Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 Year Period

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Abstract

Many studies have been prepared on structural change in the U.S. economy using input-output analysis. These include, among others, Carter's examination of U.S. economic technological change over the 1939-1963 period and, more recently, Sonis' new decomposition approaches to visually display structural change with application to U.S. input-output tables from 1947-1977.[1] This paper, using Sonis' techniques of displaying structural change, evaluates changes in the U.S. economy over the 1972 to 1996 period, focusing on interindustry linkages and the effect of international trade on those linkages. The study shows that the relative impact of manufacturing on the economy has declined in the United States from 1972 to 1996 and that import penetration has been a major factor in this decline. The graphical presentation of interindustry relationships through the "Multiplier Product Matrix" (MPM) and its associated "economic landscape" provides a visualization of the U.S. economic structure for selected years and how it has changed over time.

[1] Ann Carter, *Structural Change in the American Economy*. Cambridge: Harvard University Press, 1970. Michael Sonis, G.J.D. Hewings, and J. Guo, "Sources of Structural Change in Input-Output Systems: A Field of Influence Approach", *Economic Systems Research*, 1996, Vol. 8, No. 1.

Introduction

As the U.S. economy has grown, its structure has changed. Using very broad measures, the U.S. economy has moved from an economy dominated by manufacturing to one where services play a major role. For example, over the 1972 to 1996 period nominal GDP grew at an average annual rate of 8 percent, but contributions by manufacturing to GDP grew at an average of 6.5 percent annually. During the same period, the share of intermediate transactions to total industry gross output from manufacturing fell from 22 percent in 1972 to 17 percent in 1996 while those from services grew from 21 percent to 27 percent. Both of these measures are indicators of changes occurring in the structure of the economy, but they do not tell us fully where or why those changes are occurring.

Input-output analysis allows us to study these structural changes in the economy. It provides the tools necessary to evaluate industries, including their relationships to the rest of the economy and the effects of international trade on those relationships. It has been said that input-output analysis is one of the major contributions to economics in the 20th century that accomplished "the mutual support that theory, data and application have come to provide to one another."[2]

In this paper, we analyze structural changes in the U.S. economy and the role of international trade on those changes. For this analysis, we use a set of six input-output tables prepared over the 1972 to 1996 period. Structural change is measured using the "Multiplier Product Matrix" (MPM). The MPM provides a measure of an industry's linkages, that is, the impacts of an industry on other industries, that can be compared with those of other industries or with itself at different points in time. These linkages represent the interactions by an industry with other industries both as a producer of output

[2] William J. Baumol, "What Marshall d*idn't* know: On the Twentieth Century's Contributions to Economics", *The Quarterly Journal of Economics*, February 2000, Vol. CXV, Issue 1.

and a consumer of inputs and without regard to national boundaries. To evaluate the effects of trade on these linkages, a separate set of MPM's were created to show linkages for only domestic production. By separating domestic from total linkages, the analysis identifies, as a residual, the linkages between the U.S. economy and the rest of the world and the influence of trade on the structure of the U.S. economy.

The results of our analysis show:

- Changes to the industry linkages that define the structure of the U.S. economy have been incremental over the 1972 to 1996 period. These changes have altered the structure of the domestic economy and where it draws impetus for economic growth;
- In 1972, the strongest influence on the U.S. economic activity was concentrated in manufacturing. In the quarter century since then, manufacturing's influence has gradually decreased;
- Over the 1972 to 1996 period, much of the decline in manufacturing's influence on the domestic economy is explained by leakages from U.S. imports;
- Over the same period, non-manufacturing industries – particularly construction, real estate, and fast growing services – have gained in influence on the U.S. domestic economy;
- The decline in manufacturing's influence was greatest for slow and average growth industries. However, manufacturing industries with fast growth also showed a decline over the period.

U.S. Input-Output Tables

This analysis uses benchmark input-output (I-O) tables for 1972, 1977, 1982, 1987 and 1992 and the 1996 annual input-output table.[3] Benchmark I-O tables, each based on an economic census of the U.S. economy, provide high quality, detailed information on the structure of the economy at 5-year intervals. The annual table, though not of the same statistical quality as the benchmark tables, is included to provide an indicator of changes occurring in more recent years. **(**For an explanation of these tables and their comparability, see the Appendix, pages A1-A9.)

The benchmark I-O tables, as well as the annual table, used for this study were initially prepared at a high level of detail for approximately 500 industries and commodities. To increase comparability between years and to facilitate the analysis, the data were aggregated to a common set of 87 industries and commodities (see Appendix, pages A6-A9).

To display our results, we aggregated further to 16 industries (see Table 1). With the exception of manufacturing and services, these aggregates represent major industry groups. Manufacturing and services were divided to provide additional industry detail. Manufacturing was divided into three groups: Slow growing–growing slower than the average for of all manufacturing; average growing; and fast growing–that is, growing faster than the average for all of manufacturing.[4] Services were divided into two groups, those growing faster than the average of all services and those growing slower. The

[3] For the latest benchmark I-O, see Ann M. Lawson, "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use and Supplementary Tables," Survey of Current Business 77 (November, 1997): 36-82. For the 1996 annual I-O table, see Sumiye O. Okubo, Ann M. Lawson, and Mark A. Planting, "Annual Input-Output Accounts of the U.S. Economy, 1996," Survey 80 (January 2000):37-86.

[4] Manufacturing was divided into three groups based on the average annual growth rate of manufacturing GDP. Slow growing industries were those that grew at less than 7 percent, average were those that grew at 7 percent annually and fast were those that grew faster than 7 percent annually. Services were divided into two groups based on the average growth rate of services contributions to GDP. Slow growing services were those that grew less than 10 percent annually; fast growing were those that grew faster than 10 percent annually. Because service industries showed a bimodal distribution for growth, with no clustering near the average, only two service groups were created.

industries included in each of these groups are identified in the Appendix (see pages A6-A9).

The Changing U.S. Economy: A First Look

Over the 1972 to 1996 period, the overall growth by the U.S. economy has been accompanied by a decline in the share of manufacturing gross output, an increase in the share of services gross output, and a growing U.S. trade deficit. From 1972 to 1996, U.S. nominal GDP grew at an average annual growth rate of 8 percent from $1.2 billion to $7.8 billion (see Figure 1).[5] However, the growth of manufacturing industries' GDP lagged behind at 6.5 percent annually. Because of its slower growth, manufacturing's share of GDP declined from 24 percent to 18 percent (see Figure 2). The share of intermediate transactions to total industry gross output remained relatively constant between 1972 and 1996 at 43 percent. However, there was a large shift from manufacturing intermediate to services intermediate. Manufacturing intermediate transactions share of total industry gross output dropped from 22 percent in 1972 to 17 percent (see Figure 3). On the other hand, service industries' share increased from 21 percent to 27 percent.

In 1996, U.S. manufacturing imports were nearly $700 billion, more than 13 times the $51 billion of manufacturing imports in 1972 (see Table 2). Manufacturing exports, however, increased from $38 billion to $465 billion. As a result, the trade deficit for manufacturing goods as measured in the I-O accounts expanded from $13 billion to $234 billion, changing by a factor of 18 over 24 years (see Figure 4).[6] Figure 5 shows the non-manufacturing imports and exports changes for 1972 and 1996.

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[5] Sherlene K.S. Lum, Brian C. Moyer, and Robert E. Yuskavage, "Improved Estimates of Gross Product by Industry for 1947-98," Survey 80 (June 2000): 24-60.

[6]The valuation of trade in the I-O accounts differs from valuation in the International Transactions Accounts (ITA) and the National Income and Products Accounts (NIPA). The I-O accounts value imports and exports in producers' prices. Exports by commodity are valued at the value leaving the producers' establishment; the costs of moving the commodity to the point of export are included separately as exports of transportation costs and wholesale trade margin. Imports by commodity are valued as foreign port value plus the cost of overseas transportation and customs duty. In both the ITA's and the NI PA's, exports are

Growth in manufacturing production did not keep pace with the growth in imports of manufactured commodities. During the 1972 to 1996 period, manufacturing gross output increased from $761 billion to $3,666 billion, an increase by a factor of 5, and at a rate of growth significantly below imports.

While many economists have focused on the increasing trade deficit and its effects on the performance of the U.S. economy, little attention has been given to the effect of these deficits on the structural linkages of the economy. With the help of input-output techniques, we are able to examine the impact of growth and international trade on changes to these linkages over a period spanning a quarter of a century.

Estimating Framework

Previous studies of economic structural change using input-output analysis have compared changes in direct coefficients or total requirements coefficients over time. They have used changes in input coefficients as the measure of structural change and have looked backwards from the demand for commodities to industry production and the inputs required to meet that production. What these studies have missed is how an industry is related to industries that use its output, and how these relationships have changed. The relationships go both backward to industries producing its inputs and forward to industries using it's commodities. The measure applied in this paper, the Multiplier Product Matrix (MPM), gives equal weight to both sets of relationships. The following sections describe the analytical techniques used to analyze structural change in this paper.

Economic linkages, multipliers and Multiplier Product Matrix. -- In the framework of the input-output model, industry production has two kinds of economic

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valued at the price leaving the country and include in their value the domestic transportation costs and wholesale margins; imports are valued at foreign port value.

effects on other industries in the economy: Increased demand and supply. When industry *i* increases its production, there is increased demand for inputs from industries. In the input-output model, this demand is referred to as *backward linkage*. An industry with higher backward linkages than other industries means that expansion of its production is more beneficial to the economy in terms of causing other induced productive activities. On the other hand, an increase in production by other industries leads to additional output required from industry *i* to supply inputs to meet the increased demand. This supply function is referred to as *forward linkage*. An industry with higher forward linkages than other industries means that its production is relatively more sensitive to changes in other industries' output. In this paper, we derive both backward and forward linkages from the Leontief inverse matrix[7].

Let $A = \{a_{ij}\} = X_{ij} / X_j$ be the direct requirements coefficient matrix, where X_{ij} is industry *j*'s direct input from industry *i*, and X_j is total output of industry *j*. Then the total requirements matrix is expressed as $B = \{b_{ij}) = [I - A]^{-1}$, which is also called the Leontief inverse matrix or total requirements matrix.[8]

From $B = \{b_{ij}) = [I - A]^{-1}$, define $b_{\bullet j} = \sum_{i=1}^{n} b_{ij}$ the sum of rows for column *j* from the total requirements matrix. Since $b_{\bullet j}$ measures the total output from all industries generated from one unit final demand of product *j*, it is called the backward linkage of industry *j*. [9] Similarly, we define $b_{i\bullet} = \sum_{j=1}^{n} b_{ij}$, the sum of columns for row *i* from the total requirements coefficient matrix as the measure for forward linkage.[10]

[7] For more information on backward and forward linkages, see R. Miller and P. Blair (1985) *Input-Output Analysis: Foundations and Extensions*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
[8] In this analysis we use an industry-by-industry total requirements matrix. This matrix is calculated from the make and use tables.
[9] Another term for backward linkage is "output multiplier."
[10] Another popular approach to determine forward linkage is to use supply-side input-output model. See Miller and Blair (1985) for the supply-side input-output model.

The multiplier product matrix (MPM) was developed as a *field of influence* for all industries.[11] This measure captures the affect of both forward and backward linkages and thus provides, in a single measure, the relationship of one industry to all other industries.

Let *V* be the global intensity (the sum of the total requirements coefficients for all industries) of the Leontief inverse matrix:

$$V = \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}$$

Then, the input-output Multiplier Product Matrix (MPM) is defined as:

$$M = \frac{1}{V} \left\| b_{i\bullet} b_{\bullet j} \right\| = \frac{1}{V} \begin{pmatrix} b_{1\bullet} \\ b_{2\bullet} \\ \vdots \\ b_{n\bullet} \end{pmatrix} \begin{pmatrix} b_{\bullet 1} & b_{\bullet 2} & \cdots & b_{\bullet n} \end{pmatrix}$$

Because the MPM provides a quantitative measure of the relationships among industries, the industries can be organized into a rank-size hierarchy. The result is a graphical presentation of the industry relationships called an "economic landscape."[12] The economic landscape reveals industry structural relationships through their backward and forward linkages, enabling us to visualize the economic structure for each period and to see how this structure changes over time.

Domestic linkages versus total linkages: finding economic leakage from import penetration effects. — Generally, the intermediate transactions in the input-output table include industry consumption of goods and services regardless of the source, either foreign or domestic. The direct requirements matrix, *A*, and the total requirements matrix, *B*, derived from these tables include direct and indirect requirements from domestic as well as foreign sources. The multipliers derived from these tables tend to overestimate the impacts on domestic industry outputs derived from final consumption,

[11] Michael Sonis, G.J.D. Hewings, and J. Guo "Input-Output Multiplier Product Matrix", Discussion Paper, 94-T-12 (revised, 1997), Regional Economics Applications Laboratory, University of Illinois.

because they include inputs from foreign sources. For example, assume domestic demand for personal computers increases by $100 million. Through the multiplier effect, the total output required to meet that demand is about $200 million, however, only part of the $200 million output is produced domestically, while the rest is imported. The part supplied by imports is called an *economic leakage*.

For input-output analysis, the impact of economic leakages can be estimated by constructing separate use tables: One composed of only domestically produced inputs and one composed of imports. In our study, we estimated an import matrix – the use of imports by industries (see Appendix, page A4). The direct requirements coefficients matrix A was decomposed as $A = {}_{d}A + {}_{m}A$, where ${}_{d}A$ represents direct coefficient for domestic products, and ${}_{m}A$ represents direct coefficients for imported products. The total requirements matrix for domestic products is expressed as ${}_{d}B = [I - {}_{d}A]^{-1}$, and the matrix of economic leakages was derived as $(B - {}_{d}B)$.

Total and domestic total requirement matrices were derived for each year and the MPMs were constructed. The results enabled us to develop a more precise graphical picture of the relationships of industries to domestic output, as well as a representation of the economic leakages for each year.

MPM example. -- The relative heights and shapes of the MPM landscapes depend on the degree of interindustry relationships or linkages in the economy. To illustrate the effect of changes in linkages on the landscape, we present four examples – each with three industries, A, B, and C. The first illustrates an economy where there are no forward or backward linkages between industries. The second and third introduce interindustry linkages but the relationships are symmetrical between industries to illustrate how the height of the MPM landscape can change. The fourth example varies the interindustry linkages to illustrate how the height of the MPM landscape varies with

[12] For other properties of MPM, see Sonis et al., 1997.

different backward and forward linkages. The associated total requirements tables and the MPM landscapes are shown in Figure 6.

In the first example, an economy with no interindustry linkages, the landscape is low and flat. The flat landscape indicates that all industries have the same degree of interrelationships.[13]

In the second example, where there are interindustry linkages but they are symmetrical between industries, the landscape is flat but higher than the landscape with no interindustry linkages. As with the first example, the flatness indicates that the relationships are symmetrical between industries. Compared to the first example, the increased heights of columns indicate that there are interdependencies among industries. The larger the MPM value for an industry, the taller the cell representing that industry, and the greater the linkages – forward and backward – of the industry with other industries.

In the third example, where the backward and forward linkages are the same as in example two but the values of the individual total requirements coefficients are different, a landscape that is identical to the landscape for example two is produced. This illustrates that the average height of the overall MPM landscape is a function of the total backward and forward linkages and not the values of individual total requirements coefficients.

In the fourth example, interindustry linkages vary by industry. Compared to the third example, a landscape with different heights is produced, however the overall average height of the landscape is the same as that for example three. The varying heights indicating, the varying are the degrees of interindustry relationships. The higher the column, the greater are the interindustry relationships. Industry A has the strongest relationships with other industries, followed by industry B, and then by industry C.

[13] Total requirements coefficients greater than one exist because the one represents the one unit of initial final demand and the values greater than one represent the indirect requirements induced by other industries. .

Structural Change in the U.S. Economy: 1972 to 1996

The economic landscapes present graphically the structural changes to the U.S. economy over the last two and a half decades. The economic landscapes from 1972 to 1996 are shown in Figure 7. In these landscapes, the rows represent the hierarchy of forward linkages–relationships to using industries, while the columns represent the hierarchy for the backward linkages-- relationships to providing industries.

MPM's are generally used as a tool to compare landscapes from different regions or from different times. In this paper we compare the economic landscape for years from 1972 to 1996 period. To make these comparisons, 1972 is set as the reference year, meaning that the hierarchy of industries established for 1972 is imposed on each succeeding landscape. By maintaining the same ordering of industries and comparing landscapes over time, changes in the relative impact of industries on the rest of the economy can be observed. Differences in the height of the columns between years indicate a change in the relationship of the respective industry to the rest of the economy.

To provide order, industries are sorted by the rank of their forward and backward linkages. Using this hierarchy, the northwest quadrant provides the highest elevation with the landscape slopes downward to the south and east. Industries are ordered by their total impacts on the economy. For 1972, the apex is the intersection of industries 4A (manufacturing industries with average growth) and 4F (manufacturing industries with fast growth); this industry has the highest forward and backward linkages of all of the industries (see Figure 7, 1972 landscape). The ordering of all industries in this rank is by the size of the forward and backward linkages for industries, which gives the downward slope from the apex. The following ranks of industries is determined by the relative size of the backward linkages for the apex industry, 4A (manufacturing industries: average growth). This makes construction (3) the second rank, followed by manufacturing: fast growing (4F) and by manufacturing: slow growing (4S). As for forward linkages,

manufacturing with fast growth ranked the first, communication (6) the second, followed by manufacturing slow growth (4S) and construction (3).

The landscapes show that there is substantial variation in linkages between industries; the landscapes are not flat but varied. Over the 1972 to 1996 period, the landscape terrain changes and the average height of the landscape also changes. Between 1972 and 1996 the heights of the manufacturing columns declined, while the heights of most other industries' columns rose indicating that linkages between manufacturing and other industries have declined while linkages of all other industries have grown.

The MPM's for five other I-O tables, representing years 1977, 1982, 1987, 1992, and 1996, are also shown in Figure 7. If no structural change occurred over the years, then the hierarchies would be constant and the economic landscapes unchanged. However, comparisons of the landscapes for different years do show that the economy's structure has changed. Comparisons between adjacent periods generally show small changes. This supports the general understanding that relationships between industries are relatively stable for short periods, especially for an economy as mature as in the United States. However, comparing the landscapes for 1972 and 1996, a time span of 25 years, shows some considerable changes.

The 1996 chart shows a flattening out and general decline of the landscape, indicating smaller differences between each industry's relative impact on other industries, and a lower level of interrelationships between all industries. In particular, domestic manufacturing's relative impact – measured by its backward linkages – on the economy has declined, meaning that a change in final demand for manufacturing products generates less output from the rest of the economy in 1996 than it did in 1972. If we look at the output multipliers for domestic manufacturing (see Table 3a), we see that the multipliers decreased from 1972 to 1996, indicating that for a given change in final demand for manufacturing commodities, the output required from all other domestic industries is lower. The manufacturing: fast growing multiplier declined from 2.004 in

1972 to 1.853 in 1996; the manufacturing: average growing multiplier was reduced from 2.037 to 1.981, and manufacturing: slow growing multiplier fell from 2.205 to 2.149.

Manufacturing Output Multipliers (from table 3a and 3b)

	Domestic Output Multipliers		Total Output Multipliers		Output Multiplier Leakage	
Industry	1972	1996	1972	1996	1972	1996
Manufacturing - Average	2.037	1.981	2.145	2.255	0.108	0.274
Manufacturing - Fast	2.004	1.853	2.100	2.069	0.095	0.216
Manufacturing - slow	2.205	2.149	2.337	2.491	0.133	0.342
Manufacturing	2.138	2.028	2.259	2.318	0.121	0.291
Non-Manufacturing	1.562	1.590	1.602	1.678	0.039	0.088
Total	1.771	1.707	1.840	1.849	0.069	0.142

One factor that contributed to the reduction of industry linkages was import penetration. As discussed in the methodology section, the total requirements matrix multipliers include the demand for domestically produced as well as imported commodities. Because imports are assumed to require no domestic output, they are a leakage to the economy. To measure to what extent the economy relies on foreign commodities to satisfy domestic production and the impact of import penetration on economic linkages we derived a separate set of MPM's comprised only of domestically produced commodities. The landscapes resulting from these are shown in Figure 8. Comparing the landscapes we find that the total multiplier landscapes and the domestic multiplier landscapes for 1972 (Figures 7 and 8) are essentially the same. When we compare the landscapes for 1996, we find large differences. The 1996 domestic multiplier landscape is significantly flatter and lower than the total multiplier landscape (Figure 7). The Manufacturing: average growing total output multiplier for 1996 is 2.255 while the domestic output multiplier is 1.981, the Manufacturing: fast growing total output multiplier for 1996 is 2.069 while the domestic multiplier is 1.853 (see Table 3a and 3b). On the other hand the differences for non-manufacturing industries are not as great. For example Services: fast growing 1996 total output multiplier is 1.652 while the domestic multiplier was 1.577.

Figure 9 displays the size of the import leakages over the period. These landscapes were derived by subtracting the domestic MPM's from the total MPM's. The changes from 1972 to 1996 are dramatic, with the largest leakages occurring in manufacturing. Table 3b shows the effect of import leakages on the output multipliers, with the largest leakages occurring in manufacturing at 14 percent for Manufacturing: average growing, 12 percent for Manufacturing: fast growing and 16 percent for Manufacturing: slow growing. The import leakages for other industries are all smaller ranging from 2 percent for Finance to 11 percent for Utilities.

Conclusions

The U.S. economy has experienced a significant transformation in its economic structure over the past two and half decades. Through the use of input-output analysis techniques such as MPM, the changes to the structure of the economy can be evaluated. In this study using MPM and industry linkage analysis, we have demonstrated how the U.S. economic structure has changed:

- Interdependencies between domestic industries have decreased with a general lowering of total requirements multipliers;
- The growth of imports has had an impact on the decline of domestic industries' interdependencies as more of U.S. production is dependent on foreign source inputs rather than domestically production.
- The role of non-manufacturing industries in U.S. economy becomes stronger, with fast growing rate and increasing industry linkages.

While the analysis shows the decline in linkages and the impact of import penetration on these declines, further work is required. Additional work is required to investigate the factors that affect specific MPM cells over time and to investigate how changes in the composition of final demand have impacted the structure of the economy.

Table 1. – Aggregated Industries

Industry Code	Description
1	Agriculture, forestry and fisheries
2	Mining
3	Construction
4s	Manufacturing: slow growing
4a	Manufacturing: average growing
4f	Manufacturing: fast growing
5	Transportation
6	Communication
7	Utilities
8	Wholesale and retail trade
9	Finance
10	Insurance
11	Real estate
12s	Services: slow growing
12f	Services: fast growing
13	Special industries

Table 3a. Demestic and Total Output Multiplers

	Output multipliers												
	Domestic							Total					
Industry	1972	1977	1982	1987	1992	1996		1972	1977	1982	1987	1992	1996
Manufacturing - Average	2.037	2.099	2.151	1.938	1.986	1.981		2.145	2.271	2.337	2.127	2.208	2.255
Manufacturing - Fast	2.004	2.035	2.037	1.811	1.845	1.853		2.100	2.179	2.195	1.969	2.026	2.069
Manufacturing - slow	2.205	2.194	2.222	2.072	2.121	2.149		2.337	2.416	2.435	2.303	2.395	2.491
Agriculture	2.179	2.177	2.240	2.155	2.031	2.047		2.268	2.309	2.382	2.304	2.212	2.267
Mining	1.596	1.558	1.522	1.533	1.740	1.785		1.642	1.653	1.579	1.602	1.896	1.994
Construction	1.988	2.055	1.976	1.887	1.895	1.892		2.088	2.209	2.125	2.053	2.083	2.121
Transportation	1.659	1.730	1.888	1.762	1.772	1.808		1.698	1.800	1.996	1.849	1.867	1.919
Communication	1.334	1.362	1.429	1.686	1.681	1.765		1.350	1.393	1.470	1.734	1.738	1.840
Utilities	1.818	1.902	2.091	1.691	1.780	1.755		1.880	2.107	2.271	1.798	1.944	1.950
Trade	1.364	1.460	1.502	1.483	1.467	1.510		1.378	1.491	1.543	1.520	1.510	1.564
Finance	1.589	1.555	1.700	1.806	1.611	1.677		1.609	1.587	1.742	1.848	1.643	1.713
Insurance	1.843	1.701	1.986	1.880	1.966	2.002		1.863	1.722	2.027	1.920	2.005	2.053
Real estate	1.196	1.214	1.306	1.344	1.317	1.315		1.201	1.223	1.323	1.364	1.339	1.341
Government and others	1.104	1.121	1.177	1.156	1.122	1.128		1.110	1.136	1.198	1.176	1.138	1.149
Services - fast	1.565	1.538	1.524	1.610	1.526	1.577		1.597	1.587	1.575	1.676	1.585	1.652
Services - slow	1.771	1.755	1.797	1.784	1.701	1.712		1.836	1.846	1.895	1.890	1.802	1.831
Manufacturing average	2.138	2.145	2.164	1.971	2.009	2.028		2.259	2.343	2.359	2.174	2.245	2.318
Non-Manufacturing average	1.562	1.590	1.637	1.616	1.562	1.590		1.602	1.657	1.709	1.686	1.635	1.678
Total average	**1.771**	**1.795**	**1.809**	**1.723**	**1.684**	**1.707**		**1.840**	**1.911**	**1.921**	**1.833**	**1.801**	**1.849**

Table 3b. Multiplier Leakages

	Output multipliers leakage							Output multipliers leakage as % of domestic multiplier					
Industry	1972	1977	1982	1987	1992	1996		1972	1977	1982	1987	1992	1996
Manufacturing - Average	0.108	0.171	0.186	0.189	0.222	0.274		5%	8%	9%	10%	11%	14%
Manufacturing - Fast	0.095	0.145	0.158	0.158	0.181	0.216		5%	7%	8%	9%	10%	12%
Manufacturing - slow	0.133	0.222	0.212	0.232	0.274	0.342		6%	10%	10%	11%	13%	16%
Agriculture	0.089	0.131	0.142	0.149	0.181	0.220		4%	6%	6%	7%	9%	11%
Mining	0.046	0.096	0.057	0.070	0.157	0.208		3%	6%	4%	5%	9%	12%
Construction	0.101	0.154	0.149	0.166	0.189	0.229		5%	7%	8%	9%	10%	12%
Transportation	0.039	0.070	0.108	0.086	0.095	0.111		2%	4%	6%	5%	5%	6%
Communication	0.016	0.031	0.041	0.048	0.057	0.076		1%	2%	3%	3%	3%	4%
Utilities	0.063	0.205	0.180	0.107	0.163	0.196		3%	11%	9%	6%	9%	11%
Trade	0.014	0.032	0.041	0.037	0.042	0.054		1%	2%	3%	3%	3%	4%
Finance	0.020	0.033	0.042	0.042	0.032	0.036		1%	2%	2%	2%	2%	2%
Insurance	0.020	0.021	0.041	0.040	0.039	0.051		1%	1%	2%	2%	2%	3%
Real estate	0.005	0.009	0.017	0.020	0.022	0.027		0%	1%	1%	2%	2%	2%
Government and others	0.006	0.015	0.021	0.019	0.017	0.021		1%	1%	2%	2%	2%	2%
Services - fast	0.033	0.048	0.051	0.065	0.059	0.076		2%	3%	3%	4%	4%	5%
Services - slow	0.065	0.091	0.099	0.106	0.101	0.119		4%	5%	5%	6%	6%	7%
Manufacturing average	0.121	0.197	0.195	0.203	0.236	0.291		6%	9%	9%	10%	12%	14%
Non-Manufacturing average	0.039	0.067	0.072	0.071	0.073	0.088		3%	4%	4%	4%	5%	6%
Total average	**0.069**	**0.115**	**0.112**	**0.110**	**0.117**	**0.142**		**4%**	**6%**	**6%**	**6%**	**7%**	**8%**

Source: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.

Table 2a. U.S. International Trade (millions of dollars)

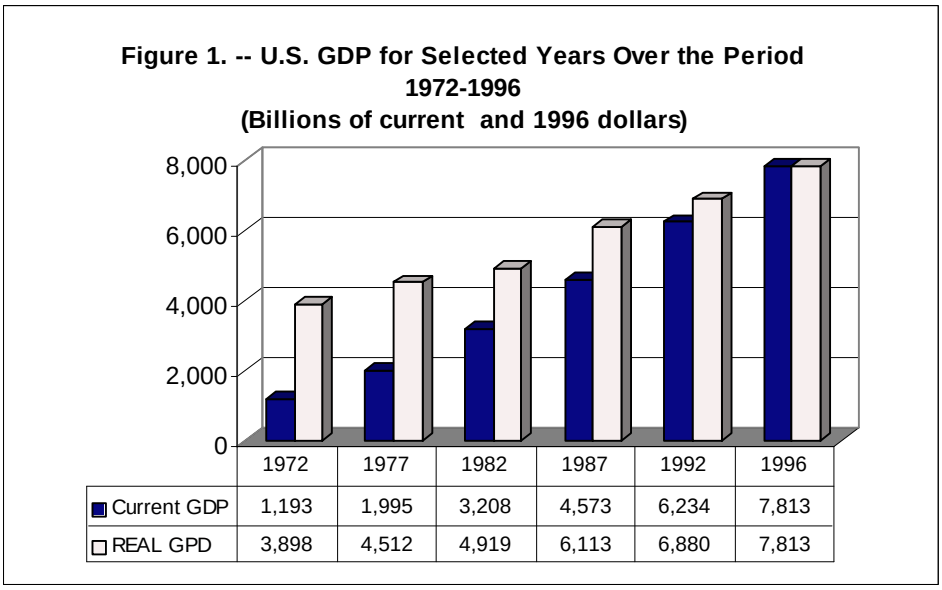
	Exports							Imports					
Commodity	1972	1977	1982	1987	1992	1996		1972	1977	1982	1987	1992	1996
Total	**72,113**	**182,043**	**357,528**	**348,572**	**602,609**	**814,770**		**79,192**	**189,505**	**340,479**	**505,933**	**649,893**	**922,949**
Manufacturing - Average	4,820	11,990	20,612	27,217	41,851	56,169		4,558	10,153	16,918	33,969	43,551	68,623
Manufacturing - Fast	11,483	26,450	49,151	77,503	136,589	179,725		9,984	22,311	44,408	102,476	148,215	213,001
Manufacturing - slow	21,348	53,647	89,856	96,808	164,290	229,464		36,257	77,208	130,434	239,150	292,253	417,656
Agriculture	5,116	13,184	19,857	14,259	19,978	27,066		2,043	3,039	4,614	7,619	14,785	20,725
Mining	852	3,502	9,052	5,795	9,213	8,123		4,071	37,701	47,278	32,036	45,071	64,794
Construction	16	26	82	96	77	97		0	0	0	0	0	0
Transportation	5,074	9,515	19,199	27,982	48,599	61,153		1,153	350	925	2,546	7,075	10,355
Communication	426	1,043	1,597	2,643	3,904	4,235		0	4	4	41	62	0
Utilities	142	263	305	308	774	768		414	1,950	4,883	2,216	576	990
Trade	4,063	12,360	21,649	26,307	44,596	66,786		0	0	0	0	0	0
Finance	22	296	5,698	12,670	17,280	26,922		0	0	207	233	297	526
Insurance	236	339	462	2,828	1,681	3,384		165	523	870	2,995	1,133	3,662
Real estate	2,031	3,661	5,930	10,688	20,484	33,580		0	0	0	0	12	11
Government and others	15,279	41,862	108,380	36,797	74,914	91,118		4,651	9,524	43,006	2,523	3,043	4,655
Services - fast	746	1,557	3,039	3,723	12,503	16,549		23	119	101	1,032	2,511	4,228
Services - slow	459	2,349	2,659	2,948	5,875	9,631		30	14	29	401	1,273	2,036
Non-comparable imports	-	-	-	-	-	-		15,843	26,610	46,804	78,696	90,036	111,687
Manufacturing	*37,651*	*92,087*	*159,619*	*201,527*	*342,730*	*465,358*		*50,799*	*109,672*	*191,760*	*375,596*	*484,019*	*699,280*
Non-manufacturing	*34,462*	*89,956*	*197,909*	*147,045*	*259,879*	*349,412*		*28,393*	*79,834*	*148,719*	*130,338*	*165,874*	*223,669*
As percentage of GDP	*6%*	*9%*	*11%*	*8%*	*10%*	*11%*		*7%*	*9%*	*11%*	*11%*	*10%*	*12%*

Table 2b. U.S. International Trade Share

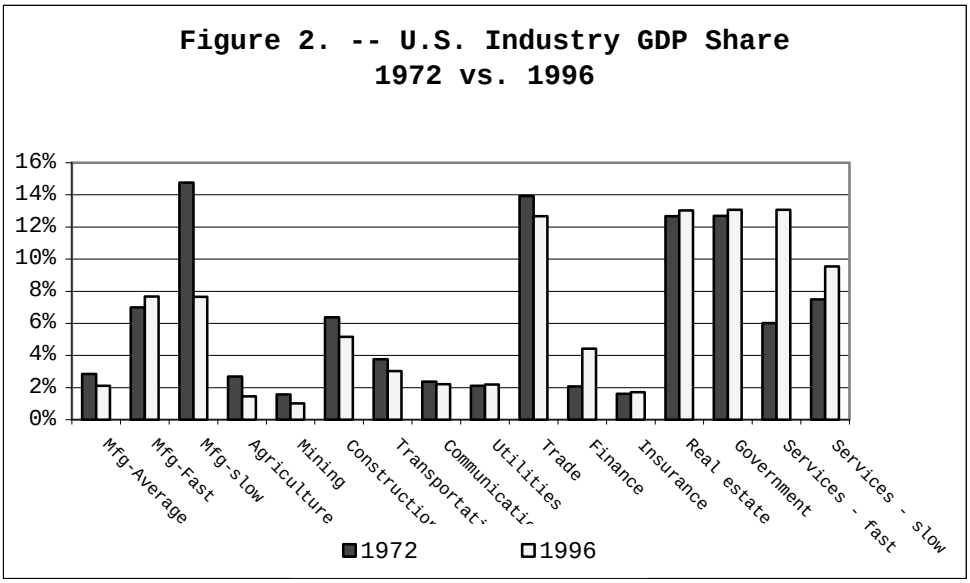
	Exports							Imports					
Commodity	1972	1977	1982	1987	1992	1996		1972	1977	1982	1987	1992	1996
Manufacturing - Average	7%	7%	6%	8%	7%	7%		6%	5%	5%	7%	7%	7%
Manufacturing - Fast	16%	15%	14%	22%	23%	22%		13%	12%	13%	20%	23%	23%
Manufacturing - slow	30%	29%	25%	28%	27%	28%		46%	41%	38%	47%	45%	45%
Agriculture	7%	7%	6%	4%	3%	3%		3%	2%	1%	2%	2%	2%
Mining	1%	2%	3%	2%	2%	1%		5%	20%	14%	6%	7%	7%
Construction	0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%
Transportation	7%	5%	5%	8%	8%	8%		1%	0%	0%	1%	1%	1%
Communication	1%	1%	0%	1%	1%	1%		0%	0%	0%	0%	0%	0%
Utilities	0%	0%	0%	0%	0%	0%		1%	1%	1%	0%	0%	0%
Trade	6%	7%	6%	8%	7%	8%		0%	0%	0%	0%	0%	0%
Finance	0%	0%	2%	4%	3%	3%		0%	0%	0%	0%	0%	0%
Insurance	0%	0%	0%	1%	0%	0%		0%	0%	0%	1%	0%	0%
Real estate	3%	2%	2%	3%	3%	4%		0%	0%	0%	0%	0%	0%
Government and others	21%	23%	30%	11%	12%	11%		6%	5%	13%	0%	0%	1%
Services - fast	1%	1%	1%	1%	2%	2%		0%	0%	0%	0%	0%	0%
Services - slow	1%	1%	1%	1%	1%	1%		0%	0%	0%	0%	0%	0%
Non-comparable imports	0%	0%	0%	0%	0%	0%		20%	14%	14%	16%	14%	12%
Manufacturing	*52%*	*51%*	*45%*	*58%*	*57%*	*57%*		*64%*	*58%*	*56%*	*74%*	*74%*	*76%*
Non-manufacturing	*48%*	*49%*	*55%*	*42%*	*43%*	*43%*		*36%*	*42%*	*44%*	*26%*	*26%*	*24%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.

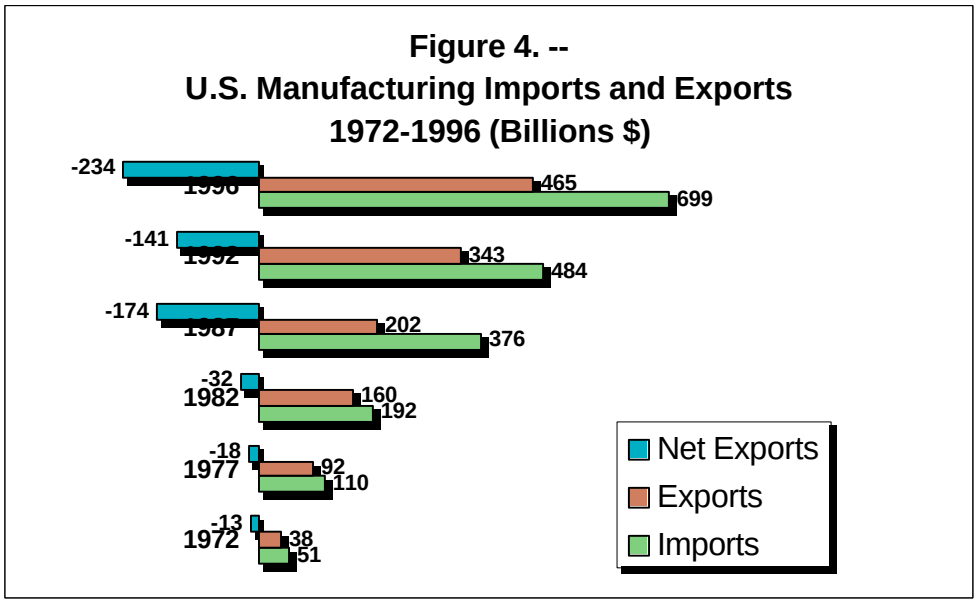
Note: The average multipliers are weighted average using industry outputs as weights.



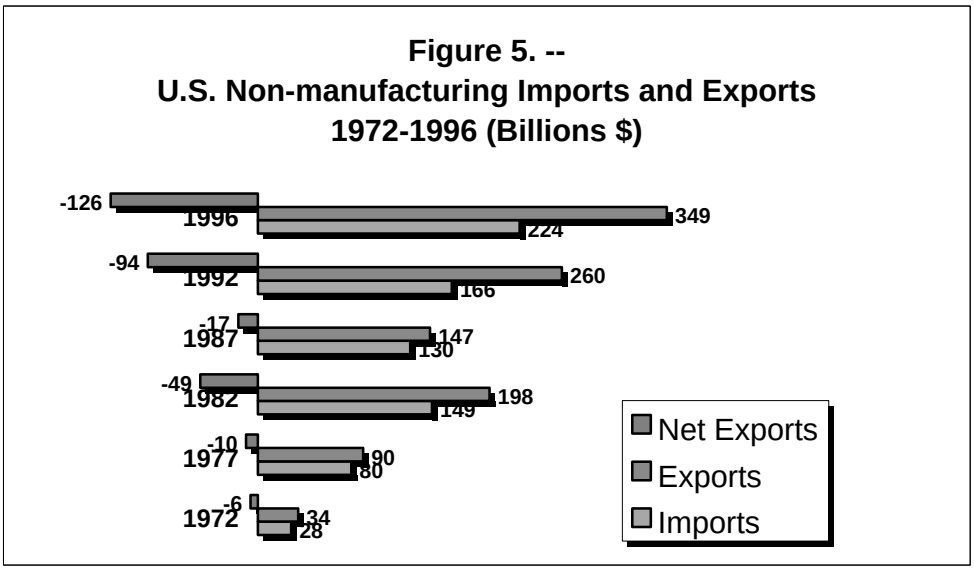
Sources:
For current GDP: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.
For REAL GDP, see Sherlene Lum et al., 2000.



Source: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.



Source: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.



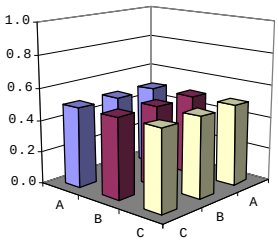
Source: U.S. input-output tables, 1972, 1977, 1982, 187, 1992, and 1996. Bureau of Economic Analysis, U.S. Department of Commerce.

Figure 6. Examples of MPM

	Total requirements matrix			
	A	B	C	FL
A	1.5	0	0	1.5
B	0	1.5	0	1.5
C	0	0	1.5	1.5
BL	1.5	1.5	1.5	4.5

	MPM			
	A	B	C	FL
A	0.50	0.50	0.50	1.5
B	0.50	0.50	0.50	1.5
C	0.50	0.50	0.50	1.5
BL	1.5	1.5	1.5	4.5

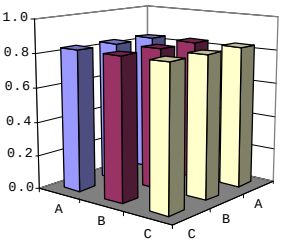
Example 1.



	Total requirements matrix			
	A	B	C	FL
A	1.5	0.5	0.5	2.5
B	0.5	1.5	0.5	2.5
C	0.5	0.5	1.5	2.5
BL	2.5	2.5	2.5	7.5

MPM				
	A	B	C	FL
A	0.83	0.83	0.83	2.5
B	0.83	0.83	0.83	2.5
C	0.83	0.83	0.83	2.5
BL	2.5	2.5	2.5	7.5

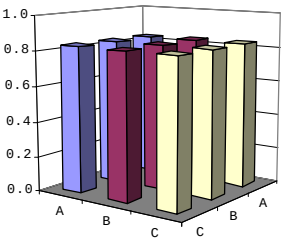
Example 2.



	Total requirements matrix			
	A	B	C	FL
A	2	0.25	0.25	2.5
B	0.25	2	0.25	2.5
C	0.25	0.25	2	2.5
BL	2.5	2.5	2.5	7.5

MPM				
	A	B	C	FL
A	0.83	0.83	0.83	2.5
B	0.83	0.83	0.83	2.5
C	0.83	0.83	0.83	2.5
BL	2.5	2.5	2.5	7.5

Example 3.



	Total requirements matrix			
	A	B	C	FL
A	1.7	0.7	0.5	2.9
B	0.5	1.7	0.4	2.6
C	0.4	0.1	1.5	2
BL	2.6	2.5	2.4	7.5

MPM				
	A	B	C	FL
A	1.01	0.97	0.93	2.9
B	0.90	0.87	0.83	2.6
C	0.69	0.67	0.64	2
BL	2.6	2.5	2.4	7.5

BL: Backward Linkage
FL: Forward Linkage

Example 4.

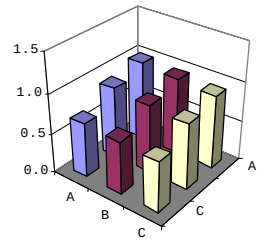
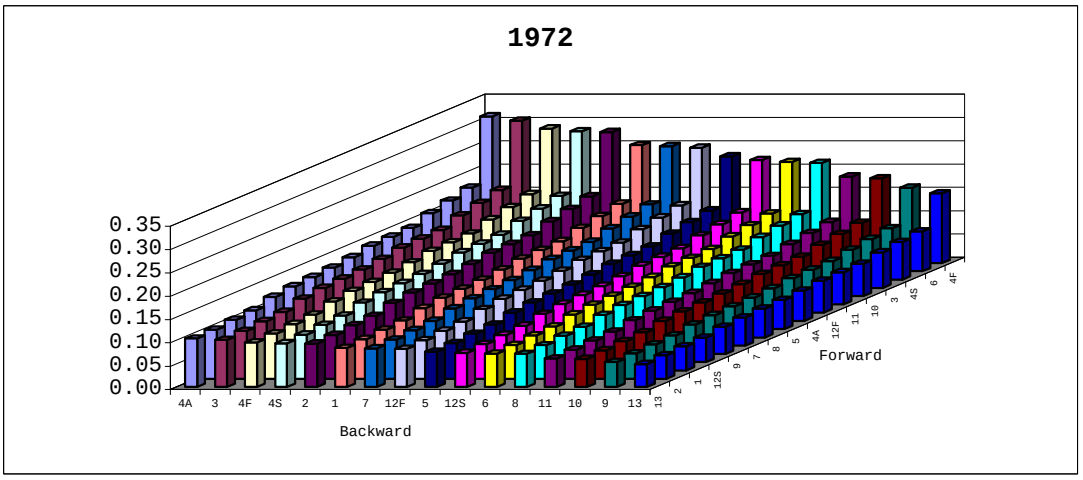
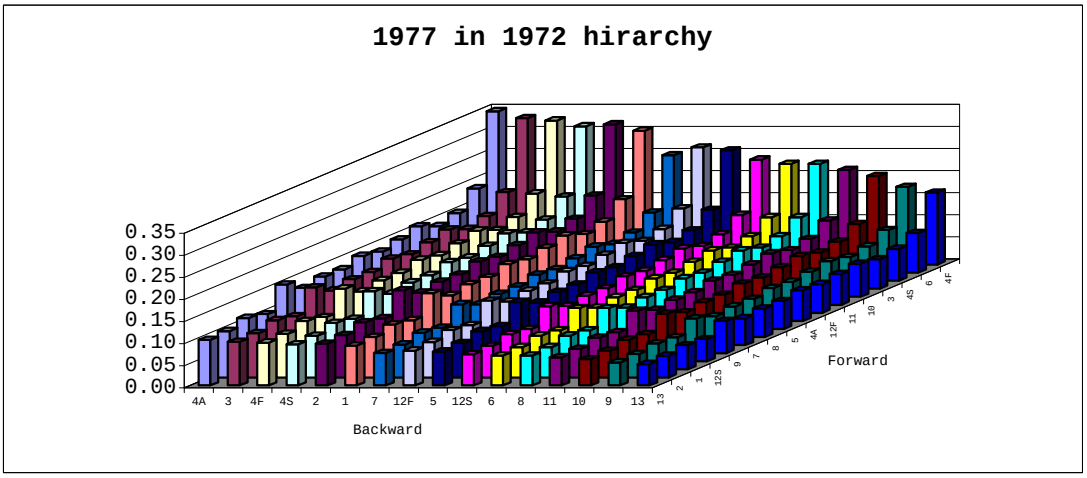


Figure 7. -- Total Multiplier Landscapes





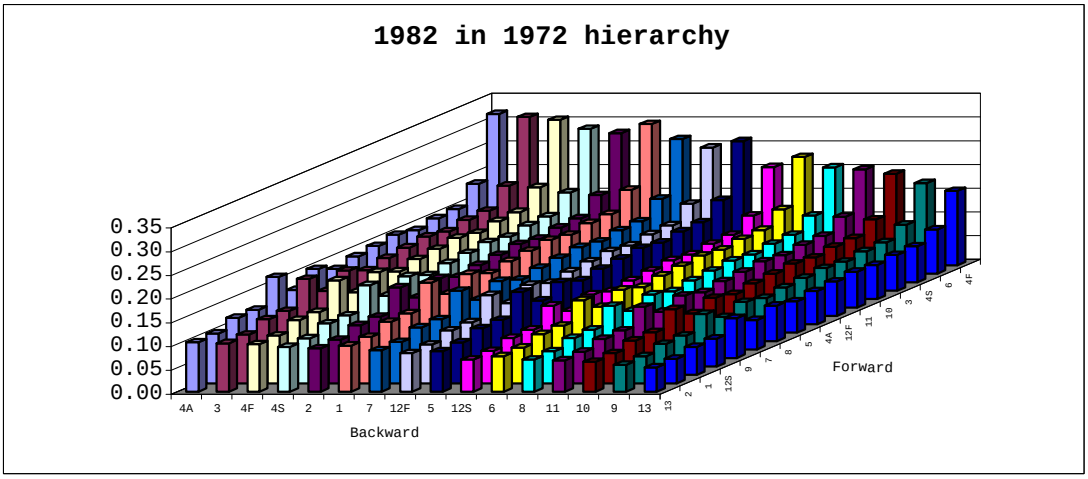
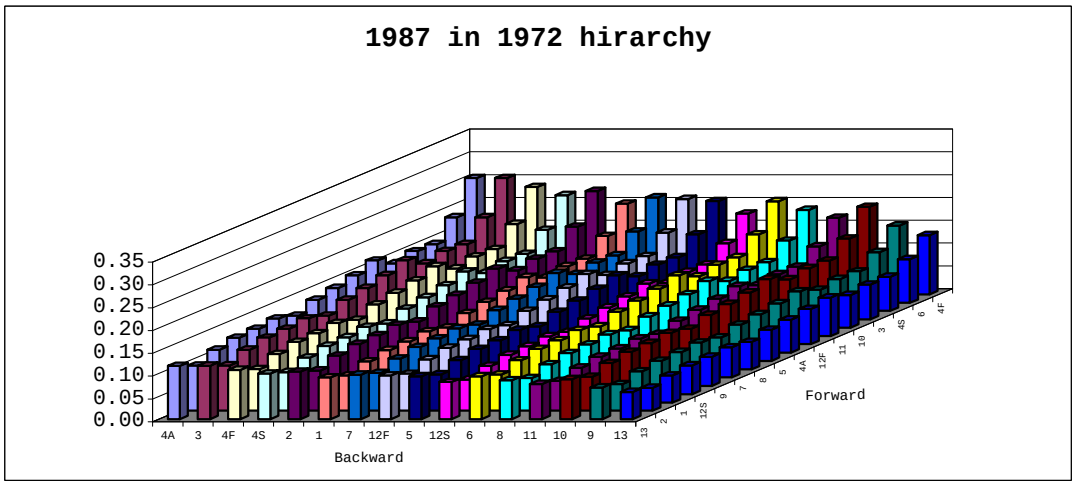
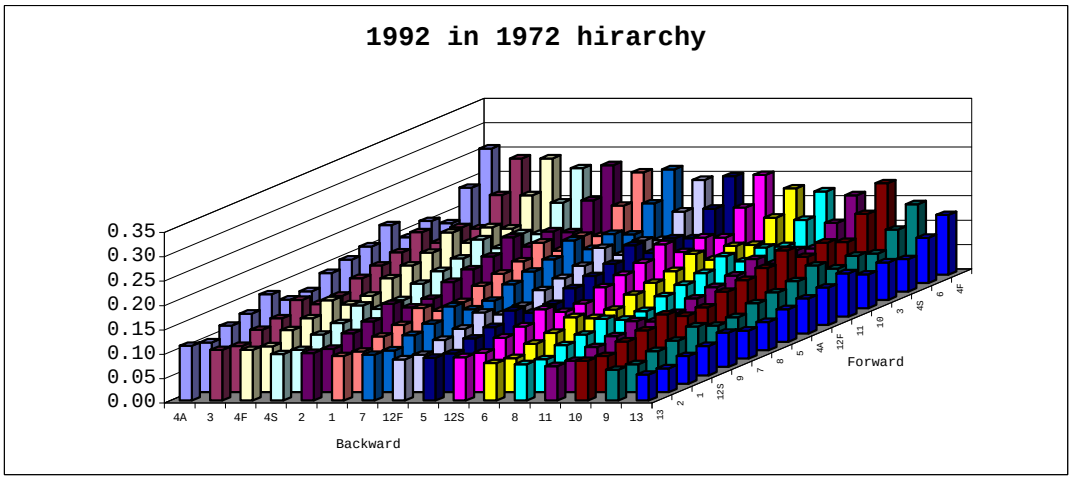


Figure 7. -- Total Multiplier Landscapes (Cont.)





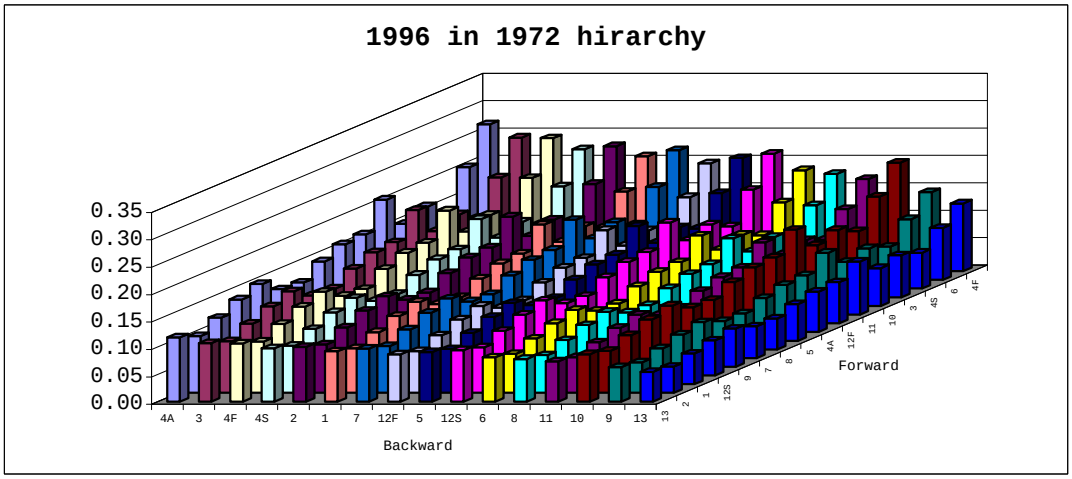


Figure 8. -- Domestic Multiplier Landscapes

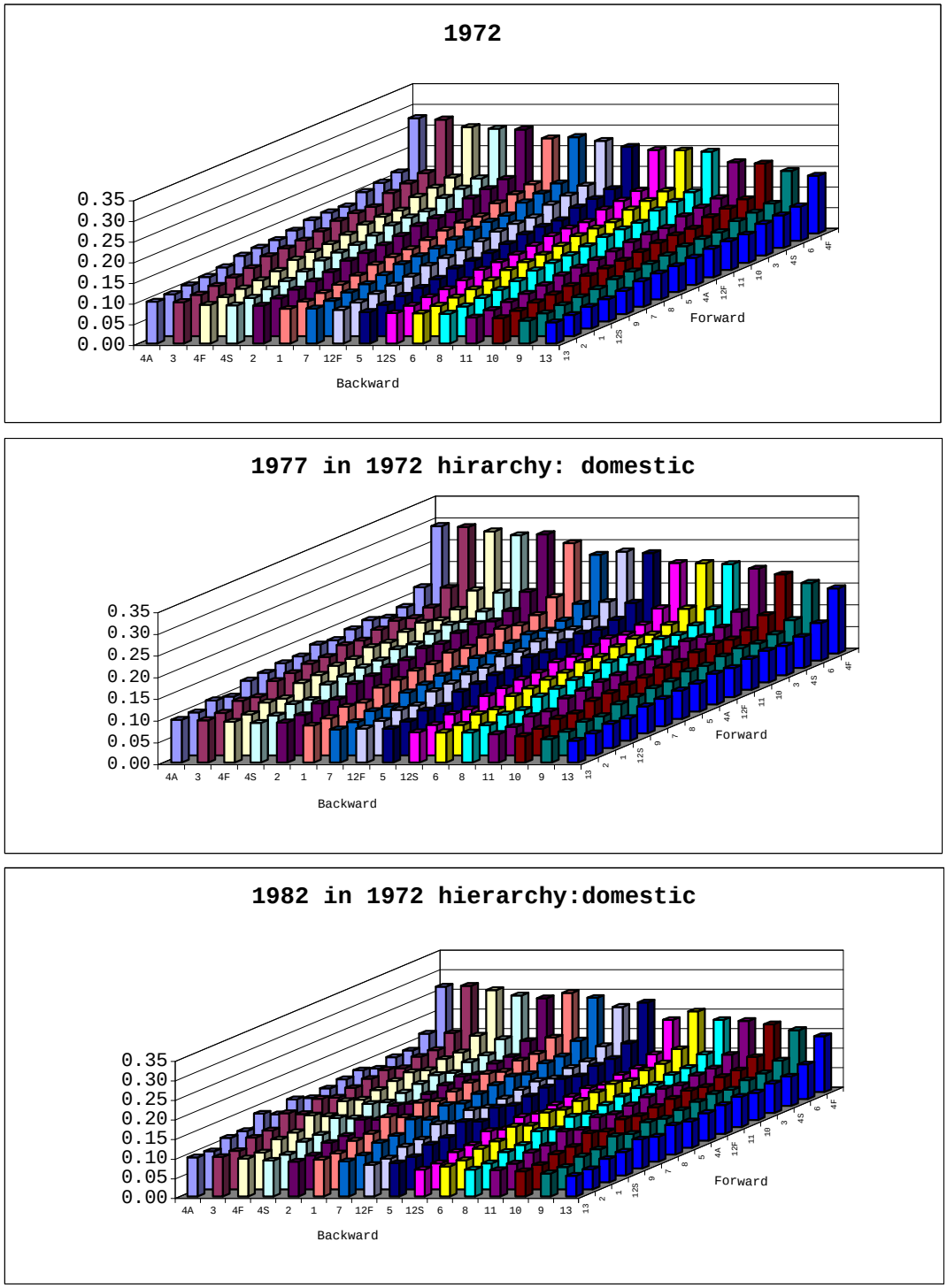
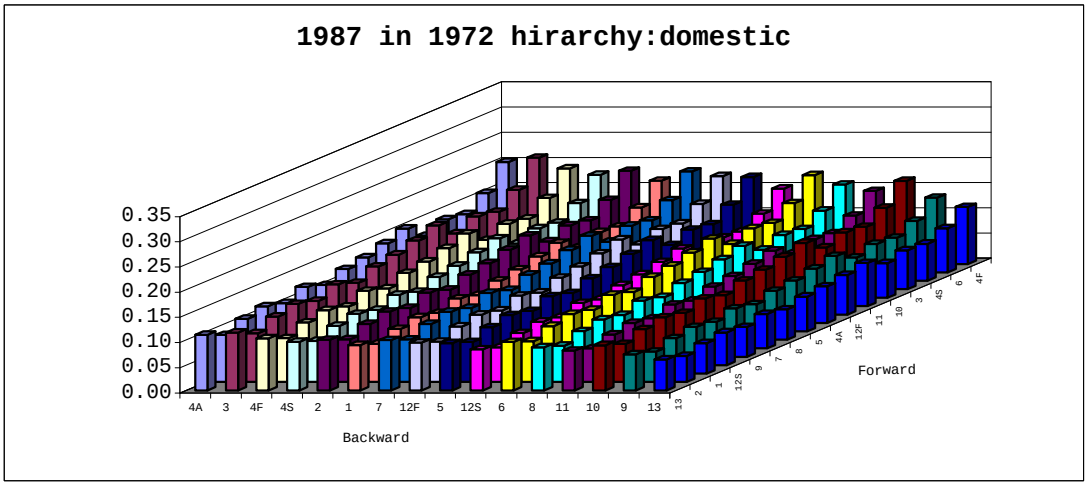
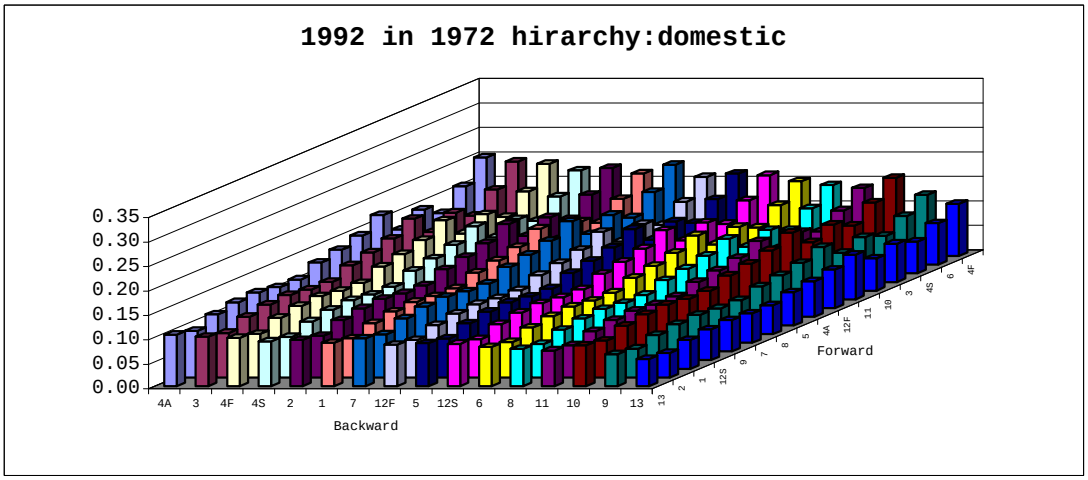


Figure 8. -- Domestic Multiplier Landscapes (Cont.)





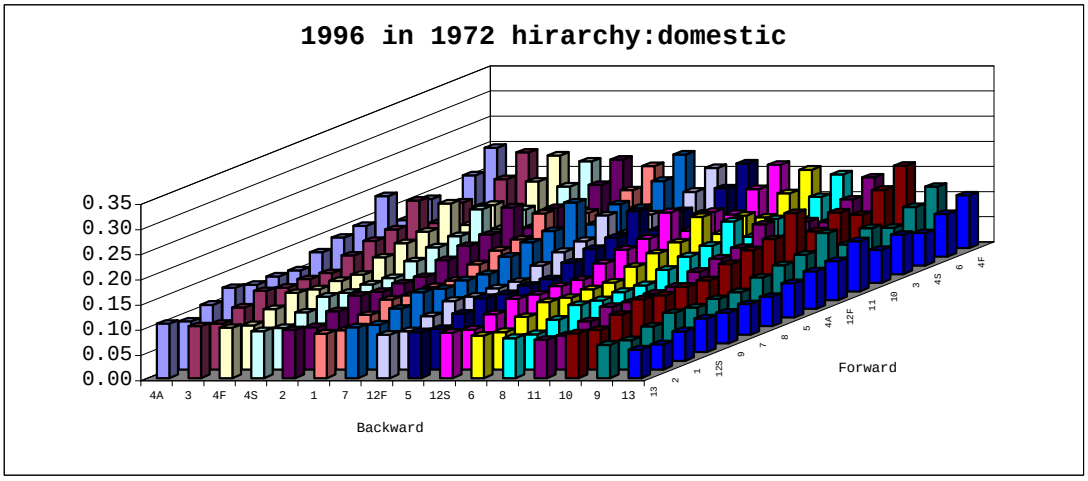


Figure 9. -- Import Leakage Landscapes

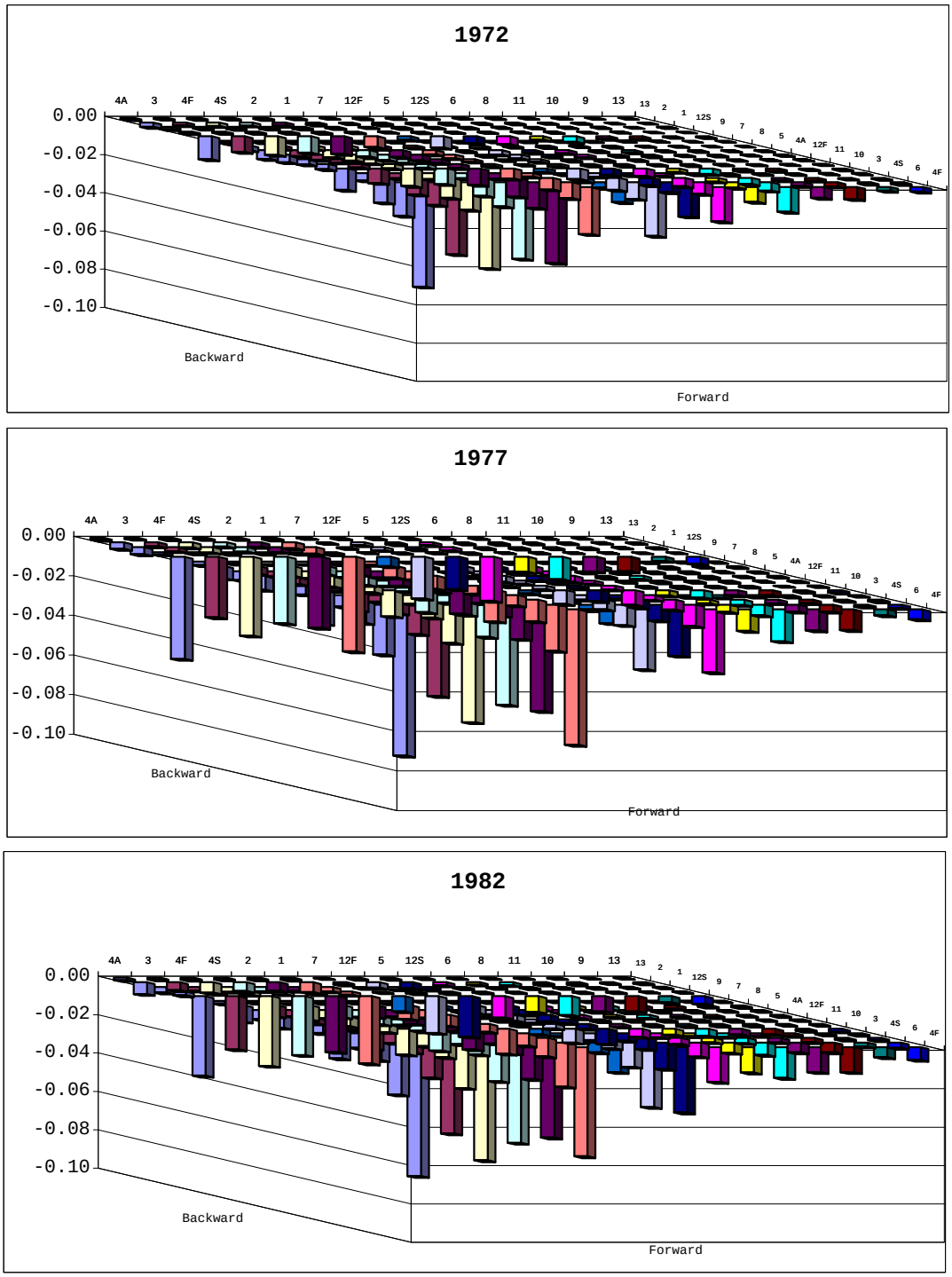
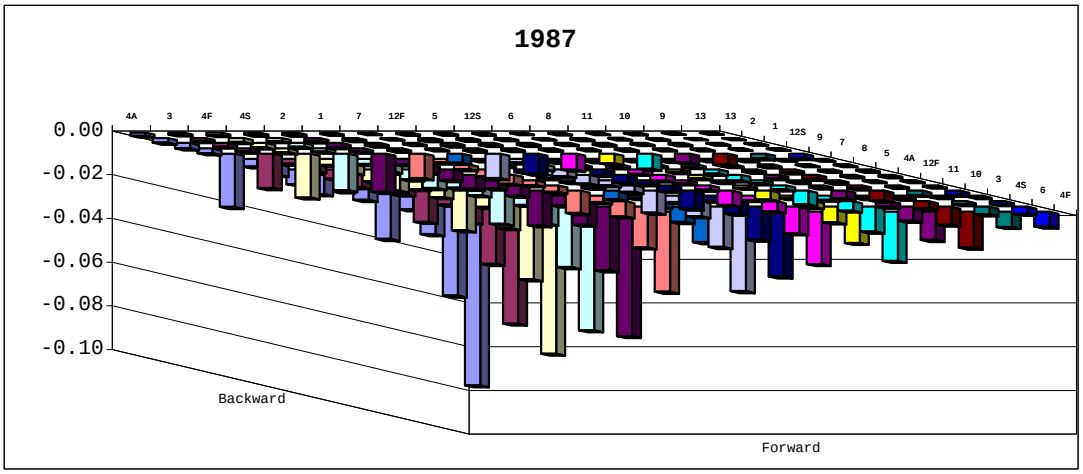
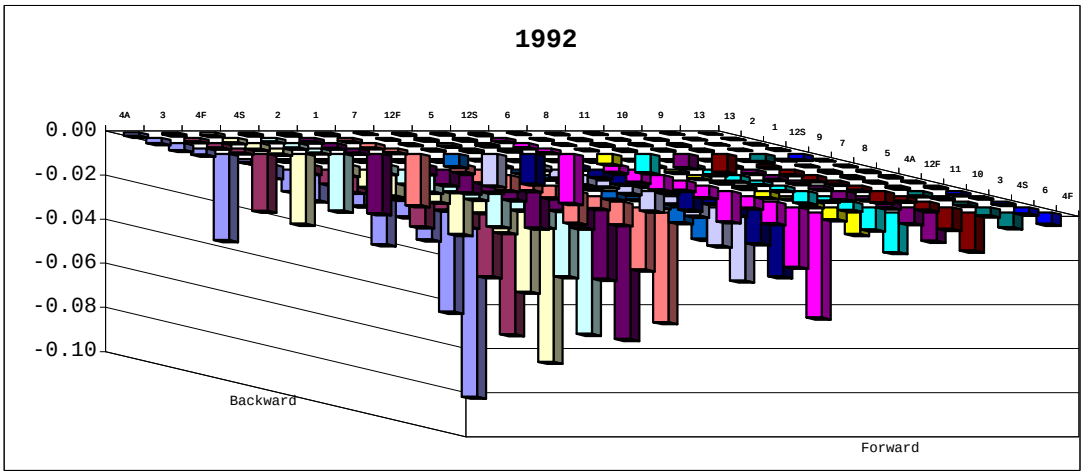
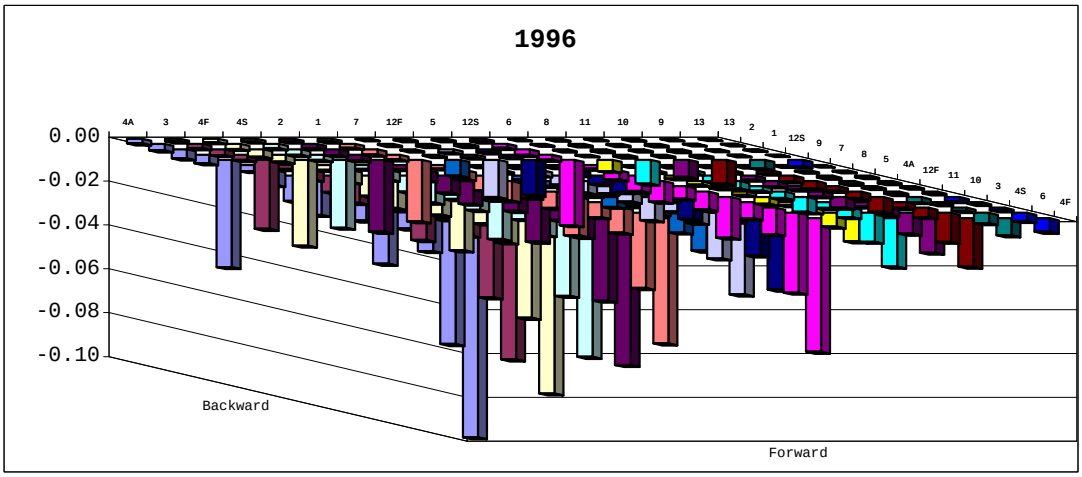


Figure 9. -- Import Leakage Landscapes (Cont.)







Appendix

Comparability of Input-Output tables

The changes in the structure of the U.S. economy identified in this study use benchmark input-output (I-O) tables for 1972, 1977, 1982, 1987 and 1992 and the 1996 annual input-output table. Benchmark I-O tables, each based on a census of the U.S. economy, provide a unique measure of the structure of the economy at specific points in time. The annual table, though not of the same statistical quality as the benchmark tables, is included to provide an indicator of changes that may be occurring near the present time.

The I-O tables provide a unique measure of the U.S. economy because each is developed independently, from the ground up, following a four step process: develop the classification structure for the table, develop the definitions for the table, estimate industry and commodity output and finally, estimate inputs to industries. Each benchmark I-O table is unique with regard to classification, definitions and source data. This uniqueness, while presenting the best picture of the economy for the year studied, makes comparisons across time periods more difficult. For each of these unique features we have attempted to either eliminate the differences, modify the tables to make them compatible, or where changes were not possible, to note the possible impact of the differences on our study.

Classification: The classification structure of the table, the industries and commodities in the table and their definitions, are based on the U.S. Standard Industrial Classification (SIC) and the source data available for constructing the table. The SIC's are grouped to I-O industries, the industries for which inputs and outputs are estimated, based on the uniqueness of the input structure and the availability of source data. The benchmark tables were prepared at the most detailed level that source data enable. The number of industries included in each table is shown in table A1. The SIC is revised periodically to present an industrial classification system that best represents the current makeup of the

U.S. economy. Over the period covered this study the SIC was revised three times: 1977, 1982 and 1987.

The classification structure of the I-O table, in particular, the detail of industries, is also dependent on the level of detail and the quality of data available on industries. A majority of the data used to construct the I-O tables is collected in the U.S. quinquennial economic censuses. Over the 1972-1992 period the coverage of industries by the censuses has been greatly expanded in terms of the number and groups of industries included and the data collected on industry inputs and outputs (see table A1). This expansion has improved the content and quality of data available for the construction of the input-output tables, and has significantly improved the quality of the estimates.

The SIC was revised in 1977, 1982 and 1987, however, the assignments of SIC's into I-O industries has been kept relatively consistent over the period and through aggregation achieve a set of tables that are consistent with regard to industry definition. To make comparisons across time feasible and to insure comparability, industries and commodities were aggregated to a common summary level. Working from detailed data from each I-O table we were able to develop a set of summary industries and commodities that are consistent for the period. A list of these industries is included in table A2.

Definitions: The benchmark I-O tables follow the national accounts definitions in place for the year of the table being produced. These definitions determine how industry output, intermediate inputs and final uses are measured. National accounts definitions are revised approximately every five years to better measure the evolving U.S. economy. Because each benchmark table is developed following a different set of definitions comparability may be affected. Most of the national accounts definitional revisions affect final uses or value added and not the measures of gross output and intermediate consumption.

With the exception of the latest national accounts definitional revisions, most revisions did not significantly impact measures of gross output or intermediate inputs and did not affect our comparisons. However the latest benchmark revisions included the capitalization of software that moved software from intermediate to final uses and an imputation for the production of own-account software.[14] This revision was incorporated into the published 1996 annual I-O. For this study, in order to make intermediate consumption comparable between tables, the 1996 I-O table was modified to treat software as an intermediate input and to exclude the imputation for own-account software.

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Source data: A large proportion of the data used in the I-O tables is collected in the U.S. quinquennial economic censuses. Over the 1972-1992 period the coverage of industries by the censuses has been greatly expanded in terms of the types of industries included and the data collected on industry inputs and outputs. This expansion has affected the content and quality of data available for the development of the input-output tables, but have an unknown impact on our comparisons.

Information on inputs to industries is generally from the economic censuses, but is not as complete as our information on output by industries. Manufacturing industry inputs generally are based on economic census data. Expansion of the economic census to most industries and significant improvements the data collected on industry inputs has greatly improved the quality of input estimates (see table A2). Where statistical data on inputs are not available BEA economists research industries and commodities to develop the most reasonable estimates of the use of commodities by industries. For this type of research greater disaggregation of industries and commodities improves the ability to estimate the inputs to industries.

[14] Brent R. Moulton, Robert P. Parker, and Eugene P. Seskin, "A Preview of the 1999 Comprehensive Revision of the National Income and Product Accounts: Definitional and Classificational Changes," Survey 79 (August 1999): 7-20.

An increase in the number of industries covered by the censuses affects the estimates of intermediate consumption in several ways. First, the increased number of industries provides more information regarding the type of industrial activity and the likely types of commodities consumed. Second, increased information on the commodities produced improves our ability to estimate the use of these commodities. For example, the census coverage of miscellaneous professional services in 1977 expanded the number of commodities to include three new commodities: legal services, engineering, architectural and surveying services and accounting, auditing and bookkeeping and miscellaneous services, n.e.c. With this additional information on commodities, I-O analysts were able to improve their estimates of the distribution of these services to industries. Third, expanded census coverage of business expenses has improved the estimates of intermediate inputs. These changes to source data used to estimate inputs have significantly improved the I-O estimates, however, it is not possible to estimate the impact of these changes on our comparisons.

Preparation of Domestic and Import Use Tables

To evaluate the changes in domestic linkages it was necessary to separate the use of commodities by industries between those from domestic versus those from foreign sources. Since statistical data is not available on the sources of inputs, it was necessary to estimate the use of imports. To make these estimates it was assumed that the import share of any industry's use of a commodity was proportional to the ratio of the commodity's total imports to the domestic supply of that commodity. The share is equal to imports divided by the sum of domestic output plus imports less exports.

For each table, at the most detailed level, import shares were calculated for each commodity and applied to the use of commodities by industries to obtain the import use table. The domestic use table was derived by subtracting the import use table from the standard use table. The import and domestic use tables were then aggregated to the summary level of detail used for this study.

Table A1.BBenchmark Input-Output Table Industries and Source Data

Benchmark I-O Year	**Number of Industries**	**Major changes in source data**
1972	496 industries	Mining, construction, manufacturing wholesale trade, retail trade, parts of transportation and parts of services (repair, personal services, business services)
1977	537 industries	Census expansion of the census of service industries including personal and repair services, business services, professional services, automobile repair and services, amusement and recreation services, other medical services, educational services, nonprofit organizations. Improved information on purchased services by industries
1982	541 industries	Expanded census of services to include hospitals
1987	483 industries	
1992	498 industries	Census includes finance, insurance and real estate, transportation, communication and utilities Census expansion of information collected on purchased services by all industries

Table A2. --Classification of Industries

[The number to the right of the major industry group headings is the I-O code used for the aggregated tables used in this study. An asterisk preceding a Standard Industrial Classification (SIC) code indicates that the SIC industry is included in more than one I-O industry.]

I-O number	I-O title	Related 1987 SIC codes
AGRICULTURE, FORESTRY, AND FISHERIES (1)		
01	Livestock and livestock products	*01, *02
02	Other agricultural products	*01, *02
03+04	Agricultural, forestry and fishery products and services	081, 083, 091, 097, 0254, *0279, 071, 072, 075, 076, 078, 085, 092
MINING (2)		
05+06	Metallic ores mining	101-6, *108, 109
07	Coal mining	121-3, *124
08	Crude petroleum and natural gas	131, 132, *138
09+10	Nonmetallic minerals mining	141-7, *148, 149
CONSTRUCTION (3)		
11	New construction including own-account construction	*108, *124, *138, *148, *15, *16, *17, 6552
12	Maintenance and repair construction including own-account construction	*138, *15, *16, *17
MANUFACTURING AVERAGE GROWTH RATE (4a)		
20+21	Lumber and wood products	24
27A	Industrial and other chemicals	281, 286, 289
40	Heating, plumbing, and fabricated structural metal products	343, 344
47	Metalworking machinery and equipment	354
49	General industrial machinery and equipment	356
58	Miscellaneous electrical machinery and supplies	369
MANUFACTURING: FAST GROWTH RATE (4f)		
15	Tobacco products	21
19	Miscellaneous fabricated textile products	239
22+23	Furniture and fixtures	25
24	Paper and allied products, except containers	261, 262, 263, 267
26A	Newspapers and periodicals	271, 272
26B	Other printing and publishing	273-9
27B	Agricultural fertilizers and chemicals	287
28	Plastics and synthetic materials	282
29A	Drugs	283
29B	Cleaning and toilet preparations	284
30	Paints and allied products	285
32+33+34	Rubber and miscellaneous plastics products footwear, leather, and leather products	30, 31
48	Special industry machinery and equipment	355

I-O number	I-O title	Related 1987 SIC codes
50	Miscellaneous machinery, except electrical	359
57	Electronic components and accessories	367
60	Aircraft and parts	372, 3764, 3769
62	Scientific and controlling instruments	381, 382, 384, 387
64	Miscellaneous manufacturing	39
MANUFACTURING: SLOW GROWTH RATE (4s)		
13	Ordnance and accessories	348, 3761, 3795
14	Food and kindred products	20
16	Broad and narrow fabrics, yarn and thread mills	221-4, *226, 228
17	Miscellaneous textile goods and floor coverings	227, 229
18	Apparel	225, 231-8
25	Paperboard containers and boxes	265
31	Petroleum refining and related products	29
35	Glass and glass products	321-3
36	Stone and clay products	324-9
37	Primary iron and steel manufacturing	331, 332, 339, 3462
38	Primary nonferrous metals manufacturing	333-6, 3463
39+42	Metal containers, other fabricated metal products	341, 342, 347, 349
41	Screw machine products and stamping	345, 3465-9
43	Engines and turbines	351
44+45+46	Farm, construction, and mining machinery, materials handling machinery and equipment	352, 3531-7
51	Computer and office equipment	357
52	Service industry machinery	358
53	Electrical industrial equipment and apparatus	361, 362
54	Household appliances	363
55	Electric lighting and wiring equipment	364
56	Audio, video, and communication equipment	365, 366
59A	Motor vehicles (passenger cars and trucks)	3711
59B	Truck and bus bodies, trailers, and motor vehicles parts	3713-5
61	Other transportation equipment	3716, 373-5, 3792, 3799
63	Ophthalmic and photographic equipment	385, 386
TRANSPORTATION (5)		
65A	Railroads and related services; passenger ground transportation	40, 41, 474
65B	Motor freight transportation and warehousing	42
65C	Water transportation	44
65D	Air transportation	45
65E	Pipelines, freight forwarders, and related services	46, 472, 473, 478
COMMUNICATION (6)		
66	Communications, except radio and TV	481, 482, 484, 489
67	Radio and TV broadcasting	483
UTILITIES (7)		
68A	Electric services (utilities)	491, 4931

I-O number	I-O title	Related 1987 SIC codes
68B	Gas production and distribution (utilities)	492, 4932, 4939
68C	Water and sanitary services	494-7
WHOLESALE AND RETAIL TRADE (8)		
69A	Wholesale trade	50, 51
69B	Retail trade	52-7, 59
FINANCE (9)		
70A	Finance	60-2, 67 (excluding 6732)
INSURANCE (10)		
70B	Insurance	63, 64
REAL ESTATE (11)		
71A	Owner-occupied dwellings	
71B	Real estate and royalties	65 (excluding 6552)
SERVICES: FAST GROWTH RATE (12f)		
72A	Hotels and lodging places	70
73A+73C	Computer and data processing services, Other business and professional services, except medical	732-8, 769, 8731, 8732, 8734, 874
73D	Advertising	731
76	Amusements	78, 79
77A	Health services	074, 80
SERVICES: SLOW GROWTH RATE (12s)		
72B	Personal and repair services (except auto)	72, 762-4
73B	Legal, engineering, accounting, and related services	81, 871, 872, 89
74	Eating and drinking places	58
75	Automotive repair and services	75
77B	Educational and social services, and membership organizations	6732, 82-4, 86, 8733
SPECIAL INDUSTRIES (13)		
78	Federal Government enterprises	/1/
79	State and local government enterprises	/1/
80	Noncomparable imports	/2/
81	Scrap, used and secondhand goods	/3/
82	General government industry	/4/
83	Rest of the world adjustment to final uses	/5/
84	Household industry	/6/
85	Inventory valuation adjustment	/7/

1. The SIC assigns codes to activities regardless of whether the establishment is owned by private firms or government agency. In the I-O accounts, SIC codes are used only to classify private activities.
2. Noncomparable imports include imported services that are not commercially produced in the United States, and goods and services that are produced abroad and used abroad by U.S. residents--for example, U.S. Federal Government defense spending abroad.
3. Scrap is a secondary product of many industries, and used goods are sales and purchases typically between final uses. Industry output is zero because there is no primary producing industry. The sales are shown as negative values in the use table.
4. Industry output is defined as the compensation of employees and consumption of fixed capital of general government agencies. The compensation of employees engaged in construction work is

included in construction. The compensation of employees engaged in the production of own-account software is included in computer and data processing services

5. The commodity entries include adjustments among PCE and government expenditures to eliminate counting the expenditures by foreign residents in both exports and PCE or government expenditures.
6. Industry output is defined as the compensation of domestic household workers.
7. The inventory valuation adjustment removes inventory profits and losses from business income.