Econ Base vs Input-Output Models

- Leontief developed an "input-output" method for estimating economic impacts and tracing the flows of dollars. Leontief later won the Nobel Prize in 1973, largely related to this work.
- Input-Output expands heavily upon the economic base model of the economy.

<u>Economic Base Techniques</u>

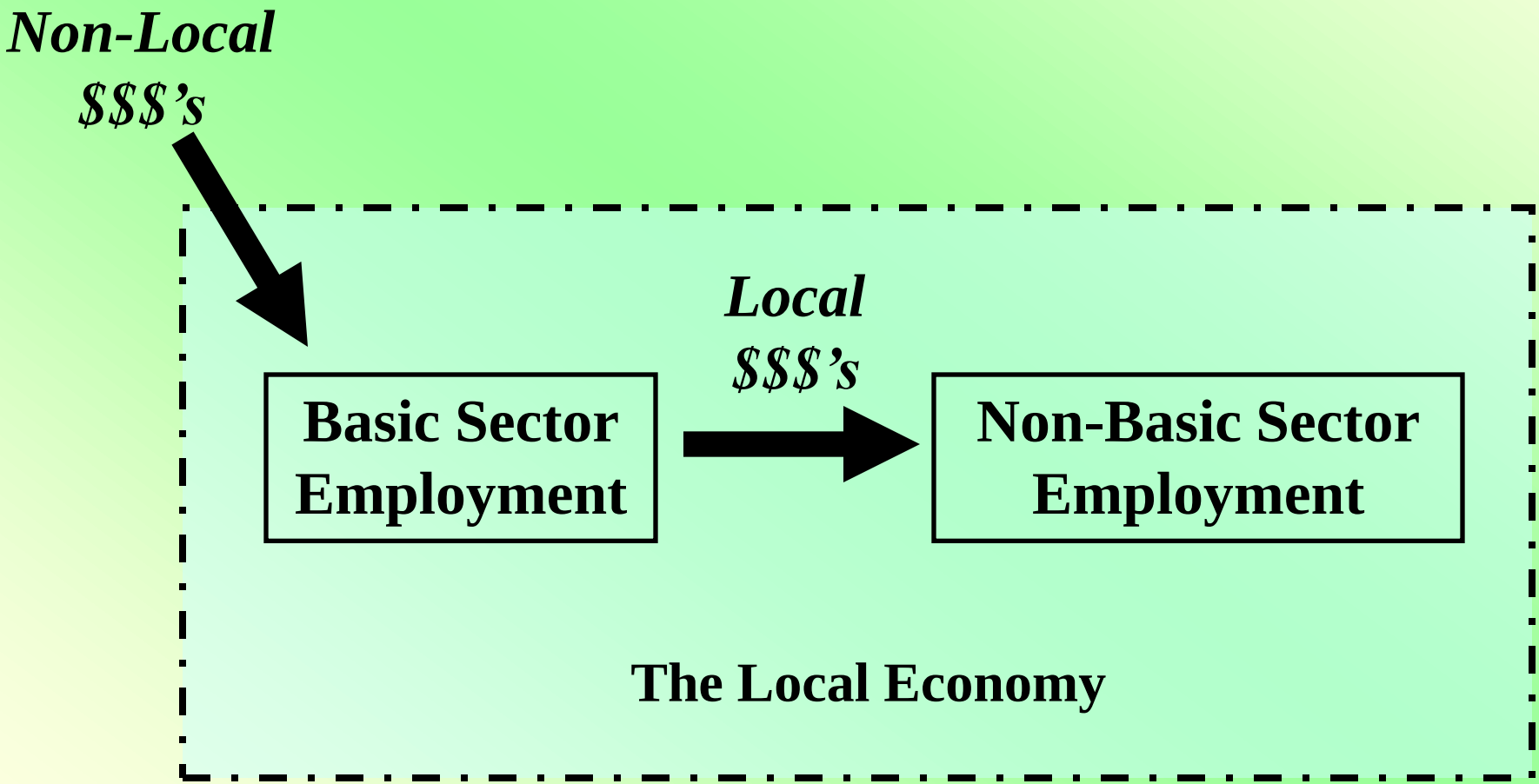
1) Basic and Non-basic sectors
2) Ripple (multiplier) effects analyzed at the B/NB level
3) Analyzes changes and impacts at a gross B/NB level
4) Very general, but…

<u>Input-Output Analysis</u>

1) Many different industries/sectors
2) Ripple (multiplier) effects contained in the interindustry transactions
3) Analyzes changes and impacts at a sector by sector level, tracing flows of dollars between industries
4) Much more precise, but…

The Economic Base Theoretical Model

- The EB model assumes that the *basic sector is the primary cause of local economic growth; that is, it is the <u>economic base</u> of the local economy*.

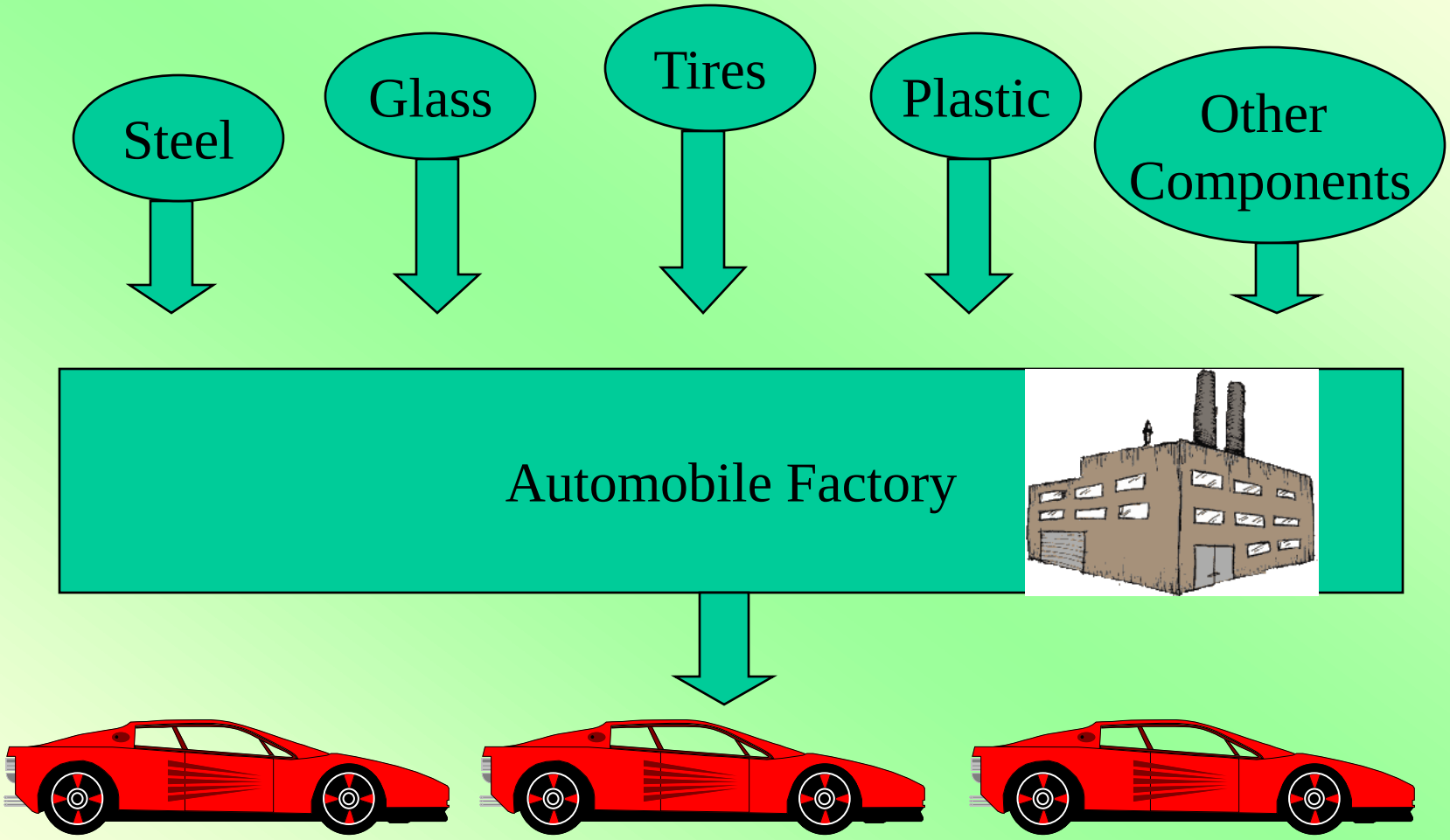


Input-Output Model

- The IO model is centered on the idea of inter-industry transactions:
  - Industries use the products of other industries to produce their own products.
  - For example - automobile producers use steel, glass, rubber, and plastic products to produce automobiles.
  - Outputs from one industry become inputs to another.
  - When you buy a car, you affect the demand for glass, plastic, steel, etc.

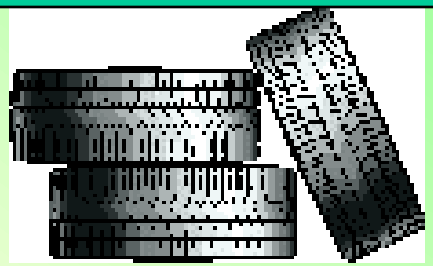
Taken from a Power Point presentation prepared by Pam Perlich at the University of Utah. http://www.business.utah.edu/~bebrpsp/IO/IO.ppt

Basic Input-Output Logic



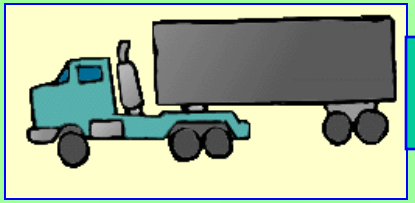
From the Tire Producer's Perspective

Tire Factory



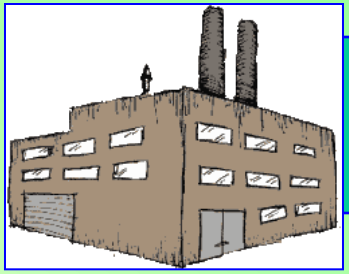
Individual Consumers

School Districts



Trucking Companies

FINAL DEMAND FOR TIRES



Automobile Factory

INTER-MEDIATE DEMAND FOR TIRES

Input-Output Analysis: The BIG Point

- The implicit assumption in economic base techniques is that each basic sector job has a multiplier (or ripple) effect on the wider economy because of purchases of non-basic goods and services to support the basic production activity. (*the Basic Sector drives the Non-basic Sector*)
- However, we know that Non-basic sector businesses purchase Non-basic goods and services and Basic sector businesses purchase Basic sector goods and services. There are *inter-industry linkages* not contained within the Economic Base model. The economy is much more complex than the economic base techniques allow or attempt to model.
- The central advantage of Input-Output analysis is that *it tries to estimate these inter-industry transactions and use those figures to estimate the economic impacts of <u>any</u> changes to the economy*.
- Instead of assuming a change in a basic sector industry having a generalized multiplier effect, the IO approach estimates how many goods and services from other sectors are needed (*inputs*) to produce each dollar of *output* for the sector in question. Therefore it is possible to do a much more precise calculation of the economic impacts of a given change to the economy.

IO Conceptualization of the Economy

- The major conceptual step is to divide the economy into "purchasers" and "suppliers".

--*Primary Suppliers*: They sell primary inputs (labor, raw materials) to other industries. Payments to these suppliers are "primary inputs" because they generate no further sales. (example: Households)

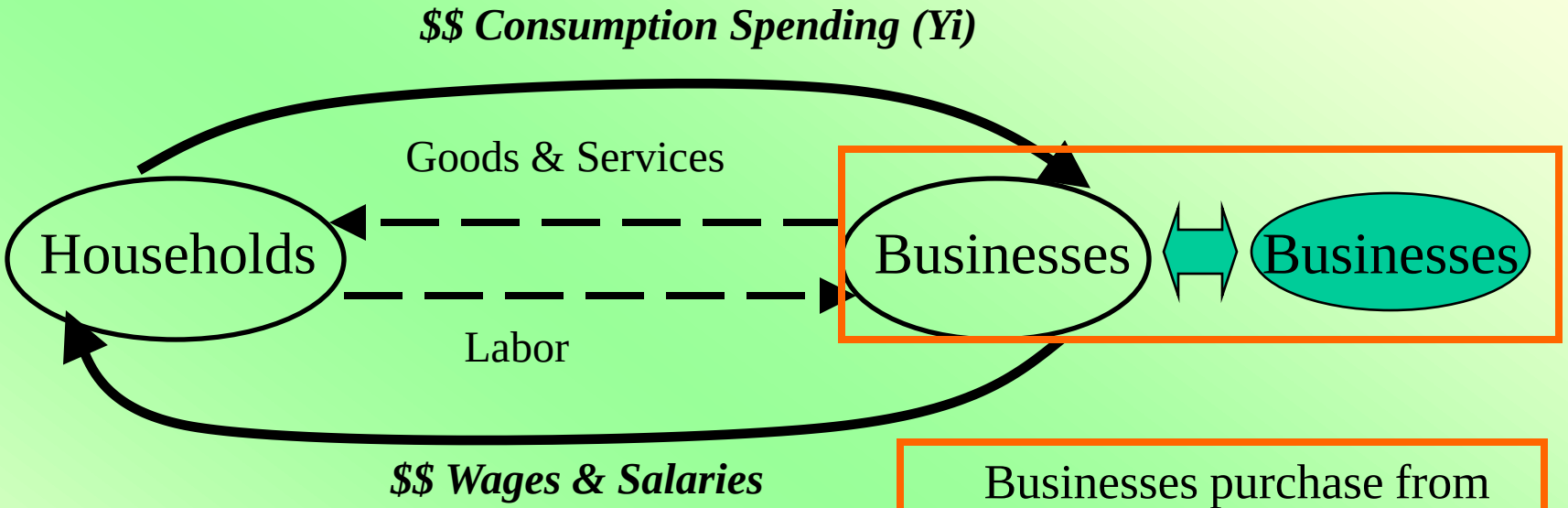
--*Intermediate Suppliers*: They purchase inputs for processing into outputs they supply to other firms or to final purchasers. (example: Automaker)

--*Intermediate Purchasers*: They purchase outputs of suppliers for use as inputs for further processing. (example: Automaker)

--*Final Purchasers*: Purchase the outputs of suppliers in their final form and for final use. (example: Households)

- *Intermediate Suppliers* and *Intermediate Purchasers* are the same thing!
- *Primary Suppliers* and *Final Purchasers* may or may not be the same entities. When they are the same (households), these activities are understood as separate activities.

Simplified Circular Flow View of The Economy



Households buy the output of business: final demand or Y_i

Households sell labor & other inputs to business as inputs to production

Businesses purchase from other businesses to produce their own goods / services.

This is intermediate demand or x_{ij} (output of industry i sold to industry j)

Taken from a Power Point presentation prepared by Pam Perlich at the University of Utah. http://www.business.utah.edu/~bebrpsp/IO/IO.ppt

The Structure of IO Analysis

- The ultimate goal of the Input-Output Analysis technique is to generate a *Total Requirements Table* that shows the flows of dollars between industries in the production of output for a given sector.
- To arrive at this final result, IO Analysis requires two earlier steps:

  1) *Transactions table*: Contains basic data on the flows of goods and services among suppliers and purchasers during a study year.

  2) *Direct requirements table*: Derived from the transactions table, this shows the inputs required directly from different suppliers by each intermediate purchaser for each unit of output that purchaser produces.
- "Input output analysis can be thought of as documenting and exploring the precise systems of interindustry exchange through which different components of regional product become different components of regional income." (Bendavid-Val, p. 87-88)
- Let's review Bendavid-Val's "Islandia example".

The Transaction Table and Direct Reqs Tables

The Transactions Table
(in thousands of units)

	Intermediate Purchasers		Final Purchasers	Total
	--Agriculture	*--Manufacturing*	*--Households*	*Sales (outputs)*
Intermediate Suppliers				
--Agriculture	10	30	60	100
--Manufacturing	5	10	35	50
Primary Suppliers				
--Households	85	10	15	110
Total Purchases (inputs)	100	50	110	260

Direct Requirements Table
(in thousands of units)

	Purchasers	
	--Agriculture	*--Manufacturing*
Intermediate Suppliers		
--Agriculture	0.10	0.60
--Manufacturing	0.05	0.20
Primary Suppliers		
--Households	0.85	0.20
Total Purchases (inputs)	1.00	1.00

Every unit of output requires inputs of a certain amount from other areas of the economy.

The First Round of Economic Impacts

Direct Requirements Table
(in thousands of units)

	Intermediate Purchasers	
	--Agriculture	--Manu
Intermediate Suppliers		
--Agriculture	0.10	0.60
--Manufacturing	0.05	0.20
Primary Suppliers		
--Households	0.85	0.20
Total Purchases (	1.00	1.00

Total Requirements Calculation (First Round)
(in thousands of units)

	Sales to Final Purch.	*Sales as Direct Inputs To Agr*	*To Manu*	*Total*
By Agriculture	200	20	60	80
By Manufacturing	100	10	20	30
By Households	0	170	20	190
Total indirect rounds				
By All Supliers	300			300

To Rd. 2

The Second-Fourth Rounds of Econ. Impacts

Total Requirements Calculation (Second Round)
(in thousands of units)

	Sales to Final Purch.	*Sales as Direct Inputs To Agr*	*To Manu*	*Total*
By Agriculture	80	8.0	18.0	26.0
By Manufacturing	30	4.0	6.0	10.0
By Households	0	68.0	6.0	74.0
Total indirect rounds				110.0

Total Requirements Calculation (Third Round)
(in thousands of units)

	Sales to Final Purch.	*Sales as Direct Inputs To Agr*	*To Manu*	*Total*
By Agriculture	26	2.6	6.0	8.6
By Manufacturing	10	1.3	2.0	3.3
By Households	0	22.1	2.0	24.1
Total indirect rounds				36.0

Total Requirements Calculation (Fourth Round)
(in thousands of units)

	Sales to Final Purch.	*Sales as Direct Inputs To Agr*	*To Manu*	*Total*
By Agriculture	8.6	0.9	2.0	2.8
By Manufacturing	3.3	0.4	0.7	1.1
By Households	0	7.3	0.7	8.0
Total indirect rounds				11.9

and so on until the mult. effect ends

The Total Requirements Results

Total Direct and Indirect Requirements Calculation					
(in thousands of units)					
		Sales to Final	*Total*	*Total*	*Total*
		Purchasers	*Direct Sales*	*Indirect Sales*	*Sales*
	Agriculture	200.0	80.0	38.7	318.7
	Manufacturing	100.0	30.0	14.9	144.9
	Households	--	190.0	109.6	299.6
	Total	300.0	300.0	163.1	763.1

When:

1) there are “Final Sales” of Agriculture = 200 and “Final Sales” of Manufacturing = 100
2) we see a Total Economic Impact = 763.1, with that impact broken down as:
    1) 300.0 in *Initial Sales to Final Purchasers*
    2) 300.0 in *Total Direct Sales*
    3) 163.1 in *Total Indirect Sales*

The 300 units in Final Sales generate an additional 463.1 units of economic activity. This illustrates the multiplier effect captured by IO models.

The Total Requirements Table

Total Requirements Table

		Every Unit in Final Demand of…	
Requires Total Sales by		*Agriculture*	*Manufacturing*
	Agriculture	1.15	0.86
	Manufacturing	0.07	1.29
	Households	1.00	1.00
	Total	2.22	3.15

For Agriculture	1.00	Sales to Final Purchasers
	1.00	Sales by Primary Suppliers
	0.22	Interindustry transactions

Similar to our Base Multiplier in Econ Base Theory

A 1.0 unit increase in demand for agriculture leads to a total of 2.22 of sales.

For Manufacturing	1.00	Sales to Final Purchasers
	1.00	Sales by Primary Suppliers
	1.15	Interindustry transactions

Similar to our Base Multiplier in Econ Base Theory

A 1.0 unit increase in demand for manufacturing leads to a total of 3.15 of sales.

RIMS Multipliers

- The Bureau of Economic Analysis (BEA) produces State Level Regional Input-Output Multipliers by industrial sector which are often used as the basis for constructing an IO model.
- Originally developed in the 1970s, RIMS (Regional Industrial Multiplier System) multipliers are used for "impact analysis" for a given economy.
- RIMS II data were developed in the 1980's (latest version is 1998)
- Users can purchase data from BEA for $275 per region. BEA provides handbooks for the use of this data.
- County or multi-county regional RIMS data come in two series
  Series I: for 490 detailed industries
  Series II: for 38 industry aggregations
- Empirical analysis shows that RIMS II data is accurate within 5% of locally developed industry multipliers.
- Advantages of the RIMS Multipliers:
  1) Cheap
  2) Can be compared across regions
  3) Detailed industries
  4) Updated regularly to reflect new data

Example RIMS Multipliers

Table 2.4.—Total Multipliers for Output, Earnings, and Employment by Industry Ag
Jackson County, MO

	Final-demand multiplier		
	Output [1] (Dollars) (1)	Earnings [2] (Dollars) (2)	Employment [3] (Jobs) (3)
Farm and agricultural services, forestry, and fishing:			
Farm products and agricultural, forestry, and fishing services	1.7944	0.5693	57.6
Forestry and fishing products	1.4646	.2058	10.5
Mining:			
Coal mining	1.0000	0	0
Oil and gas extraction	1.4591	.1584	6.7
Metal mining and nonmetallic minerals, except fuels	1.5680	.3337	12.6
Construction:			
Construction	1.8723	.4528	21.4
Manufacturing:			
Food and kindred products and tobacco products	1.5222	.2060	8.5
Textile mill products	1.4834	.2795	16.6
Apparel and other textile products	1.4528	.2776	16.5
Paper and allied products	1.4647	.2763	10.7
Printing and publishing	1.6296	.3174	12.6
Chemicals and allied products and petroleum and coal products	1.6214	.2812	9.5
Rubber and miscellaneous plastics products and leather and leather products	1.5946	.3112	14.5
Lumber and wood products and furniture and fixtures	1.6863	.3702	17.6
Stone, clay, and glass products	1.7749	.3348	14.0
Primary metal industries	1.7600	.3125	11.7
Fabricated metal products	1.7173	.3722	14.1
Industrial machinery and equipment	1.7207	.3916	15.3
Electronic and other electric equipment	1.6214	.3334	13.9
Motor vehicles and equipment	1.6967	.3160	10.7
Other transportation equipment	1.5913	.3769	12.0
Instruments and related products	1.6120	.3556	12.8
Miscellaneous manufacturing industries	1.7072	.3744	20.2

[1]Total dollar impact due to $1 in output in the industry. [2]Change in earnings due to $1 change in industry. [3]Change in employment resulting from $1 million increase in output delivered to final demand.

For More Info on RIMS Multipliers

- The Bureau of Economic Analysis (BEA) has several web resources on RIMS Multipliers and how they are prepared:

RIMSII Home Page

http://www.bea.doc.gov/bea/regional/rims/

Brief Description of RIMS II

http://www.bea.doc.gov/bea/regional/rims/brfdesc.cfm

RIMSII User's Handbook

http://www.bea.doc.gov/bea/ARTICLES/REGIONAL/PERSINC/Meth/rims2.pdf

The Problems with IO Analysis

Practical Issues

- *Data needs* and *complexity*: IO models are *tremendously complex* and *very data hungry*. This typically places these models in the hands of experts.

Theoretical Issues

- *Time/Data issues*: Usually a single year's data are used to develop the Total Requirements Table. But 1) purchases may actually reflect a longer term investment and 2) short term trends may impact the data.
- *Stability of the technical coefficients over time*: Technology changes, prices change, and demand changes, all affecting the coefficients in the Tot Reqs Table. This can impact the results if the coefficients are "out of date".
- *IO assumes a linear relationship between increasing demand for inputs and outputs*: This assumes away 1) externalities and 2) increasing/ decreasing returns to scale.
- *Industrial categorization*: IO models still assume that each industry 1) has a single, homogeneous production function and 2) each produces one product. These assumptions do not reflect the real economy very well.

The Power of IO Models

- Despite these problems IO analysis is a tremendously popular and powerful analytical tool.
- "The chief value of regional input-output analysis is in its descriptive analytical power." (Bendavid-Val, p.113)
- "As a descriptive tool, input-output tables:

  -*present an enormous quantity of information in a concise, orderly, and easily understood fashion*;
  -*provide a comprehensive picture of the interindustry structure of the regional economy*;
  -*point up the strategic importance of various industries and sectors*;
  -*highlight possible opportunities for strengthening regional income and employment multiplication*." (Bendavid-Val, p.113)
- Urban Planners should be capable of understanding the structure, assumptions, and data requirements of Input-Output Analysis. While you may not be performing this analysis in your jobs, you almost certainly will come across this type of work sometime in your career.