugs	0.51	3.10	3.50	3.02	2.05	2.43
25. Therapeutic apparatus	1.00	2.87	3.37	2.77	2.33	2.51
26. Prof. medical serv.	8.20	10.81	6.20	4.78	4.12	4.24
27. Hospital services	9.17	10.84	6.19	4.78	4.11	4.24
28. Priv. medical insurance	10.65	10.90	5.93	4.56	3.90	4.07
TRANSPORT & COMMUNICATIONS	6.79	6.63	3.49	2.10	2.39	2.58
29. Motor vehicles	5.79	4.87	1.89	-0.56	1.41	2.14
30. Private vehicle expenses	8.81	7.00	4.27	3.34	2.97	2.98
31. Transport services	5.47	8.45	4.43	3.26	3.24	3.09
32. Communications	1.82	7.49	2.27	2.29	1.38	1.38
ENTERTAINMENT & EDUCATION	4.36	5.65	4.88	4.06	3.31	3.68
33. Entertainment goods	0.52	2.79	3.69	3.06	2.48	2.97
34. Entertainment services	6.77	8.44	6.53	5.22	4.55	4.50
35. Books & periodicals	8.41	5.72	2.67	3.62	2.69	3.93
36. Education	7.27	8.78	6.55	5.06	4.62	4.58
OTHER GOODS & SERVICES	8.64	9.15	5.98	4.74	4.10	4.08
37. Pers. goods & care prod.	5.66	8.10	5.96	5.11	4.18	4.58
38. Other goods n.e.c.	5.38	5.56	4.28	3.33	2.75	3.05
39. Restaurants & hotels	9.59	8.65	4.68	3.21	2.80	2.09
40. Travel services	10.43	8.48	4.15	2.71	2.93	3.62
41. Financial services	7.11	7.69	4.52	3.38	2.53	3.08
42. Other services	7.11	7.30	5.20	3.87	3.06	3.36
43. Oth. expendit., n.e.c.	8.51	10.17	7.50	6.30	5.38	5.73
PRIVATE INTERIOR CONSUMPTION	6.65	6.26	4.12	3.08	2.59	2.54
(INTER. CONS. BY NON-RESID.)	7.12	6.34	3.96	2.87	2.32	2.26
EXTERIOR CONS. BY RESIDENTS	2.19	0.82	1.04	1.42	1.16	4.06
PRIVATE NATIONAL CONSUMPTION	6.67	6.15	4.09	3.09	2.57	2.54

Table 8.29: MIDE Model Projections - Fixed Capital Investment.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURAL PRODUCTS	-0.43	1.85	0.34	0.84	-0.82	-0.20
METAL PRODUCTS & MACHINERY	7.02	1.11	3.93	4.21	5.13	4.72
2. Metal products	5.52	1.37	2.52	2.88	3.29	2.97
3. Agricultural machinery	-0.94	-1.21	2.60	10.59	11.76	8.04
4. Industrial machinery	9.27	0.44	2.57	5.58	5.07	5.41
5. Office mach. & computers	7.58	1.65	5.31	4.28	5.31	4.50
6. Elect. & electronic mach.	6.06	1.73	5.78	2.78	5.41	4.58
TRANSPORT EQUIPMENT	8.55	1.90	4.18	4.40	4.40	4.70
7. Automotive vehicles	8.01	2.25	2.75	3.35	4.56	4.22
8. Other Transport equipment	12.20	-0.24	13.61	10.16	3.61	7.10
RESIDENTIAL CONSTRUCTION	5.35	-3.68	3.85	3.79	4.87	3.94
NON-RESIDENTIAL CONSTRUCTION	18.78	6.96	4.00	5.04	4.68	5.02
OTHER PRODUCTS	2.80	0.57	5.59	4.66	4.03	2.50
FIXED CAPITAL INVESTMENT	10.93	2.69	4.02	4.54	4.75	4.63

Table 8.30: MIDE Model Projections - Prices of Fixed Capital Investment.
(Average annual percentage growth rates.)

	88-90	90-92	92-94	94-96	96-98	98-100
AGRICULTURAL PRODUCTS	-3.20	1.02	3.45	2.46	2.21	2.14
METAL PRODUCTS & MACHINERY	3.50	2.40	2.22	2.63	1.84	2.80
2. Metal products	3.08	4.71	3.75	3.55	2.66	3.13
3. Agricultural machinery	6.30	2.07	2.15	2.21	1.68	2.54
4. Industrial machinery	3.24	2.07	2.14	2.23	1.68	2.56
5. Office mach. & computers	3.97	2.40	1.63	2.27	1.72	2.44
6. Elect. & electronic mach.	3.22	1.63	2.01	2.60	1.70	3.13
TRANSPORT EQUIPMENT	2.93	1.60	2.17	1.82	1.63	2.61
7. Automotive vehicles	2.33	1.49	1.55	1.65	1.25	2.08
8. Other Transport equipment	6.12	2.67	3.64	1.40	3.25	4.01
RESIDENTIAL CONSTRUCTION	6.75	6.25	4.63	3.54	2.94	3.13
NON-RESIDENTIAL CONSTRUCTION	6.76	5.64	4.36	3.42	2.87	3.04
OTHER PRODUCTS	5.36	3.19	3.27	2.98	3.01	3.32
FIXED CAPITAL INVESTMENT	5.70	4.98	4.03	3.39	2.89	3.15

CHAPTER 9:

CONCLUSIONS AND DIRECTIONS FOR FURTHER WORK

The purpose of this dissertation was to develop and apply a dynamic, macroeconomic, multisectoral model of the Spanish economy. Combining the classical input-output formulation with extensive use of regression analysis, the *Modelo **M**acroeconómico **I**ntersectorial **d**e **E**spaña* (MIDE) employs a "bottom-up" approach to modeling. In this approach the macroeconomic quantities are determined by summing up individually modeled sectoral and commodity level results. The bottom-up, disaggregated characteristic of the MIDE model enables it to provide a much richer description of the economy than other existing models of Spain. Other characteristics of the model include:

1) An aggregate consumption function which smoothes the effects of changes in income. It also integrates a wealth effect designed to stifle demand during periods of high inflation. Increases in unemployment also dampen demand. A system of consumption functions allocate total private consumption among 43 categories of goods.

2) Investment accelerator functions which respond to activity in the investing industries, relative investment to production prices, and monetary conditions.

3) Export equations which depend on demand conditions in Spain's trading partner countries, relative prices and exchange rates. Similarly, the import functions depend on domestic demand and the relative price of imports to domestic production.

4) Sectoral potential output which is modeled with essentially exogenous productivity trends.

5) A wage function which responds to recent inflation and the gap between unemployment and the "natural rate of unemployment".

6) Sectoral profit functions which respond to wage costs and, for tradeable goods industries, international prices and tariff rates.

The addition of the MIDE model to the small inventory of empirical models of Spain is particularly timely. The MIDE model is the only multisectoral, dynamic, macroeconomic model of the Spanish economy with significant (i.e., over twelve sectors) disaggregation. Therefore, it can be used for applications where other, existing models are inadequate.

The most important influence on the course of the Spanish economy for the next decade will be the continuing integration of the EC. The *Europe 1992* program will eliminate all barriers to trade, capital and labor movements between the Community countries. Many people feel that Spain will not be capable of competing in this market and unemployment, the most serious problem in Spain, will increase with the arrival of the single market. Another EC issue troubling to Spaniards is the prospect of meeting the convergence criteria in preparation for European monetary union. The recent Convergence Plan outlined by the government makes it clear that substantial labor market and government budgetary reforms will have to be made.

The MIDE model, as a comprehensive and detailed representation of the Spanish economy, is a convenient tool for investigating the impact of EC integration. In this work, the MIDE model provided individual assessments of the effects of the elimination of border controls, the opening of public procurement contracts, financial liberalization, changes in producer behavior and fiscal harmonization. It also provided an evaluation of the total impact of the single market integrating all of the above aspects of integration. The results demonstrate that with successful adaptation to the single market, governmental budgetary restraint, wage moderation and some luck in export markets, the Spanish economy can approach "monetary convergence" with the rest of the EC. Moreover, convergence can be accomplished without suffering significant decreases in the growth of income and employment. Finally, the model's detailed industry-level projections illustrate a maturing economy becoming even more integrated in the international economy.

MIDE, as any large scale empirical model, is in a continuous state of development. Moreover, the data base is constantly being improved as new information becomes available. One direction for future work involves the installation of the 1986 input-output table as the base of the model. In addition to the advantages of integrating more recent economic structure of the economy into the model, basing the model on the 1986 table will simplify the data compilation tasks required to maintain the model, because the current version of the national accounts are use this table as a benchmark. Moreover, the table is more disaggregated, consisting of 56 sectors, as opposed to the current 43 of the MIDE model.

Another interesting project is the separation of the sectoral import functions of the model by source between the EC and the Rest of the world. The same will be done for sectoral exports, according to destination. Since the price relationships of the two geographic areas will be very different in the future, I expect that this will enhance the model's foreign trade predictive capabilities.

Finally, the most important direction for future work should address what I consider to be the weakest aspect of the present MIDE model. That is, the relationship between investment, capital stock, potential output and prices. While it is relatively easy to specify a relationship between conditions in the labor market and prices (the unemployment rate has a negative relationship with wages, and wages feed into prices), due to the lack of data on investment purchases by sector, capital capacity constraints cannot be directly modeled on the sectoral level. The current formulation posits that rapid increases in sectoral output signal high capacity utilization which translate into higher sectoral profits. Higher profits lead to higher prices, mitigating demand increases and stabilizing the economy. This "proxy" variable approach can clearly be improved on. Moreover, industry capital stocks can be made to depend on investment in order to make the determination of potential output endogenous.

There are several different possibilities for accomplishing this task. One scheme could make the profits depend positively on the capital-output ratio. Another would be to construct full-blown production functions to project labor and capital requirements. This would add an endogenous component to the determination of labor productivity. It would also change the way MIDE determines investment. However, any satisfactory solution depends on the acquisition of data on disaggregated investment purchases. The recent appearance of this type of data in the Bank of Spain’s central balances could make the project feasible.

The Spanish economy will continue to grow and change in the years to come. This growth and change will be different across sectors of the economy. Macroeconomic, multisectoral models are designed to describe the impacts on individual sectors of the economy in the midst of macroeconomic change. Since MIDE provides long term forecasts in a comprehensive and integrated framework, it can play an important role in analyzing questions confronting economists, government and business planners.

APPENDIX: THE DATA BASE OF THE MIDE MODEL

The foundation of the MIDE model is the 1980 Input-Output table with 43 sectors (TIO80), constructed by the Instituto Nacional de Estadística (INE). The national accounts (Contabilidad Nacional de España or CNE), also compiled by the INE, provide the macroeconomic quantities of the model (with the exception of money supply, interest rates and exchange rates which come from the Banco de España, and employment, which comes form a separate survey.) To construct the model as outlined in this work, times series on output, investment sales, inventory change, exports, imports, prices, income (value added) and employment for each of the input-output (IO) sectors are required. In addition, I needed private consumption expenditures in as much product detail as possible. The national accounts provides sectoral-level, times series data for outputs, value added, consumption and investment. Although the availability of this data varies, the national accounts served as the initial source and benchmark for the compilation of data for these variables. Sectoral data for inventory change, imports, exports, employment and output prices had to be constructed from other sources.

Since 1954, disruptions in the homogeneity of the national accounts have occurred five times. These revisions were made by INE so the national accounts would conform more fully to the European System of Integrated Economic Accounts (SEC). Consequently, I had three different sets of national accounts data covering three different periods. The first set of accounts, labelled CN70 since its constant-price quantities appear in 1970 prices, covers the period of 1954 through 1982.[11] The second set, the CN80 accounts, presents data for

[11] The 1964-69 data of this set of national accounts was itself compiled from the earlier national accounts based in 1964 (CN64). However, since INE published all the data of these years according to the CN70 definitions, we need not be concerned with this technicality.

1980 through 1988. Its constant-price quantities are expressed in 1980 prices. Finally, a third set of national accounts, CN86, provides data for the period of 1985 through 1991. The MIDE model is based on the CN80 accounts since they are benchmarked to the 1980 input-output table.

The national account revisions involved modifications in both the coverage and definitions of the data. The "coverage" of a data series changes when the magnitude of a variable with the same definition would be different in the same period when it is measured by the different accounting schemes. For instance, the current value GDP reported by the CN70 accounts for 1980 differs from the 1980 figure in the CN80 accounts. Such differences between overlapping data points occurs from changes in data collection or accounts reconciliation methodology. A more serious heterogeneity occurs when the variable definitions change between the accounting schemes. For example, virtually all of the sectoral classifications for disaggregated variables changed between the CN70 and CN80 accounts.

Often, the revisions presented severe compatibility problems between the data of different accounts. In order to construct times series of data covering any reasonable interval for regression purposes, it was necessary to homogenize the other two sets of data to the CN80 based accounts. The homogenization between the CN80 and CN86 data was particularly important. Without linking the most current data, historical simulations of the MIDE model could not be verified adequately, and forecasts could not use all the information currently available. The Ministerio de Economía y Hacienda partly solved the linkage problem by constructing homogeneous CN80 series from the CN70 data for 1954

The original source of the 1954-63 data was the CN58 based national accounts. This was homogenized with the CN70 accounts by Uriel (1986).

through 1979 for the principal aggregates (Corrales and Taguas, 1989). Not only did the provision of this data reduce my data revision workload, it provided a general technique for linking the remaining CN70 data and the CN86 data with the CN80 accounts.[12]

This technique takes a "top-down" approach to homogenization, starting with the Gross domestic product. Nominal GDP from different accounts is linked with the following transformation:

$$X_t^{80} = X_t^{70} \left[\frac{X_{80}^{80}}{X_{80}^{70}} \right]$$

where X_t^{80} is GDP in current prices for year t in the CN80, and X_t^{70} is GDP in current prices for year t in the CN70 accounts. (For the CN86 to CN80 linkage, the 70 would be replace by 86.) The equation simply multiplies the series of the linked accounts (CN70) by the ratio between the two values in the base year (1980) of the base account (CN80). Identically, GDP in constant prices is linked using:

$$KX_t^{80} = KX_t^{70} \left[\frac{KX_{80}^{80}}{KX_{80}^{70}} \right]$$

where the "K" preceding the variable signifies constant prices. This technique has the advantage of preserving the rate of growth of GDP, for both the current and constant price values, as stated in the original published data. Transforming the components of GDP (consumption, investment, imports, etc.) in the identical manner, however, produces series which will not sum to the new GDP figure. Therefore, some type of scaling must be used

[12] There are several technical considerations, and some subjectivity, involved in performing this type of data homogenization. Rather than detail these here, I refer the reader to Corrales and Taguas (pp. 21-28).

to guarantee that the sum of the computed components add up to GDP. The best way is to apportion the difference between the sum of the new components and the new value of GDP using the relative weight of each component. While this technique will not guarantee that the growth rate of each component in the new base will be equal to its growth rate in the old base, their differences will be minimized. The linkage and scaling is accomplished simultaneously by the equation:

$$X_{i,t}^{80} = X_{i,t}^{70} \left[\frac{X_{i,80}^{80}}{X_{i,80}^{70}}\right] \left[\frac{X_t^{80}}{\sum_i^n X_{i,t}^{70} \dfrac{X_{i,80}^{80}}{X_{i,80}^{70}}}\right]$$

where $X_{i,t}^{b}\ ;i\!=\!1,n$ are the n components of GDP in year t and CN base b.

The process was repeated for constant price values of the GDP components. The components of each GDP component were homogenized similarly. For example, fixed investment in equipment, transport machinery, residential construction and non-residential construction are linked using the total fixed investment calculated above as the control.

This technique was satisfactory when the definitions and the degree of aggregation for each data series is equivalent between the bases, as is normally the case for macroeconomic quantities and between the CN80 and CN86 sectoral data. The homogenization problem was particularly troublesome with the CN70 to CN80 sectoral linkages because: 1) the level of aggregation and sectoral definitions had changed between the two accounts, and 2) there was no overlapping data for several items which did not appear in the published CN70 accounts after 1977 or 1978.

The general approach for homogenizing the CN70 and CN80 accounts for any given set of variables, say private consumption by commodities, was to apply the proportional scaling technique when sectoral definitions were equivalent. Where sectoral definitions were changed, I used special techniques and simplifying assumptions for an individual or group of sectors, and often used other data from outside the national accounts. The resulting sectoral time series follow the definitions and disaggregation provided by the CN80 and sum to the homogeneous macroeconomic data provided by Corrales and Taguas. Since the major purpose of these pre-1980 data is the estimation of the behavioral equations of the model, I ultimately judged their quality and consistency by their usefulness in these equations. If the data yield sensible estimates of parameters for the model, without evidence of heterogeneity in the sample, they are considered usable.

Furthermore, the data was extensively evaluated against other available data, such as raw production, consumption or foreign trade statistics. For example, constant price production of the coal industry is compared to tons of coal produced, or tons of meat produced is compared against the constant price value of meat consumed (foreign trade being negligible). Generally, these comparisons were favorable. Sometimes, unfavorable comparisons of this type led to revisions of the data. More often than not, however, there was little alternative to the calculated series. While conserving the computed series, a note was made indicating that it was unreliable. The text of this dissertation is sprinkled with examples where known data problems for a particular variable resulted in the modification of the regression intervals or standard estimation methods. With these opening comments out of the way, I now move to discuss the compilation of the data base by each type of sectoral series.[13]

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[13] Further details of the problems presented by, and the techniques used for the linkage of the sectoral level variables between the CN70 and the CN80 are presented in Sanz (1990). The most specific information is contained in various internal documents and programming code of the Fundación Tomillo, which can be provided by request.

Real private interior consumption and prices by commodity (43 commodities)

Real Consumption: 1964-89
Prices: 1964-89
Original data sources:

- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1982a) CN70.
- INE (various years) *Indices de Precios de Consumo (IPC).*

Three serious compatibility problems existed between the CN70 data with the CN80 data. First, the commodity level data from 1964 through 1979 is compiled by Private national consumption (i.e. inclusive of resident consumption outside the country and exclusive of nonresident consumption inside the country.) Second, the commodity definitions were different and the level of disaggregation was lower for the CN70 data. From 1964 through 1977, consumption in the CN70 was published in constant and current prices for nine major product categories and 30 sub-categories (not 43 as in CN80). There is little or no detail under major functions 3 (Rents and utilities), 4 (Furniture and articles for the home) and 5 (Drugs, medical services and health goods). Finally, for the years 1978 and 1979, data covering only the nine major product categories were published.

The first step was to convert the CN70 nine major product categories to interior consumption. This conversion was done with the aid of unpublished data provided by the INE which indicated the content of the tourism consumption in each of the nine categories. The series were then homogenized, using the proportional scaling technique explained above, to the CN80 data for both the real and nominal values. These major categories formed two groups. For one group, there was no further detail available in the CN70. The second group contained further detail more or less compatible with the CN80 defined commodities.

For the first group, the detailed real commodity consumption data was simply apportioned to the CN80 definitions using the 1980 share of the major category. Where possible, a new deflator for each of these commodities was computed using the published private consumption index (IPC). For the second group, the missing constant price consumption detail for 1978 and 79 was determined by allocating the total for their major group according to their 1980 proportions. The deflators for these years were determined for each good using the published consumption price indices. The pre-1978 CN70 detailed commodity data was then linked to the resulting 1978 figure and scaled to the major category total, for both current and constant price amounts. Dividing the results yielded the deflator. Each of these detailed commodities either corresponded directly to a CN80 commodity or required further disaggregation. These final disaggregations were conducted using the 1980 proportions.

The linkage of the CN86 data, for the years 1987 through 1989 did not require such manipulations since, mercifully, the commodity definitions are the same. In fact there was little difference between data points in overlapping years. The standard homogenization procedure worked fine.

Constant price consumption by IO sector (43 IO sectors)

Real Consumption: 1964-89
Original data sources:

- INE (1983a) *Encuesta de Presupuestos Familiares, 1980-1981*.
- INE (1986) TIO80.

To compute these series, I simply multiplied the base year bridge matrix by the consumption series by commodity for each year. The bridge matrix displays the proportion of consumption sold by input-output (IO) category (listed in the rows) to each of the private interior consumption categories (listed in the columns). It was computed by using the 1980-81 budget survey which contained private consumption at a very detailed level of aggregation. By using the correspondence (listed in the national accounts) between these products and the IO sectors, the 43 level commodity consumption was allocated to the IO sectors using the IO table total consumption by sector and the 1980 commodity consumption as row and column controls, respectively. Dividing the flows in each of the cells by the sum of the column produces the consumption coefficients applicable for each year.

Constant price output and output deflators (43 IO sectors)

Constant price output and price deflators by sector are the two most important series of any multisectoral model. Current price production for each of the input-output (IO) sectors is available from the national accounts from 1980 through 1985 (CN80). As presented in the national accounts, this figure is the sum of inputs (i.e., the sum down the column of the IO table). To arrive at this figure, INE uses either a direct measure of sales for a given industry or a measure of total value added and intermediate purchases of the industry. In general, value added for each industry is known through various annual surveys. For agriculture and industry, surveys are conducted which provide estimates for all three figures: production, value added and intermediate purchases. As we shall see, however, annual data for service sectors is often incomplete and some simple assumptions must be made to complete the national accounts.

CN86 data, though available for 1986 and 1987, was not compatible with the CN80 data because of complications arising from the introduction of the Value Added Tax in that year. Therefore, it was often not used. Because of the absence, in the national accounts, of any current price production series previous to 1980 and after 1985, and of *any* constant price production or price series, the availability of this data was a serious problem. It was necessary to seek out data from other sources. This necessitated a heterogeneous approach to the output data across sectors.

Sector 1: Agriculture, forestry and fisheries

Real Output: 1964-90
Prices: 1964-90
Original data sources:

- Ministerio de Agricultura (various years) *Cuentas del sector agrario*.
- INE (various years) *Anuario Estadístico*.
- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.

Gross current price production for the agriculture, forestry and fishery industries are published by the Ministry of Agriculture and Fishing (MAPA). The sum of these production figures forms the basis of the national account (CN) and input-output table current price output published by INE for 1980 to 1985. By linking the MAPA figures from 1964 and through 1990 with the CN data, I obtained current price production for all the years. MAPA also publishes a producer's price for the combined agricultural and forestry industries and a figure for the tons of fish landed by the fisheries industry. From the latter, a crude price index for the fisheries industry was constructed and combined with the former, using 1980 output weights, to yield the sectoral deflator. Finally, 1980 constant price production was obtained by dividing the current price production by the deflator.

Sectors 2-25: Industry (Energy, Mining and Manufacturing)

Output: 1964(70)-91
Prices: 1970-91
Original data sources:

- INE (various years) *Anuario Estadístico*.
- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.
- INE (various years) Indices de Precios Industriales, 1974-91.
- INE (various years) Indices de Produción Industriales, 1972-91.

Official industrial price indexes for the years 1974 through 1990 are available in the CNAE sectoring scheme (the Spanish equivalent of the U.S. Standard Industrial Classification or SIC) at a high level of disaggregation (four digit). This enabled the construction of appropriate output deflators for each of the industrial sectors. These deflators were "backcasted" to 1970 with regressions of the deflators on the CN70 value-added deflators for each of the sectors. The CN80 current price outputs were then deflated by these indices to obtain constant price outputs for 1980-1985.

Official industrial production indexes are available from 1972 to 1990 at the four digit level of disaggregation and back to 1964 at the two digit level. The annual rates of growth of the appropriate production indices for each sector were then used to extend series backward from 1980 and forward to 1991. Since most of the MIDE industries correspond directly to two digit CNAE categories, the new series extend backward to 1964. For the few industries where this was not the case, the appropriate production indices were backcasted to 1970 by regressing the detailed index on its corresponding two digit index.

Sector 26: Construction

Real Output: 1964-91
Prices: 1970-91
Original data sources:

- SEOPAN (various) *Informe Anual Sobre la Construcción*.
- INE (1991b) CN86.
- INE (1988) CN80.
- INE, (1986) TIO80.

A construction price index compiled by the National Association of Construction Firms (SEOPAN) extends back to 1970. The current price production figures of the national accounts for 1980 through 1987 were deflated with this index. Since the resulting output series was highly correlated (.996) with the national accounts constant price construction investment total, output for 1964-1979 and 1988-91 was moved with this series.

Sectors 27: Reconstruction and Repair
Sector 28: Wholesale and Retail Trade

Real Output: 1964-89
Prices: 1964-89
Original data sources:

- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.

The first item to note concerning these two sectors is that even though the TIO80 published them as two distinct sectors, the CN80 accounts reported their production and value added data together. Therefore, it was convenient to treat any extrapolation of its production data together, and then separate it with some criteria. A second matter of interest is that in the CN80, the ratio of total value added to production is constant. I cannot be sure why this is, but I assume that the only data available to INE was the value added data. In the absence of total revenue or intermediate input data, INE was forced to make this simplification. For the extrapolation of current price production I adopted this assumption.

Therefore, current price value added for the combined sector was extrapolated backward to 1964 (CN70) and forward to 1988 (CN86) using the general homogenization technique outlined above. The current price production was then imputed at the constant ratio implied by the TIO80. In order to deflate this quantity, I constructed a homogenous value added deflator from the three sets of national accounts. To split the resulting output between the two sectors, I used the proportions implied by the consumption by IO sector. I used the IO consumption values as independent variables in regressions to extend real output through 1989. The prices are extended through 1989 with regression using the aggregate services value added deflator.

Sector 29: Hotels, restaurants and bars
Sector 36: Commercial and residential rents
Sector 38: Private health Services
Sector 39: Recreation, cultural, other personal services
Sector 37: Private education
Sector 43: Domestic and other non-market services

Real Output: 1964-89
Prices: 1964-89
Original data sources:
- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.
- INE (various years) *Indices de Precios de Consumo (IPC).*

The large majority of demand for each of these sectors is private consumption and foreign trade is either nonexistent or trivial. In addition, each of these production sectors have close correspondences to individual private consumption categories. Therefore, the single best deflator to use in each case is the corresponding private consumption deflator. The current price production figures of the national accounts for 1980 through 1987 are deflated with this index. Since the resulting production is highly correlated with the private interior consumption for each of the sectors output for 1964-1979 and 1988-90 is moved with these series.

Sector 30: Interior transportation services (railroads, busses, subways, highway transport)
Sector 31: Maritime and air transport
Sector 32: Other transport services (ports, airports, shipping)
Sector 33: Communication

Real Output: 1964-91
Prices: 1964-91
Original data sources:
- Ministerio de Transportes, Turismo y Comunicaciones (1989).
- INE (various) *Boletín Trimestral de Coyuntura*.
- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.
- INE (various years) *Anuario Estadístico*.

For Interior transport, Maritime and Air transport and Communications, output and price indices were constructed with various revenue and raw production statistics. For example, the sum of the revenues of the government telephone and post corporations tracked very satisfactorily with the national accounts version of nominal production of the communications sector. I linked this revenue series to the CN data. A price deflator was formed by dividing the specific revenue series with corresponding output statistics. For example, a telephone price is computed by dividing the revenue of the telephone monopoly with the number of telephone calls, telegrams, etc. for each year. The constant-price output series is determined by moving the IO table output with weighted output indices of telephone calls, letters, etc. The resulting series were check against various value added data from the national accounts, and adjustments were made when large discrepancies were evident.

Transport output indices were constructed with the help of similar indices compiled by the INE using data from the Ministry of Transport. Prices for the same sectors were either compiled from raw output and revenue data or using indices published by the Ministry of Transport.

The current price production for Other transport services, sector 32, relied primarily on value added data. The price index for the sector was constructed from the indices of the other transport sectors with a regression equation.

Sector 34: Banking and Insurance
Sector 40: Public Administration
Sector 42: Public education
Sector 43: Public health services

Real Output: 1964-91
Prices: 1964-91
Original data sources:
- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.

Production and value added data for these sectors is very complete for all versions of the national accounts. Therefore, the determination current price production was an easy affair. Also, since value added is such a large proportion of output for each of these sectors, the value added deflators from the national accounts provide reasonable production price indices.

Real fixed investment expenditures and prices by commodity (11 commodities)

Real Investment 1954-90
Prices: 1964-90
Original data sources:

- INE (1991b) CN86.
- INE (1988) CN80.
- INE (1986) TIO80.
- Corrales and Taguas (1988).

The investment classification corresponds to the CN80 definitions. The accounts provide current price series from 1980 through 1990 for each of the products, and constant price series for six categories: Agricultural products (Commodity 1), Machinery and metal products (Commodities 2-6), Transport material (7-8), Non-residential construction (9), Other products (10) and Residential construction (11). Data previous to 1980 exists in constant and current prices for only four categories: Machinery and other products (1-6 and 10), Transport material (7-8), Non-residential construction (9) and Residential construction (11). These series have been homogenized and extended back to 1954 by Corrales and Taguas (1989). No further compilation was required for the two construction categories.

Eight of the nine remaining commodities have a close correspondence with production sectors of the input-output table. With the exception of category 10, Other products, each commodity is manufactured by only one industry. This direct correspondence simplifies the construction of a matrix which allocates the quantities demanded to the production sector (referred to in Chapter 4 as the B matrix). However, since the investment series are in purchaser prices, they include commercial margins, transportation costs and services provided by five other input-output industries. To create the B matrix, these mark-ups were allocated to the respective service sectors using information on the construction of the 1980 IO table provided by INE (see Sanz 1989).

The information provided by the share matrix allowed the construction of purchaser prices for each the products using the production and import prices, weighted for the proportion of imports in domestic demand, from the corresponding input-output sectors. The purchaser prices were then scaled to be consistent with the available aggregate investment deflators. Series in constant prices for each of the products were estimated for the years previous to 1980 by using the more aggregated investment quantities and the respective production sector domestic demand as indicators. In order to construct an estimate of the capital stock for each of the products, it was necessary to have investment series extending back to 1954. These were constructed by "backcasting" each series with regression equations using the relevant aggregate constant-price series as the independent variable.

Imports and Exports (33 IO sectors)

Real Quantities: 1970-89
Prices: 1970-89
Original data sources:

- INE (1991b) CN86, TIO87.
- INE (1991c) CN86, TIO86.
- INE (1988) CN80.
- INE (1986) TIO80.
- Dirección General de Aduanas (various) *Estadística del Comercio Exterior de España*.
- Banco de España (various) *Boletín Estadístico*.
- Cañada and Carmena (1989).
- Bajo and Torres (1989).

Imports and exports each have 25 merchandise categories and 8 service categories. Current price import and export data was provided by the INE for the 56 sectors of the 1985 IO data for the years 1981 through 1987, while the 1980 data comes from the IO table. For 1970 through 1979, and 1988 through 1989, Fundación Tomillo aggregated six digit (Brussels' Nomenclature) merchandise trade data taken directly from the Dirección General de Aduanas (Customs). Merchandise prices for the entire period and for each sector are unit value indices also computed by Tomillo using the detailed customs data. For the same years, current price service imports and exports were compiled from the balance of payments accounts of the Bank of Spain and adjusted to conform with the national accounts data. They are then deflated by their respective domestic production deflators.

Constant price values are scaled to the merchandise and service totals supplied by the national accounts. For service imports, this scaling procedure provides new deflators which drive a wedge between the sectoral domestic prices and the import prices in proportion to the difference between the aggregate service domestic prices and the aggregate service import prices. Finally, the trade and transport margins contained in merchandise exports are allocated to the respective service sectors according to the margins indicated in the 1980 input-output table. In general, while the merchandise data is of high quality, that of services (excluding tourism which comes directly from the national accounts) has some problems. Fortunately, service trade comprises small shares of both aggregate trade and sectoral outputs. A detailed description of the entire process in contained in Fierros (1990).

Industry import tax rates have been constructed by extrapolating and homogenizing the tariff rates computed by Cañada and Carmena (1989), Bajo and Torres (1989) and the INE in the construction of the 1980, 1986 and 1987 IO tables.

Inventory Change (25 merchandise IO sectors)

Real Quantities: 1970-89
Original data sources:

- Ministerio de Agricultura (various) *Cuentas del sector agrario*.
- Ministerio de Industria y Energía (various) *Encuesta de Opiniones Empresariales*.
- INE, (various) *Encuesta Industrial*.
- INE, (1991b) CN86, TIO87.
- INE, (1991c) CN86, TIO86.
- INE, (1988). CN80.
- INE, (1986). TIO80.

Employment (43 IO sectors)

Persons employed

Thousands of persons: 1972(76)-91
Original data sources:

- INE (various years) *Encuesta de Población Activa*.
- Treadway, A. (1990b).

The Employment Survey (Encuesta de Población Activa) provides homogenous employment series at a disaggregated level from 1976. These were used directly. The Survey suffered a rupture in methodology before 1976. Treadway homogenized the data from the previous Survey with the later Survey at a relatively high aggregation. For 1972-76, employment for most of the industrial sectors was obtained using disaggregated data from the earlier Employment Survey to disaggregated Treadway's data. This disaggregation was not possible for service sectors.

Hours Worked per Year

Hours: 1972-1989
Original data sources:

- INE (various years) *Encuesta de Salarios*.
- Carbajo and Perea (1987).

The Wage Survey (*Encuesta de Salarios*) publishes a quarterly figure of the average monthly hours worked for that quarter. In 1989, the Wage Survey began to publish hours worked data at a sufficient disaggregation for MIDE's sectoral scheme. Previous to then, published data enumerated only 17 sectors. The collection of the data suffered several methodological breaks, which made it difficult to compare data from different periods. Carbajo and Perea (1987) homogenized the series to provide continuous time series from 1963 for each of the 17 sectors. In order to reach hours worked per year for each of the MIDE sectors, I assumed that the annualized Carbajo and Perea data is the same for the MIDE sectors covered by a single Wage Survey sector. For example, the Wage Survey published one figure for the food processing, beverage and tobacco industries. Therefore, the corresponding MIDE sectors (15-19) have identical series for annual hours worked per worker.

Value Added (43 IO sectors)

Wages and Salaries
Gross Profits
Net Indirect Taxes
Value Added Taxes

Nominal Quantities: 1980-88
Original data sources:

- INE (1991b) CN86, TIO87.
- INE (1991c) CN86, TIO86.
- INE (1988) CN80.
- INE (1986) TIO80.

These values were all taken directly from the national accounts. The homogenization between the CN80 and CN86 accounts was straightforward because only nominal quantities were involved.

Sector and Commodity Classifications of the MIDE Model

Production sectors of the Input-Output Table

1. Agriculture, forestry and fisheries
2. Coal, lignite, and radioactive material
3. Coke
4. Crude petroleum, natural gas and refining
5. Electrical, gas, steam and water utilities
6. Ferrous and nonferrous minerals and metals
7. Nonmetallic minerals and products
8. Chemicals
9. Metal products, except machinery and transport
10. Industrial and agricultural machinery
11. Office machinery, computers, precision and optical instruments
12. Electrical and electronic material and accessories
13. Motor vehicles and engines
14. Other transport material
15. Meat, prepared and preserved, other animal products
16. Dairy products
17. Other food products
18. Beverages
19. Tobacco products
20. Textiles and apparel
21. Leather products, shoes
22. Wood and wood products
23. Paper and publishing
24. Rubber and plastic products
25. Other manufactured products
26. Construction and civil engineering
27. Repairs and reconstruction
28. Wholesale and retail trade
29. Restaurants, cafes and hotels
30. Interior transport
31. Maritime and air transport
32. Transport services
33. Communications
34. Banking and insurance
35. Business services
36. Commercial and residential rents
37. Private education and research services
38. Private health services
39. Recreation, cultural, personal and other services
40. Public administration
41. Public education services
42. Public health services
43. Domestic and other services n.e.c.

Private Interior Consumption Commodities

1. Bread and cereals
2. Meat
3. Fish
4. Milk, cheese and eggs
5. Oils and fats
6. Fruits and vegetables
7. Potatoes and other tubers
8. Sugar
9. Coffee, tea and cocoa
10. Other food products
11. Nonalcoholic beverages
12. Alcoholic beverages
13. Tobacco products
14. Clothing
15. Shoes
16. Rent and expenditures on water
17. Heat and electricity
18. Furniture and fixed accessories, carpets
19. Household textiles and other accessories
20. Household appliances
21. Tableware and other domestic utensils
22. Goods and services for household maintenance
23. Domestic services
24. Drugs and other pharmaceutical products
25. Therapeutic equipment and apparatus
26. Medical services of doctors and other professionals
27. Hospital attention
28. Private medical insurance premiums
29. Motor vehicles
30. Expenditures on motor vehicles
31. Transport services
32. Communication services
33. Entertainment goods
34. Entertainment and cultural services
35. Books, newspapers and magazines
36. Education
37. Personal care and other personal products
38. Other products n.e.c.
39. Restaurants, cafes and hotels
40. Travel services
41. Financial services n.e.c.
42. Other financial services
43. Other expenditures n.e.c.

Investment Products

1. Agricultural, forestry and fishery products
2. Metal products
3. Agricultural machinery and tractors
4. Industrial machinery
5. Office machinery, computers, precision and optical instruments
6. Electrical and electronic machinery and material
7. Motor vehicles
8. Other transport material, including ships, planes, and railroad
9. Residential construction
10. Nonresidential construction
11. Other products

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