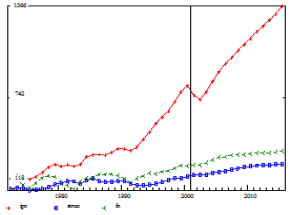

The U.S. Benchmark IO Table

History, Methodology and Myths

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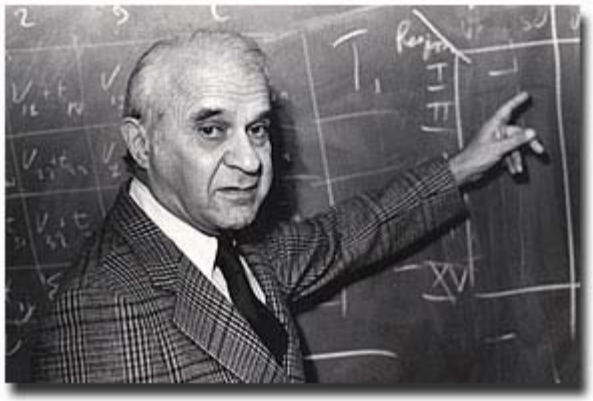
Three Themes

- History – From Leontief's early work to the upcoming 2007 U.S. table, to be released in 2012.
- Methodology – How is the U.S. benchmark table produced?
- Myths – What myths or ideals motivate the development and analysis of the IO table?

History



Leontief's Early Work

- Ph.D Thesis – *The National Economy as a Circular Process*. Dissatisfied with neoclassical concepts of supply and demand, wanted to create a framework to provide systematic, consistent, factual background.
- NBER (1930) – Began to gather data
- Harvard (1932) – Goal is to create a modern *tableau economique*
- 1919 table (1936) – 44 sectors, including households and unallocated.
- 1929 table (1939) – *Structure of the American Economy* published 1941.

Partnership with BLS

- 1939 table (1944) – White House commissioned BLS to study mobilization and demobilization issues. BLS hired Leontief to set up shop in Cambridge to produce the table.
- Study on effects of demobilization on employment was published (Leontief, 1944).
- Air Force project SCOOP was large source of funds for the 1947 table, with early version completed in 1951, and more complete version in 1954.
- With 450 sectors, this represented a fundamentally new scale of effort.
- Leontief inverse matrix took 10 hours to compute, on UNIVAC I.

Transition to OBE

- BLS funding was cut, and there was no 1954 table, due to fears of central planning.
- National Accounts Review committee (1958) recommended the IO table as a useful tool for internal reconciliation of the national accounts.
- Interindustry Division was created at OBE in 1959, and 1958 IO table work began, which was completed in 1964.
- With fewer resources and short time available, the table had 86 sectors.

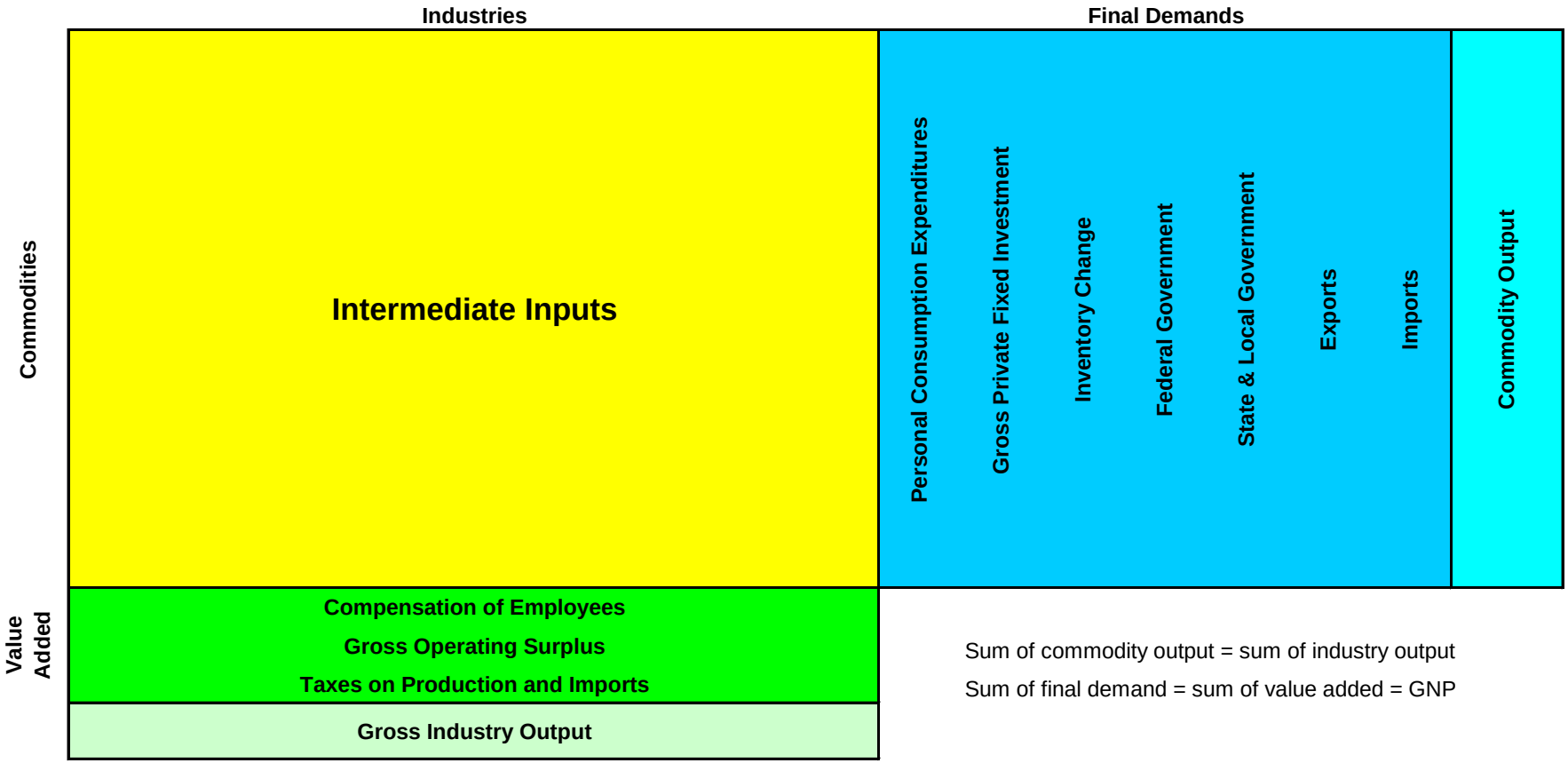
1963 and 1967 Tables

- Much larger in scope, with 367 intermediate industries.
- More attention given to value added estimates, and reconciliation of IO value added with national accounts. Profit-type income treated as a residual.
- Both tables had an accompanying capital flow table, showing the purchases of investment by commodity by using industry. A capital flow table for the 1958 table was created by BLS.

The 1972 Table

- Published in 1979, a major break with previous tables, adopting the 1968 SNA make and use framework. 396 intermediate industries and commodities.
- Redefinitions were introduced, which made the IO industries come closer to a product definition (example: construction performed on-site in other industries).
- Commodity-by-commodity table also supplied, but using *industry technology assumption*.

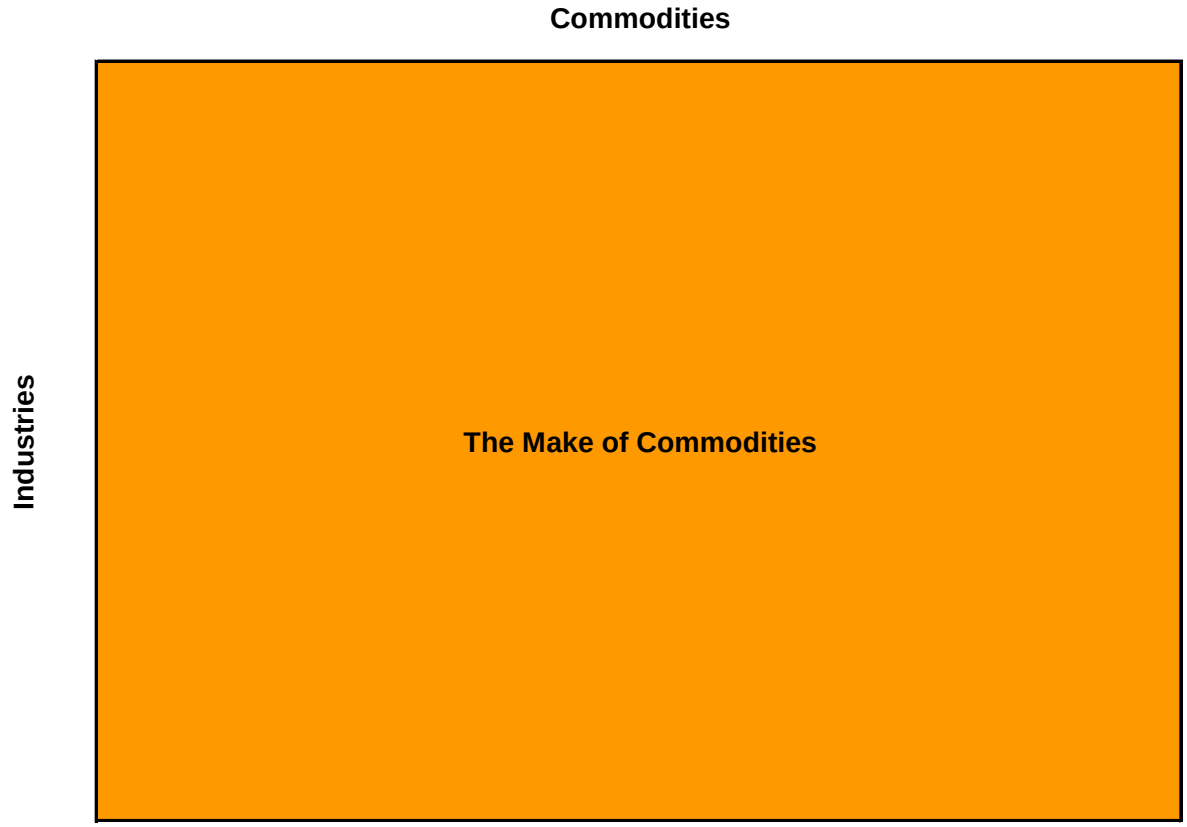
The Use Table



Sum of commodity output = sum of industry output

Sum of final demand = sum of value added = GNP

The Make Table



Look across the row to see commodities made in each industry.
Look down the column to see in what industries a commodity is produced.

Tables 1977 to 1992

- Size of tables continued to increase, with 537 industries in 1977, and 541 in 1982.
- However, 1982 table took 9 years to build, so size of 1987 table was reduced to 480.
- Capital flow tables continued to be published, except in 1987.
- 1992 was last table on SIC (Standard Industrial Classification) basis.
- 1992 table moved software purchases to investment, and split government into consumption and investment.

Tables 1997 to 2007: NAICS

- NAICS (North American Industry Classification System) first used for 1997 table, which had 495 sectors. Published with 5-year lag (2002).
- 2002 table published in 2007, on 2002 NAICS. Includes several innovations, including *government as producer*, where government purchases are shown as an intermediate sector.
- 2007 table will be based on 2007 NAICS and NAPCS (product classification). 2007 table may also provide data in basic prices, in supply and use framework.

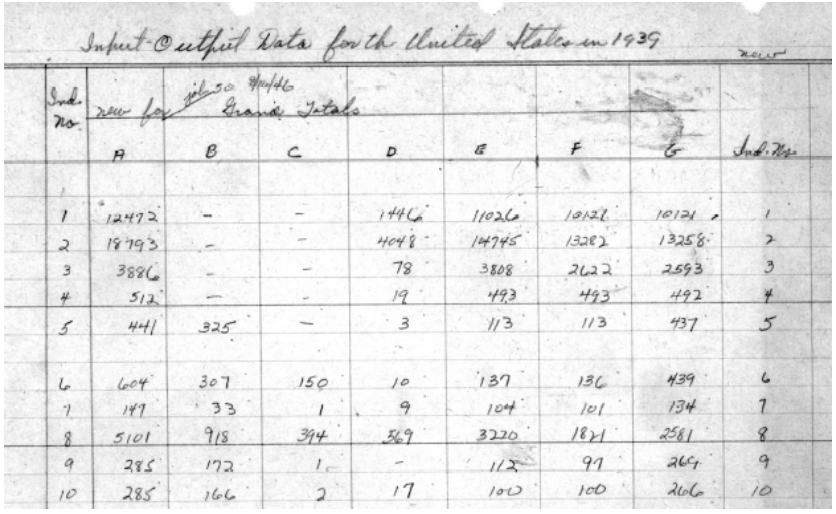
U.S. Benchmark Table History

Large Scale Benchmark Tables Produced by BLS and BEA

Reference Year	Publication Year	Classification System	Number of Industries / Commodities	New Features	Treatment of Secondary Products
1947	1954		450	First large scale table for the U.S.	Sale
1958	1964	1957 SIC	86	Integration with national accounts	Sale
1963	1969	1957 SIC	367	Expanded industrial detail, 3 value added rows	Sale
1967	1974	1967 SIC	367		Sale
1972	1979	1972 SIC	496	Make and use format	Make & use
1977	1984	1977 SIC	537	Adjustments for underreporting	Make & use
1982	1991	1977 SIC	541	Workfile table made available	Make & use
1987	1994	1987 SIC	480	Supplementary tables without redefinitions	Make & use
1992	1997	1987 SIC	498	Expanded Census coverage	Make & use
1997	2002	1997 NAICS	495	Adoption of NAICS, treatment of auxiliaries	Make & use
2002	2008	2002 NAICS	430	Government as producer	Make & use
2007	2013?	2007 NAICS	??	Use of 2007 NAPCS for products	Supply & use?

Methodology

How to Build a Benchmark Table



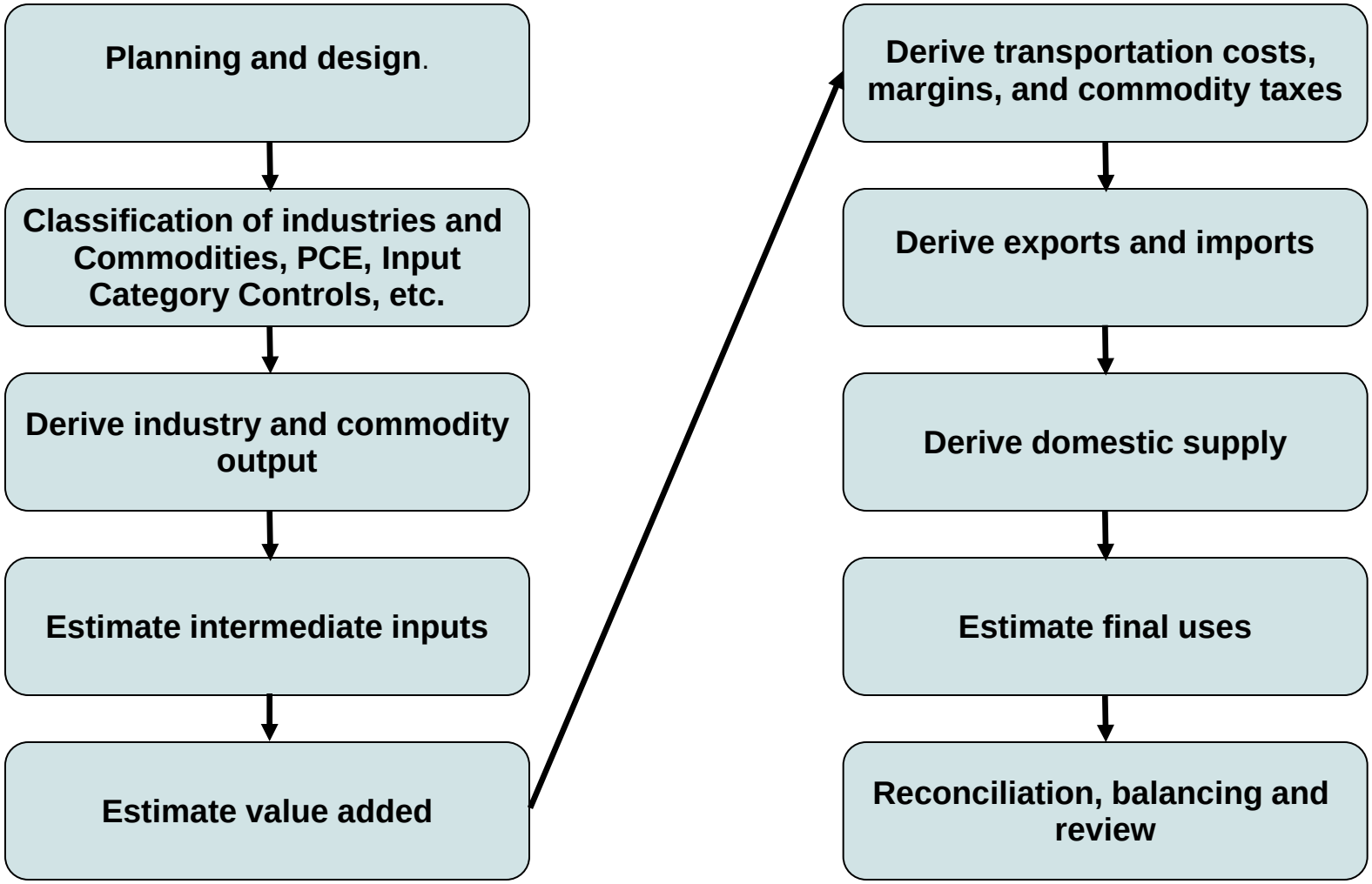
Input-Output Data for the United States in 1939

Ind. No.	A	B	C	D	E	F	G	Ind. No.
1	12472	–	–	1446	11026	10121	10121	1
2	18793	–	–	4048	14745	13282	13258	2
3	3886	–	–	78	3808	2622	2593	3
4	513	–	–	19	493	493	492	4
5	441	325	–	3	113	113	437	5
6	604	307	150	10	137	136	439	6
7	147	33	1	9	104	101	134	7
8	5101	918	394	569	3220	1821	2581	8
9	285	172	1	–	112	97	264	9
10	285	166	2	17	100	100	266	10

Executive View

- The benchmark IO table takes between 5 and 9 years to build. The target is now 5 years.
- Targeted level of sector detail is between 400 and 500, but this is influenced by user needs and data constraints. Summary and aggregate versions are also published.
- Published in years ending in ‘2’ and ‘7’, which are *Economic Census* years.
- Closely related to the development of national accounts (NIPA) and Annual IO tables.

Schematic Diagram



Planning and Classification Decisions

- Planning may start as early as 2 years before development starts.
- Needs to incorporate what is known about changes in data sources, changes in definitions and concepts, changes in methodology, and changes in classification.
- Classification decisions are based on history, data availability, and users' requests.
- Industry and commodity output are based on the NAICS.

NAICS Sectors (2-digit)

Sector	Description
11	Agriculture, forestry, fishing and hunting
21	Mining
22	Utilities
23	Construction
31-33	Manufacturing
42	Wholesale trade
44-45	Retail trade
48-49	Transportation and warehousing
51	Information
52	Finance and insurance
53	Real estate and rental and leasing
54	Professional, scientific and technical services
55	Management of companies and enterprises
56	Administrative and support, and waste management
61	Educational services
62	Health care and social assistance
71	Arts, entertainment and recreation
72	Accomodation and food services
81	Other services, except public administration
92	Public administration

Sectors from 2002 IO Table

I–O industry code and title	Related 2002 NAICS codes
3253 Agricultural chemical manufacturing	
325310 Fertilizer manufacturing	325311–4
325320 Pesticide and other agricultural chemical manufacturing	325320
3254 Pharmaceutical and medicine manufacturing	
325411 Medicinal and botanical manufacturing	325411
325412 Pharmaceutical preparation manufacturing	325412
325413 In-vitro diagnostic substance manufacturing	325413
325414 Biological product (except diagnostic) manufacturing	325414
3255 Paint, coating, and adhesive manufacturing	
325510 Paint and coating manufacturing	32551
325520 Adhesive manufacturing	32552
3256 Soap, cleaning compound, and toiletry manufacturing	
325610 Soap and cleaning compound manufacturing	32561
325620 Toilet preparation manufacturing	32562

Industry and Commodity Output

- For goods, industry output is defined as shipments plus inventory change.
- For services and transportation, it is defined as receipts, or revenues.
- For trade it is the margin or ‘markup’.
- Production of other commodities is identified in the Economic Census.
- Output is adjusted for *nonemployers* and *misreporting*.
- Industries not covered by the Census require turning to other agencies and their source data.

Extract of Item Output

325411AO	Medicinal and botanical manufacturing, other miscellaneous receipts	9.9
325411IC	Medicinal and botanical, inventory change	29.9
325411RSL	Medicinal and botanical manufacturing, value of resales	-0.4
325411T	Medicinals and botanicals	12754.4
325412AO	Pharmaceutical preparation manufacturing, other miscellaneous receipts	510.7
325412CW	Pharmaceutical preparation manufacturing, contract work	507.5
325412IC	Pharmaceutical preparation, inventory change	-18.4
325412RSL	Pharmaceutical preparation manufacturing, value of resales	-1.7
325412T1	Pharmaceutical preparations, for veterinary use	2562.8
325412X	All other pharmaceutical preparations	101997.2

Receipts for a Service Industry: 811

811		Repair and maintenance
	30750	Motor vehicle mechanical and electrical repair and maintenance
	30760	Motor vehicle body, paint, and interior repair
	30770	Other motor vehicle care and maintenance
	30780	Commercial and industrial machinery and equipment repair and maintenance
	30790	Electronic and precision equipment repair and maintenance
	30800	Personal and household goods repair and maintenance
	30820	Other repair and maintenance
	39000	Merchandise sales
	39250	Rental or lease of goods and/or equipment
	39500	All other receipts

Intermediate Inputs

- Manufacturing industries have the most detailed information available (Table 7. Materials Consumed by Kind).
- Many industries have input data available for broad categories. These correspond to *Input Category Controls* in the database. These must be split further to the commodity level.
- Prorates – For example, prorate sales of tires based on stocks of motor vehicles used.

Value Added

- Compensation of Employees (COE) – Main source is payroll data from the Census.
- Taxes on Production and Imports (TOPI) – Includes excise and sales taxes, property taxes, & license fees. Estimated from government tax collection data.
- Gross Operating Surplus (GOS) – Estimated first as a residual, but then reconciled with estimates from GDP by industry.

Transportation & Trade Margins, Commodity Taxes

Layers of Transactions

1. Basic value
2. Commodity tax
3. Truck margin
4. Air margin
5. Water margin
6. Rail margin
7. Pipeline margin
8. Wholesale trade margin
9. Retail trade margin

- Basic value + commodity tax = producer's value
- Sum of all components = purchaser's value.
- U.S. tables are producer's value, most international tables are in basic values.

Foreign Trade

- Estimates are based on foreign trade statistics from the Census Bureau and from BEAs International Transaction Accounts (ITAs).
- Commodity level imports are shown at domestic port value (= foreign port value plus customs duties, freight charges and insurance).
- Special commodities:
  - Noncomparable imports – nowdays mostly imports of services where the exact commodity cannot be determined
  - Rest of world adjustment – an offset to entries in the personal consumption and government columns

Domestic Supply and Final Uses

- Domestic supply = output + imports + government sales – inventory change – exports
- *Commodity flow ratios* are used to help estimate consumption, investment and government final demand by commodity. These ratios define the share of total supply going to each major destination.
- Estimates of construction come from data on value of construction put in place.
- Estimates of government consumption and investment come from the Treasury Department, Department of Defense, and other agencies.

Reconciliation, Balancing & Review

- Personal consumption, gross private fixed investment and government estimates are reconciled with estimates from the national accounts.
- The structure of the table is checked for reasonableness, and compared with previous benchmark tables.
- Preliminary edits are made to the table to make the final balancing easier.

Balancing and Reconcilation Procedure

1. Initial estimates of intermediate in the benchmark and GOS in the annual IO are assigned reliability indicators.
2. Reconciliation model is excuted, which minimizes the distance of the final estimate from the initial estimate, subject to equality and accounting constraints, and taking reliability into account.
3. The model derives measures of intermediate and GOS for both the benchmark and the annual IO.

Future Benchmark Tables

- Work on the 2007 table is underway, which will use 2007 NAICS (for industries) and NAPCS (for commodities).
- Table may be published in basic values, and in supply and use framework.
- Further advances can be expected in the integration of the benchmark with the annual IO/GDP by industry accounts.
- Capital flow table and/or employment table may be produced.

Myths
of the IO Table

What Are Myths?

- "Fictional or unproven beliefs" – Not implied in this paper
- "Themes embodying ideals" – Motivate and direct our approach to using input-output tables.
  - May not be completely true
  - Real world approaches face constraints of resources and politics.
  - Myths are enduring, outlasting intellectual fads.

What Are the IO Myths?

- IO as a systematic *factual background* for detailed economic analysis
- IO tables as a *consistent* detailed picture of changes in the economy *over time*. Related to the myth of constant price IO tables.
- *Internal consistency*. There is always a tension between the internal consistency of the IO framework versus published data, which may not be consistent.
- *Price calculations* in IO – use value added to calculate price
- *Capital flow table* – TFP measurement, depreciation, R&D spillovers, accelerator
- Agreement of IO with knowledge of *businesmen and engineers*
- *Purity*. Possibility of a "Pure" commodity by commodity IO table using commodity technology.

Observations

- *Factual basis.* Although the U.S. is blessed with a rich set of *Economic Census* data, most elements of the IO table require estimates and judgment.
- *Consistency over time.* This is made difficult by changes in classification, and in definitions of concepts.
- *Price calculation*. The IO identity requires commodity value added to calculate a commodity price. Allocation of value added to commodities requires strong assumptions.
- *Internal consistency*. This is a strength, which makes the derived table more reliable than the source data.
- *Capital flow table.* Based on weak or nonexistent data.
- *Purity*. Various exceptions to the commodity technology assumption can be found. However, the analytical advantages are overwhelming.

Where Are We Today?

- The methods of benchmark IO table construction were born in Leontief's early work, especially with the 1939 and 1947 tables.
- The methods continue to be improved, and to stimulate the collection of relevant data.
- For the 2007 table, a larger share of data than ever before will come from the Census.
- The reconciliation and integration of the IO with the national accounts helps IO modelers immensely.
- Basic values and supply and use framework will ease international comparisons with the U.S.

IO Wish List

- Full table of employment by benchmark IO industry.
- Capital flow table is extremely important and useful!
- Energy accounts: detailed energy flows by IO industry.
- Emissions accounts: estimates of CO2 and other GHG by IO industry.
- Health satellite accounts: Relation of the IO and national accounts to national health accounts.
- R&D satellite accounts: Show alternative treatments of R&D in the IO and national accounts (in the BEA Strategic Plan).