

# The Evolving External Orientation of Manufacturing: A Profile of Four Countries

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Changes in exchange rates, shifts in trade policy, and other international developments can significantly influence the profitability and performance of a country's manufacturing industries. To understand and measure the exposure of domestic manufacturing industries to international events, one must first examine the channels that transmit such shocks to production activity and, ultimately, to the economy as a whole. Capturing a country's industrial reliance on international markets—which we refer to as the “external orientation” of its industries—involves measuring the extent to which manufacturers sell products to foreign markets, use foreign-made inputs, and, more indirectly, compete with foreign manufacturers in domestic markets through imports.

The growing internationalization of the production process and trade means that no single measure can capture the importance of the world economy to a given industry. Today, the most widely used indicator of an industry's exposure to world events is its “openness to

trade,” typically calculated as import plus export revenues of final products divided by domestic production revenues. This measure has been used extensively in studies addressing industry exposure to external shocks such as exchange rate movements and trade policies.

Although the openness to trade measure is useful in some contexts (for example, in understanding the reasons for growth in world trade),<sup>1</sup> it can be misleading because it fails to consider the growing use of foreign inputs in the manufacture of domestic goods. To some degree, the use of foreign inputs in domestic production works to offset the revenue exposure to foreign shocks that arises because of a manufacturer's dependence on foreign sales and the presence of import competition. Consider, for example, a shoe manufacturer in the United States that imports and exports small amounts of its finished product. Such a company would appear to have limited openness to trade. Suppose, however, that the same manufacturer relies heavily on imported leather as an input in production. An appreciation of the U.S. dollar would likely lead to a drop in the price of the imported leather

used by the manufacturer and consequently an increase in profitability. The openness to trade measure would capture only the negative effect of the rising dollar on the manufacturer's profitability. Clearly, a broader assessment of industrial external orientation will prove informative to policymakers and economists seeking to understand the effects of external shocks on particular manufacturing industries.

This article presents four measures of external orientation using industry-specific and time-varying data for manufacturing industries in four countries—the United States, Canada, the United Kingdom, and Japan. For each of these countries, we report export revenue share, imports relative to consumption, and imported input share in production of all manufacturing industries identified by two digits in the Standard Industrial Classification system. We also report an overall measure, net external orientation, defined as the difference between industry export share and imported input share in production.<sup>2</sup> We present approximately twenty years of data for the industries in each country from the early 1970s to the mid-1990s.

Our discussion of the data and methodology used in constructing the external orientation measures is followed by country-specific histories of the export share, import share, imported input share, and net external orientation of each manufacturing industry. The country sections are followed by cross-country comparisons of industry trends in external orientation. The results we present are useful for predicting how particular international shocks will influence manufacturing industries over time.

#### MEASURES OF EXTERNAL ORIENTATION

The first of our four measures of external orientation is export share, the ratio of industry export revenues to industry shipments ( $\chi_i$ ). This measure captures the portion of a producer's revenues that is generated in foreign markets. Manufacturers with high export shares are likely to have total revenues that are more sensitive to international shocks than producers with low export shares. Our second measure, import share, or the ratio of imports to consumption ( $M_i$ ), captures foreign penetration in a particular industry. Reve-

nues are also likely to be more sensitive to international shocks when there is a high degree of foreign penetration in domestic markets. Thus, a manufacturer in an industry with a high ratio of imports to consumption may experience a larger change in its ability to compete in local markets—and have domestic revenues that are more vulnerable to an external shock. We construct the series for export share and import share by using industry sales, consumption, and trade data from country sources (see the appendix for data sources).

Imported input share—imported inputs as a share of the value of production ( $\alpha_i$ )—is our third measure.

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Because data on imported inputs are not available from country sources, we construct this series by combining industry import data with country input-output data that describe the expenditures on different categories of inputs by each manufacturing industry in each country (see box). In contrast to the other two measures, which provide guidance on the vulnerability of producer revenues to international forces, the imported input share measure provides a window into the potential sensitivity of a producer to shocks experienced through the cost side of its balance sheet. A manufacturer that relies very heavily on imported inputs will likely be more exposed to international shocks through costs than a producer that relies mostly on domestically produced inputs. Nevertheless, since revenue and cost exposures can offset each other, thereby smoothing the effects of external shocks on producer profits, a manufacturer with high imported input share will not necessarily have greater net exposure to international shocks than a producer with low imported input share.

Finally, we present a measure of net external orientation, defined as the difference between industry export share and imported input share ( $\chi_i - \alpha_i$ ). An industry with positive net external orientation has a larger export share than imported input share. An industry with negative net external orientation has a greater imported input share than export share. This net measure is more indicative of the direction of an industry's exposure to an international shock than any other single measure. However, net external orientation does not provide a reliable measure of the degree of industry exposure to international events. To arrive at such a measure, observers should utilize, but not rely exclusively on, our measures of external orientation. Each type of shock can be expected to elicit different types of industry or market adjustments. Moreover, in some instances, export revenue sensitivity to a particular type of shock may differ

from imported input cost sensitivity to the same shock. These sensitivities may also vary across industries and according to the particular type of imported inputs used in each industry's production.

We present the measures of external orientation from the early 1970s to the mid-1990s for all two-digit Standard Industrial Classification manufacturing industries in the United States, Canada, the United Kingdom, and Japan.<sup>3</sup> The industries examined—approximately twenty for each country—represent most manufacturing production categories, including food, textiles, chemicals, instruments and related products, electrical machinery, and nonelectrical machinery.<sup>4</sup> We identify broad external orientation patterns in industries and changes over time and document our findings in a series of summary tables. These tables show both the level of the individual external

#### CALCULATING IMPORTED INPUT SHARE

Imported inputs as a share of the value of production provide a useful measure of an industry's cost-side external orientation. These data generally are not published by country data sources. To construct the series, we start with data drawn from the production input-output tables for each manufacturing industry of each country. These tables provide detailed information on industry expenditure, within a given year, on each type of final output of all manufacturing (and, in most cases, nonmanufacturing) industries. We then multiply the share of total industry expenditures attributable to specific input categories by the respective import-to-consumption ratios. We sum the resulting data to arrive at a measure of imported inputs in production. The methodology for constructing our imported input share series is based on Campa and Goldberg (1995).

The formula for the imported input share of an industry  $i$  is

$$\alpha_t^i = \frac{\sum_{j=1}^{n-1} m_t^j p_t^j q_{j,t}^i}{VP_t^i},$$

where  $i$  = index representing the output industry;

$j$  = index representing the production input industry;

$m_t^j$  = share of imports in consumption of industry  $j$  in period  $t$ ;

$p_t^j q_{j,t}^i$  = value of inputs from industry  $j$  used in the production of industry  $i$  in period  $t$ .

$VP_t^i$  = value of total production cost of industry  $i$  in period  $t$ ; and

$n$  = total number of product input categories. The  $n$ th input is labor.

The appendix describes the specific data sources and the features of the data used for the four countries. The imported input share series is useful for comparing industries within a particular country. The constructed series is not fully comparable across countries, however. Two important reasons exist for cross-country differences. First, for Canada and Japan, the measure includes imported inputs from agriculture, raw materials, and manufacturing. By contrast, for the United States and the United Kingdom the measure includes only manufacturing inputs. Second, the denominator, which represents the value of total production, differs across countries because of data availability.

orientation series for select years and the similarities over time in the ranking of industries according to particular measures. The evolution of each external orientation measure for each industry is shown in Charts A1-A12 in the appendix.

The similarities or differences in external orientation of industries over time, or at points in time across countries, are captured using Spearman rank correlation statistics. These statistics measure the correlation between two variables on the basis of the ordinal positions of the variables without explicitly adjusting for differences in their levels. For example, we use Spearman rank correlations to determine whether those industries with the highest export shares in the 1970s remained the most export-oriented industries across the 1980s and 1990s. Using data for specific years, we rank industries from low to high, according to the size of their export shares. The industry rankings are then correlated with each other across two different years. If the resulting Spearman rank correlation statistic is high and positive, then the industries that are relatively more focused on exports in one year are also the industries that are relatively export-oriented in the other year. Likewise, those industries that do not rely heavily on exports are the same in the different years.

Five key conclusions result from our analysis of industry external orientation:

1. In all the countries except Japan, the *levels* of three measures of external orientation of manufacturing industries—export share, import share, and imported input share—have increased considerably in the last two decades. The external orientation of industries in Canada and the United Kingdom is considerably higher than in the United States and Japan.
2. The *relative rankings* of manufacturing industries in terms of export share, import share, and imported input share have been very stable over time in each country. In other words, an industry with higher export share than other industries in the early 1970s remained relatively export-oriented into the mid-1990s. Similarly, industries with relatively high import share or imported input use in the early 1970s remained relatively dependent on imports and imported inputs through the mid-1990s.
3. Significant changes over time and differences across countries are evident in the *net* external ori-

entation of industries. In the U.S. industries, levels of net external orientation shifted dramatically between the early 1980s and the early 1990s. By contrast, in Japan the net external orientation of industries has been very stable over the past two decades.

4. Export share tends to be high in the same industries—electrical machinery, nonelectrical machinery, transportation equipment, and instruments and related products—across the four countries. The main difference in industry export orientation is one of degree: while Canadian, U.K., and U.S. exports are produced by a broader range of manufacturing industries, most of Japan's exports are generated by the small subset of industries that export a very high percentage of their output.
5. Unlike export share rankings, the import share and imported input share rankings of industries are not highly correlated across countries. By the mid-1990s, only the imported input share rankings of manufacturing industries in the United States and the United Kingdom were positively correlated. Overall, the industries that rely most heavily on imported inputs differ sharply among the four countries.

## U.S. MANUFACTURING INDUSTRIES

All four measures of external orientation indicate that U.S. manufacturing industries have become increasingly integrated with the world economy in the period 1972-95. Despite a brief dip by some industries when the dollar peaked in 1985, the overall export share of U.S. manufacturing roughly doubled, from about 7.5 percent in the early 1970s to 13.4 percent by the mid-1990s (Table 1 and Chart A1). Indeed, in three industries—apparel and other textiles, furniture and fixtures, and leather and leather products—export share more than tripled over the past two decades.

When we compare the rankings of industries by export share at various points during the past two decades, we find that those industries with relatively high export shares in the mid-1970s were still the most export-oriented by the mid-1990s (Table 1, bottom row). Thus, despite the large increases in overall levels of export share across industries, the relative pattern of export orientation among the manufacturing industries in the United States has been very stable over time.

U.S. manufacturing industries have also experienced large expansions in imports as a share of consumption. The increase in the import share of total manufacturing is comparable to the growth in export share. In contrast to the developments in export shares, however, the extent to which import penetration has increased differs greatly across industries. In several industries, import share has risen to more than 20 percent of domestic consumption (that is, in apparel and other textiles, leather and leather products, industrial machinery and equipment, electronic and other electric equipment, transportation equipment, and instruments and related products). By contrast, import shares remain below 10 percent of U.S. consumption in seven of the twenty manufacturing industries (food and kindred products; tobacco products; textile mill

products; printing and publishing; petroleum and coal products; stone, clay, and glass products; and fabricated metal products). By and large, the same industries maintained a relatively high import share from the early 1970s through the mid-1990s (Chart A1). But the difference in the levels of import share across industries with low and high import penetration has significantly widened.

U.S. manufacturing industries have also steadily increased their use of imported inputs in production, on average from about 4 percent in 1975 to more than 8 percent in 1995 (Table 1 and Chart A2). The increase in imported input use across manufacturing was greatest in the first half of the 1980s, when the U.S. dollar dramatically appreciated and reduced the cost of foreign-produced inputs relative to inputs produced domestically. By 1985, imported

Table 1  
EXPORT SHARE, IMPORT SHARE, AND IMPORTED INPUT SHARE OF U.S. MANUFACTURING INDUSTRIES IN SELECTED YEARS

Industry	1975			1985			1995		
	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share
Food and kindred products	3.3	3.7	2.8	3.6	4.3	3.6	5.9	4.2	4.2
Tobacco products	6.9	0.6	1.4	8.1	0.5	1.6	14.9	0.6	2.1
Textile mill products	5.1	4.3	3.0	3.6	7.7	5.4	7.6	9.1	7.3
Apparel and other textiles	2.0	8.5	1.3	1.8	22.4	2.3	7.4	31.4	3.2
Lumber and wood products	7.2	6.9	2.2	5.3	10.5	3.5	7.6	10.3	4.3
Furniture and fixtures	1.3	3.0	3.6	1.6	9.2	5.3	5.5	14.1	5.7
Paper and allied products	5.9	5.9	4.2	4.3	7.1	5.1	9.0	10.0	6.3
Printing and publishing	1.6	1.0	2.7	1.2	1.2	3.0	2.4	1.6	3.5
Chemicals and allied products	10.1	3.6	3.0	11.7	6.5	4.5	15.8	11.0	6.3
Petroleum and coal products	1.7	9.7	6.8	3.1	9.5	6.8	3.9	5.7	5.3
Rubber and miscellaneous products	4.8	4.9	2.7	3.9	6.3	3.9	9.2	12.8	5.3
Leather and leather products	3.9	17.7	5.6	6.1	49.6	15.7	14.4	59.5	20.5
Stone, clay, and glass products	3.4	3.4	2.1	3.4	7.6	3.6	5.6	9.5	4.7
Primary metal products	5.1	9.8	5.0	3.7	16.6	9.2	11.2	17.4	10.6
Fabricated metal products	6.3	3.0	4.7	4.7	5.5	7.8	7.9	8.5	8.7
Industrial machinery and equipment	23.3	6.3	4.1	20.1	13.9	7.2	25.8	27.8	11.0
Electronic and other electric equipment	11.1	8.5	4.5	10.1	17.0	6.7	24.2	32.5	11.6
Transportation equipment	15.8	10.4	6.4	13.0	18.4	10.7	17.8	24.3	15.7
Instruments and related products	16.8	7.4	3.8	15.5	13.7	5.4	21.3	20.1	6.3
Other manufacturing	9.9	13.4	4.6	8.1	35.0	8.5	13.5	41.1	9.9
TOTAL MANUFACTURING	8.4	6.3	4.1	7.9	11.0	6.2	13.4	16.3	8.2
INDUSTRY RANK CORRELATIONS WITH 1975 VALUES	---	---	---	0.901	0.850	0.934	0.765	0.614	0.812

Source: Authors' calculations, based on annual data from U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures*, and U.S. Department of Commerce, Bureau of Economic Analysis, "Benchmark Input-Output Accounts for the U.S. Economy, 1982," *Survey of Current Business*, July 1991.

inputs as a share of total costs in U.S. manufacturing industries had risen to about 6 percent. Even after the dollar depreciated in the second half of the 1980s, the presence of imported inputs continued to increase in the United States. Overall, imported input share has more than doubled in many manufacturing industries over the past two decades.

In the early to mid-1970s, sixteen of the twenty U.S. manufacturing industries registered a positive net external orientation—that is, their export shares exceeded

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their imported input shares (Table 2 and Chart A3). These sixteen industries were responsible for more than 85 percent of all manufacturing shipments. As a result, during this period most discussions of the effect of trade policies and dollar value movements focused on implications for export activity. By the early to mid-1980s, the balance of external orientation had shifted tremendously. In 1985, only eight U.S. manufacturing industries, accounting for slightly more than half of manufacturing shipments, retained a positive

net external orientation. In 1986, only seven industries, which together were responsible for 45 percent of total shipments, had a positive net external orientation (Chart A3).

The pendulum gradually swung back over the course of the late 1980s and early 1990s. In the late 1980s, the growth of export share again exceeded that of imported input share. Today, U.S. manufacturing industries are even more exposed to international shocks through their export market sales than through their imported input use. By 1995, only five of the twenty manufacturing industries recorded negative net external orientation. Once again, industries with positive net external orientation accounted for more than 80 percent of all manufacturing shipments to both domestic and foreign markets.

Despite the relative stability of rankings of the export, import, and imported input shares (indicated by the Spearman rank correlation statistics), the scale of net external orientation for many industries has changed considerably over time in the United States. Net external orientation of manufacturing is a useful instrument for thinking about changes in potential industry exposure to exchange rate movements and other external shocks. The greater the negative net external orientation of an industry, for example, the more likely that a dollar appreciation will improve, rather than worsen, the industry's profitability.

#### CANADIAN MANUFACTURING INDUSTRIES

Canadian manufacturing industries have also greatly increased all channels of external orientation and become

Table 2  
NET EXTERNAL ORIENTATION OVER TIME: THE UNITED STATES

Export Share Exceeds Imported Input Share by:	1975		1985		1995	
	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments
More than 10 percent	2	11.3	2	11.8	4	23.9
5 to 10 percent	5	27.9	2	9.4	1	10.2
0 to 5 percent	9	48.5	4	37.2	10	49.2
0 to -5 percent	3	5.6	10	36.3	4	16.3
-5 to -10 percent	1	6.8	2	5.2	1	0.3
More than -10 percent	0	0.0	0	0.0	0	0.0

Source: Authors' calculations, based on annual data from U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures*, and U.S. Department of Commerce, Bureau of Economic Analysis, "Benchmark Input-Output Accounts for the U.S. Economy, 1982," *Survey of Current Business*, July 1991.

more globally integrated. In the period 1974-93, Canada experienced more changes than any other country in our sample in the actual ranking of sectors according to export shares. By contrast, import share and imported input share rankings have been much more stable (Table 3 and Charts A4 and A5).

In most industries, growth in export share was tremendous. For total manufacturing, export share rose from 23 percent in 1974 to nearly 50 percent in 1993. For two industries, export share rose tenfold: furniture and fixtures grew from 4.6 percent to 49 percent, and chemicals and chemical products expanded from nearly 3 percent to 37 percent. In Canada, most industries that started from low initial export shares tripled or quadrupled their use of export markets between the mid-1970s and mid-1990s. Industries exporting more than 37 percent of their output in the early 1970s generally exported more than

60 percent by the mid-1990s. This shift in export orientation clearly shows that the Canadian economy is more closely linked to the world economy.

The import share for most Canadian manufacturing industries exceeded 10 percent of domestic consumption in the early 1970s (averaging 25 percent of total manufacturing). These figures rose across the board from the mid-1970s to the early 1990s. By the early 1990s, the minimum import penetration of Canadian manufacturing industries was about 20 percent. In most cases, however, an industry's import share was 50 percent or more.<sup>5</sup>

The imported input share of manufacturing industries in Canada has not shifted as dramatically as the shares for the other external orientation channels. Across all manufacturing industries, the average imported input share rose from 16 to 20 percent from 1974 to 1993. Although some industries did experience more rapid increases (for

Table 3  
EXPORT SHARE, IMPORT SHARE, AND IMPORTED INPUT SHARE OF CANADIAN MANUFACTURING INDUSTRIES IN SELECTED YEARS

Industry	1974			1984			1993		
	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share
Food and beverages	8.2	10.3	6.6	8.0	11.0	5.7	18.6	18.4	6.6
Tobacco products	10.2	3.8	6.6	6.4	3.3	5.3	40.0	51.7	9.8
Rubber and plastic industries	6.4	29.0	11.0	16.3	25.6	10.8	34.4	41.9	16.6
Leather industries	4.7	31.3	12.6	6.2	41.3	12.3	22.8	72.4	21.8
Textile industries	6.2	34.2	14.9	9.4	33.5	14.2	25.4	49.3	20.2
Knitting mills	4.2	17.2	17.9	5.9	29.0	17.9	18.8	48.0	21.6
Wood industries	38.1	12.9	3.6	49.7	11.0	3.3	75.2	24.4	4.8
Furniture and fixtures	4.6	13.7	9.7	17.5	14.3	8.1	49.2	51.5	14.2
Paper and allied products	49.5	10.7	4.8	53.4	14.9	5.4	62.6	30.2	10.5
Printing and publishing	2.6	14.1	4.2	4.5	13.1	5.5	6.2	19.6	8.8
Primary metal products	37.2	25.9	14.7	28.4	20.7	11.6	53.2	38.1	11.4
Fabricated metal products	7.1	19.4	10.8	12.4	21.9	8.6	16.8	27.4	13.6
Machinery industries	35.2	65.9	17.7	64.5	83.6	21.9	110.8	104.0	26.6
Transportation equipment	55.8	62.1	29.1	78.1	77.7	37.0	94.4	93.5	49.7
Electrical machinery products	14.5	36.5	13.2	28.0	46.9	17.1	38.9	60.8	30.9
Nonmetallic mineral products	7.0	16.8	6.1	13.4	20.3	6.6	21.8	32.5	8.5
Petroleum and coal products	11.4	8.1	70.0	15.2	9.2	15.1	27.1	18.2	12.1
Chemicals and chemical products	2.7	26.4	9.03	3.5	25.5	8.8	37.2	46.9	15.1
TOTAL MANUFACTURING	23.0	25.5	15.9	30.3	30.6	14.4	48.4	46.7	20.2
INDUSTRY RANK CORRELATIONS WITH 1974 VALUES	---	---	---	0.841	0.957	0.938	0.688	0.687	0.754

Source: Authors' calculations, based on annual data from Statistics Canada, System of National Accounts, *The Input-Output Structure of the Canadian Economy*.

Note: Results for 1993 are preliminary estimates.

example, paper and allied products, printing and publishing, and electrical machinery products), imported input use declined in many cases. The use of imported inputs in petroleum and coal products declined precipitously from 70 percent in 1974 to 12 percent in 1993. The share of imported inputs also fell in primary metal products.

Unlike U.S. manufacturing industries, where the direction of net external orientation has swung back and forth, Canada's manufacturing industries have moved steadily toward greater positive net external orientation (Table 4 and Chart A6). In 1974, nine out of eighteen manufacturing industries, accounting for 67 percent of total manufacturing shipments, registered positive net external orientation. For five of these industries—which together account for 40 percent of all manufacturing shipments—the net orientation toward exports was well above 10 percent. By the mid-1990s, sixteen out of eighteen manufacturing industries in Canada held a positive net external orientation, representing more than 90 percent of manufacturing shipments. This increasing tendency toward positive net external orientation came as a result of substantial export growth.

#### U.K. MANUFACTURING INDUSTRIES

The external orientation of the manufacturing industries in the United Kingdom grew significantly in the period 1970-93. For total manufacturing, the export share of total shipments increased from nearly 20 percent in 1974 to almost 30 percent by 1993 (Table 5 and Chart A7). The

largest absolute increase in U.K. manufacturing export share was in professional goods. As in the United States and Canada, the industries that entered the 1970s as relatively large exporters continued to be relatively large exporters into the mid-1990s.

Even with the widespread expansion of export share, some manufacturing industries are exceptionally oriented toward external markets. For example, chemicals and allied products, nonelectrical machinery, electrical machinery, and professional goods all show export shares exceeding 45 percent of their total production

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*The net external orientation of manufacturing industries in the United Kingdom . . . has varied considerably over the past two decades.*

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for 1993. Like the high numbers for Canadian industry export shares, some of these U.K. numbers reflect a significant re-export phenomenon: certain products entering the country as imports are not destined for home market consumption. Because these products are re-exported to third markets, with varying degrees of value added by U.K. manufacturing industries, the export share measure may inflate the industry's external orientation.

The import share of U.K. manufacturing industries also increased, from approximately 20 percent to

Table 4  
NET EXTERNAL ORIENTATION OVER TIME: CANADA

Export Share Exceeds Imported Input Share by:	1974		1984		1993	
	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments
More than 10 percent	5	40.5	6	45.3	12	78.7
5 to 10 percent	0	0.0	3	6.3	2	9.2
0 to 5 percent	4	26.8	4	31.9	2	5.5
0 to -5 percent	3	12.5	2	6.0	2	6.6
-5 to -10 percent	4	10.9	2	8.2	0	0.0
More than -10 percent	2	9.4	1	2.3	0	0.0

Source: Authors' calculations, based on annual data from Statistics Canada, System of National Accounts, *The Input-Output Structure of the Canadian Economy*.

Note: Results for 1993 are preliminary estimates.

34 percent of consumption. Tobacco products, chemicals and allied products, rubber products, nonelectrical machinery, and electrical machinery registered large gains in import share. The overall rise in import share, however, largely reflects a pre-established pattern of foreign penetration in certain domestic industries. In particular, industries with a high import share in the 1970s were also the industries with high import penetration in the 1990s. Thus, although the level of external exposure for particular industries may have increased, the United Kingdom did not experience a major shift in the composition of manufacturing industries facing foreign competition.

Imported input share rose in all U.K. manufacturing industries over the past two decades, from an average of more than 13 percent in 1974 to 22 percent in 1993 (Table 5 and Chart A8). The industries that exhibited the

most significant increases in imported input use were the same ones that experienced significant gains in import share. This finding makes sense because manufacturing industries tend to use their own broad product groups as inputs in their production. The finding also reflects the re-export activity of some industries and underscores the value of focusing attention on both the net external orientation of manufacturing industries and the separate channels of external orientation.

The net external orientation of manufacturing industries in the United Kingdom, like the net orientation of U.S. industries, has varied considerably over the past two decades (Table 6 and Chart A9). In contrast to the strong positive net orientation observed in the 1970s, less than 60 percent of manufacturing shipments in the 1980s were in industries with a net external orientation favoring

Table 5  
EXPORT SHARE, IMPORT SHARE, AND IMPORTED INPUT SHARE OF U.K. MANUFACTURING INDUSTRIES IN SELECTED YEARS

Industry	1974			1984			1993		
	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share
Food	5.8	21.4	8.4	7.3	18.1	8.6	9.6	18.9	9.1
Beverages	17.7	11.1	8.8	20.5	13.5	11.1	22.3	16.2	13.2
Tobacco products	10.6	3.4	8.3	24.9	23.2	10.0	8.0	58.7	10.0
Textiles and wearing apparel	18.3	20.1	15.7	22.5	35.8	26.7	30.9	29.1	24.2
Leather and leather products	16.7	18.0	15.0	25.7	42.0	24.7	33.8	73.2	35.6
Wood products	2.0	34.3	20.6	3.6	33.8	21.8	2.7	15.6	12.9
Furniture and fixtures	5.7	6.0	14.7	7.7	15.4	19.9	7.9	51.9	14.1
Paper and paper products	7.1	28.6	18.9	10.0	32.6	23.2	15.1	31.2	23.1
Printing and publishing	6.9	4.1	10.9	7.8	5.5	13.5	8.3	5.6	13.6
Chemicals and allied products	25.0	19.6	13.1	36.7	32.0	20.6	45.1	38.5	22.5
Petroleum and coal products	12.9	14.8	3.7	18.2	24.7	6.1	19.0	9.4	4.8
Rubber products	16.9	10.9	11.8	23.7	23.1	19.1	31.2	33.2	21.3
Plastic products	8.6	13.4	14.1	10.1	15.2	21.6	8.6	14.5	24.7
Nonmetallic products	11.7	8.3	7.8	9.8	9.8	13.0	11.8	11.7	13.8
Iron and steel	11.9	14.5	11.7	17.0	16.9	15.6	29.1	26.0	20.1
Nonferrous metals	29.1	38.6	29.1	39.6	47.7	36.9	37.6	51.8	40.1
Fabricated metal products	11.2	6.6	15.4	17.9	16.1	20.8	17.1	19.1	24.6
Nonelectrical machinery	35.6	26.9	16.1	44.5	43.1	24.9	51.1	52.5	31.3
Electrical machinery	18.4	17.6	14.9	24.0	30.0	23.6	47.0	51.7	34.6
Transport equipment	30.7	18.4	14.3	35.1	38.1	25.5	40.8	47.7	32.2
Professional goods	42.1	39.9	13.2	109.2	108.8	22.6	107.6	111.9	29.5
Other manufacturing	76.6	76.6	20.6	116.4	114.7	28.2	118.2	112.8	29.0
TOTAL MANUFACTURING	18.5	19.6	13.4	24.1	29.0	19.0	29.8	33.8	21.7
INDUSTRY RANK CORRELATIONS WITH 1974 VALUES	---	---	---	0.915	0.837	0.883	0.893	0.735	0.801

Source: Authors' calculations, based on data from Central Statistics Office of the United Kingdom, *1990 Input-Output Balances for the United Kingdom* (1993), and annual data from Organization for Economic Cooperation and Development, *Industrial Structure Statistics*.

Table 6  
NET EXTERNAL ORIENTATION OVER TIME: THE UNITED KINGDOM

Export Share Exceeds Imported Input Share by:	1974		1984		1993	
	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments
More than 10 percent	5	31.0	6	30.6	6	37.2
5 to 10 percent	3	10.7	2	12.1	5	22.4
0 to 5 percent	7	27.0	5	15.8	1	12.9
0 to -5 percent	3	20.6	4	26.6	4	7.7
-5 to -10 percent	2	2.4	1	2.9	4	15.4
More than -10 percent	2	8.3	4	12.1	2	4.4

Source: Authors' calculations, based on data from Central Statistics Office of the United Kingdom, *1990 Input-Output Balances for the United Kingdom* (1993), and annual data from Organization for Economic Cooperation and Development, *Industrial Structure Statistics*.

exports rather than imported input use. By the mid-1990s, the importance of industries with negative net external orientation—measured by their weight in total manufacturing shipments—declined significantly. Nonetheless, the actual number of industries with negative net external orientation actually rose. On the whole, these industries became a smaller portion of total U.K. manufacturing.

#### JAPANESE MANUFACTURING INDUSTRIES

The patterns of external orientation in Japanese manufacturing industries are markedly different from those in U.S., Canadian, and U.K. industries. First, both the levels and rankings of industry export share and import share have been very stable from 1974 to 1993 (Table 7 and Chart A10). Second, the bulk of Japanese industrial exports are concentrated in four industries with a heavy export orientation. Third, import share and imported input share are significantly lower in Japan than in the other countries.

Most of Japan's exports are concentrated in durable goods manufacturing industries, including ordinary machinery, electrical machinery, transportation equipment, and instruments and related products.<sup>6</sup> In 1993, the export share of these four industrial groups (accounting for 67 percent of total exports from Japan) represented approximately 20 to 30 percent of industry shipments. Although for the other countries the rank correlation of export share by industry across time has been very stable, export activity in Japan has actually become even more concentrated in the four main export industries over the past twenty years.

The import share of Japanese manufacturing industries has remained relatively low and stable. By the mid-1990s, import penetration averaged almost 6 percent of industrial consumption; much of this activity was related to raw materials imports. Considering the growth in levels of imported inputs in the other countries and the general pattern of globalization of manufacturing,<sup>7</sup> this lack of movement is striking. These external orientation measures will undoubtedly contribute to debates on whether the Japanese economy is relatively closed and shed light on the factors that might explain Japan's unique structure.

Even more surprising, most Japanese manufacturing industries have observed declines in imported input shares over time (Table 7 and Chart A11). The two industries that are strong users of imported inputs, and that dramatically pull up

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*The patterns of external orientation in Japanese manufacturing industries are markedly different from those in U.S., Canadian, and U.K. industries.*

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the overall averages for Japanese industries, are petroleum and coal products and nonferrous metal products. Without these two industries, imported input shares generally are below 5 percent across the board.

The net external orientation of manufacturing industries in Japan reveals a highly stratified economy (Table 8 and Chart A12). Five industry groups—leather and leather products, ordinary machinery, electrical machinery, transportation equipment, and instruments and related products—representing 40 percent of manufacturing shipments, hold a positive net external orientation exceeding 10 percent. Because many other industries export very little of their output, about 30 percent of Japanese manufacturing is consistently more exposed internationally through the use of imported inputs than through exports. The absolute size of the negative net orientation of these industries has been declining over time because the export growth for even these industries exceeds the growth of imported inputs in production. These patterns of external orientation across Japanese manufacturing suggest that shocks to the economy—such as large changes in the value of the yen—will likely affect individual Japanese manufacturers in dramatically different ways.

## CROSS-COUNTRY COMPARISONS OF EXTERNAL ORIENTATION

As the previous sections show, export shares of manufacturing industries have been growing in the United States, the United Kingdom, Canada, and Japan. This growth, however, is unevenly distributed across industries and countries. In all the countries except Japan, the import share and imported input share of the manufacturing industries have also been on the rise. This growth may reflect an increasingly integrated structure of production and common industry trends across industrialized countries. In this section, we ask: Are the countries becoming more similar over time in the degree to which their manufacturing industries are externally oriented?

The Spearman rank correlation coefficients are used to analyze the similarities and differences among the four countries over time. We construct the correlation coefficient in several steps. First, we give each manufacturing industry within a country a ranking (from lowest

Table 7  
EXPORT SHARE, IMPORT SHARE, AND IMPORTED INPUT SHARE OF JAPANESE MANUFACTURING INDUSTRIES IN SELECTED YEARS

Industry	1974			1984			1993		
	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share	Export Share	Import Share	Imported Input Share
Food and beverages	1.1	6.4	10.0	1.11	7.0	7.1	0.6	8.0	4.3
Textile products	8.5	6.8	4.6	9.2	7.9	4.3	5.8	14.6	4.8
Lumber and wood products	0.8	5.2	7.4	1.0	6.7	5.5	0.6	12.0	6.0
Pulp, paper, and paper products	3.0	4.6	3.0	2.7	4.5	2.9	2.4	3.7	2.1
Printing and publishing	0.6	1.1	1.4	0.8	0.6	1.5	0.4	0.6	0.9
Chemical products	12.5	7.8	5.2	9.8	8.5	4.8	8.0	5.9	2.6
Petroleum and coal products	2.1	10.6	57.9	2.2	13.0	54.0	2.5	8.4	25.5
Leather and rubber products	12.5	5.5	3.6	14.8	7.2	3.5	12.6	8.2	2.6
Nonmetallic products	4.0	1.0	14.5	7.0	2.2	11.8	4.8	2.5	7.1
Iron and steel	15.0	1.5	4.6	11.0	2.3	4.9	7.4	2.3	3.1
Nonferrous metal products	10.0	17.9	24.0	8.6	25.7	18.7	7.9	18.9	9.8
Fabricated metal products	7.3	1.0	1.8	7.7	1.2	2.2	3.3	1.4	1.7
Ordinary machinery	12.3	4.3	2.1	18.3	2.7	1.9	20.8	3.9	1.8
Electrical machinery	15.5	4.0	3.1	24.6	4.0	3.4	24.9	6.9	2.9
Transportation equipment	24.4	2.5	1.8	32.8	3.2	2.4	25.0	3.7	2.8
Instruments and related products	27.7	16.7	4.7	34.0	11.9	4.1	31.9	17.3	3.7
Other manufacturing	7.8	5.7	3.3	7.6	5.1	3.2	11.9	14.8	4.4
TOTAL MANUFACTURING	10.5	4.9	8.2	13.5	5.5	7.3	12.1	6.3	4.1
INDUSTRY RANK CORRELATIONS WITH 1974 VALUES	---	---	---	0.978	0.968	0.976	0.929	0.858	0.831

Source: Authors' calculations, based on annual data from Ministry of Trade and Industry, International Trade and Industry Statistics Association, *Japan Input-Output Tables Extended Chart*.

Table 8  
NET EXTERNAL ORIENTATION OVER TIME: JAPAN

Export Share Exceeds Imported Input Share by:	1974		1984		1993	
	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments	Number of Industries	Share of Manufacturing Shipments
More than 10 percent	5	43.7	5	39.1	5	38.8
5 to 10 percent	3	13.7	2	22.0	1	14.5
0 to 5 percent	2	9.2	2	8.5	4	18.7
0 to -5 percent	2	6.0	5	11.2	4	21.8
-5 to -10 percent	2	15.9	1	11.2	1	2.7
More than -10 percent	3	11.5	2	8.2	2	3.5

Source: Authors' calculations, based on annual data from Ministry of Trade and Industry, International Trade and Industry Statistics Association, *Japan Input-Output Tables Extended Chart*.

to highest) according to export share, import share, and imported input share for 1974, 1984, and 1993. Then, for each of these three measures of external orientation, we correlate the rankings of similar industries across pairs of countries. This comparison—or correlation—is performed for each external orientation measure and for each country pair (Table 9).<sup>8</sup> If the correlation statistic is high, the rankings of industries according to a particular orientation measure are similar across two countries. If the correlation statistic is negative, the industries with relatively strong external orientation in one country are more likely to have a relatively low external orientation in the sec-

ing increasingly alike. Other cross-country comparisons of external orientation rankings are more mixed, underscoring the need to consider the individual measures separately. In addition, we find that most of the external orientation rank correlations—reported in the bottom row of each of the country tables (Tables 1, 3, 5, and 7)—have been stable over time within each of the four countries.

#### EXPORT SHARE RANKINGS

Rankings of industries in terms of export share are highly positively correlated in the United States and the United Kingdom, suggesting that similar manufacturing industries in these two countries are the most oriented toward exporting. By contrast, Canadian industry rankings have little in common with the rankings of industries for the United States and the United Kingdom. Industries in Japan have moderate export share rank correlations with industries in the other countries. Similarities in export share across countries reflect the fact that all four countries share heavy export industries—the various machinery and equipment industries, transportation equipment, and instruments or professional equipment. Comparisons of the rank correlation statistics computed at different dates support these observations.

#### IMPORT SHARE RANKINGS

Industries in the United States and the United Kingdom are also the most alike in terms of import share. Although Canada was very similar to these countries in the 1970s,

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*The external orientation patterns of U.S. and U.K. industries are the most similar, and they are becoming increasingly alike.*

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ond country. If the rank correlations for the manufacturing industries in two countries increase between two years, the implication is that the two countries are becoming more alike in terms of the particular external orientation measure.

Our main conclusion from this analysis, detailed below, is that the external orientation patterns of U.S. and U.K. industries are the most similar, and they are becom-

the Spearman rank correlation statistics show that this is no longer true. The similarities between Canadian industries and U.S. and U.K. industries have eroded over time, while Canadian and Japanese industries have maintained very different rankings of import share.

Over the past two decades, correlations between Japanese industry rankings by import share and the rankings of industries in the United States and the United Kingdom have turned negative. These results imply that those industries with a relatively high import share in Japan are likely to have a relatively low import share in the United States and the United Kingdom. This pattern may arise because the United States and the United Kingdom have seen considerable growth of import share in manufacturing industries that are also export-oriented, while the import penetration of Japanese industries has grown mainly in those industries that rely more heavily on imported inputs.

#### IMPORTED INPUT SHARE RANKINGS

In terms of imported input share, the United States and the United Kingdom have the highest correlation among country

rankings of industry. This correlation appears to be growing over time. In the 1970s, the Canadian rankings of imported input share were negatively correlated with the rankings of the United States and the United Kingdom, but from the late 1970s to the 1990s, the correlations turned positive. Japanese

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*Manufacturing industries in Japan are becoming increasingly dissimilar to the U.K., U.S., and Canadian manufacturing industries in their use of imported inputs.*

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industry rankings are increasingly negatively correlated with the rankings of industries in the United States and the United Kingdom in terms of imported input use. Thus, industry use of imported inputs is becoming more similar over time across the manufacturing industries in the United States, the United Kingdom, and Canada. The manufacturing industries in

Table 9

SPEARMAN RANK CORRELATIONS OF INDUSTRIES BY EXTERNAL ORIENTATION MEASURE IN SELECTED YEARS

	EXPORT SHARE								
	United Kingdom			Japan			Canada		
	1974	1984	1993	1974	1984	1993	1974	1984	1993
United States	0.65	0.63	0.72	0.28	0.43	0.47	0.19	0.23	0.01
Canada	0.10	0.10	0.01	0.21	0.34	0.31			
Japan	0.40	0.44	0.37						
	IMPORT SHARE								
	United Kingdom			Japan			Canada		
	1974	1984	1993	1974	1984	1993	1974	1984	1993
United States	0.38	0.58	0.70	0.36	0.05	-0.31	0.51	0.59	0.11
Canada	0.30	0.39	0.21	0.04	0.16	0.15			
Japan	0.56	0.30	-0.27						
	IMPORTED INPUT SHARE								
	United Kingdom			Japan			Canada		
	1974	1984	1993	1974	1984	1993	1974	1984	1993
United States	-0.03	0.44	0.70	0.00	-0.04	-0.31	-0.16	0.24	0.11
Canada	-0.04	0.13	0.21	-0.05	-0.09	0.15			
Japan	-0.11	-0.08	-0.27						

Source: Authors' calculations.

Japan, however, are becoming increasingly dissimilar to the U.K., U.S., and Canadian manufacturing industries in their use of imported inputs.

## CONCLUSION

There are important differences in the external orientation of industries within and across countries. Nevertheless, the United States, Canada, Japan, and the United Kingdom share a set of manufacturing industries that are relatively strong exporters. These countries, however, differ substantially in terms of the import share and imported input shares of their manufacturing industries. Exports relative to domestic manufacturing production and imports relative to consumption are highest in Canada and the United Kingdom, followed by the United States and Japan. In the United States, these shares have increased sharply over time, whereas in Japan, external orientation measures have stayed relatively stable. The export share and imported input share of manufacturing industries in Canada and the United Kingdom are consis-

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*Our results can be used by analysts  
estimating the effects of exchange rate  
changes on the profitability and activities  
of manufacturing industries.*

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tently greater than in the United States. Although Japan has fewer industries geared toward exporting, these industries register strong export shares without relying extensively on imported inputs in production.

Industries in the United States show the most volatile patterns in net external orientation. After remaining, on average, primarily export-oriented in the 1970s, U.S. industries experienced increased international exposure in the early to mid-1980s through their reliance on imported inputs in production. In the late 1980s and in the 1990s, export shares grew faster than imported

input shares, raising the positive net external orientation of U.S. industries.

Canadian industries are more heavily oriented toward exporting than industries in the United States. In 1993, 80 percent of Canadian manufacturing industries held a very high positive net external orientation, compared with 40 percent of manufacturing industries in the early 1970s. U.K. and Japanese manufacturing sectors have exhibited relatively stable patterns of net external orientation, despite substantial changes in real exchange rates and demand conditions in these economies over the past two decades.

Japanese manufacturing industries are distinct from those in the other countries in a number of ways. First, a small group of relatively large industries accounts for the bulk of Japan's exports. Second, Japanese industries have relatively low import share and generally low imported input share. Nonetheless, because some industries export very little of their production, roughly a third of manufacturing output in Japan is in industries with a consistently negative net external orientation. Finally, over time, Japan has become less like the United States and the United Kingdom in industry import share and imported input use.

This article has reviewed the size and composition of the external orientation of manufacturing industries according to four measures—export share, import share, imported input share, and net external orientation. The results have many potential applications. Most important, our results can be used by analysts estimating the effects of exchange rate changes on the profitability and activities of manufacturing industries in these countries. Careful empiricism can track the extent to which industry performance—as measured by stock market returns, profits, growth, or any other measure of industry activity—is affected by international shocks.<sup>9</sup> The scope of these effects is likely to depend on the size and direction of the measures of external orientation we have identified. Ultimately, our broad measures of industry external orientation are important tools for analyzing the magnitude and significance of international shocks for economic activity within a country.

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## APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY

### UNITED STATES

Industry sales data are from U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures*. Data on exports to shipments (export share) and imports to new supply (import share) are from U.S. Department of Commerce, Bureau of Economic Analysis, "Benchmark Input-Output Accounts for the U.S. Economy, 1982," *Survey of Current Business*, July 1991 and April 1994. Imported input share,  $\alpha^i$ , includes in the numerator imported inputs from manufacturing industries, assuming  $p_t^j q_{j,t}^i = p_{82}^j q_{j,82}^i$  for all  $t$ , and  $VP_t^i = \sum_j p_{82}^j q_{j,82}^i + w_t^i$ , where  $w_t^i$  is wages and salaries in nominal dollars from the U.S. National Income and Product Accounts, deflated by the U.S. producer price index reported in *International Financial Statistics*, International Monetary Fund (Series 63), and expressed in 1982 dollars.

We construct the imported input share series using the two most recent years of input-output data—1982 and 1987—reported in the "Benchmark Input-Output Accounts for the U.S. Economy." Because the dollar was unusually strong in 1987, we offer the measures using the 1982 input-output structure as the more representative of U.S. manufacturing. When comparing the imported input series constructed from the two input-output years, we see only a couple of differences: the apparel and other textile industry shifts from purchasing heavily in chemicals and allied products to buying more semifinished textile products; the lumber and wood products industry reduces inputs from chemicals and allied products, petroleum and coal products, and rubber and miscellaneous products and buys much more from itself.

### CANADA

Data on the input-output structure of production and the import and export shares of manufacturing are drawn from Statistics Canada, System of National Accounts, *The Input-Output Structure of the Canadian Economy*. These data cover

the period 1974-93. This source also reports data on exports, imports, employee compensation, and total production for each industry. Canada's imported input series,  $\alpha^i$ , is the ratio of imported inputs purchased from agriculture, mining, raw materials, and manufacturing industries to total inputs purchased from these industries plus industry labor costs.

### UNITED KINGDOM

Because of data limitations, we use only one year of input-output data in our calculations. These data are reported in Central Statistics Office of the United Kingdom, *1990 Input-Output Balances for the United Kingdom* (1993). Annual data from 1970 to 1994 on manufacturing exports, imports, wages and salaries, employee social security costs, and total production are drawn from Organization for Economic Cooperation and Development, *Industrial Structure Statistics*. The imported input share,  $\alpha^i$ , includes in the numerator imported inputs from manufacturing industries, assuming  $p_t^j q_{j,t}^i = p_{90}^j q_{j,90}^i$  for all  $t$ , and in the denominator  $VP_t^i = \sum_j p_{90}^j q_{j,90}^i$ .

### JAPAN

Data on the input-output structure of manufacturing are from Ministry of Trade and Industry, International Trade and Industry Statistics Association, *Japan Input-Output Tables Extended Chart*. Data cover the period 1974-93 and are reported in millions of yen. This source reports annual input-output information as well as exports, imports, employee compensation, material costs, and total production. Japan's imported input series,  $\alpha^i$ , is the ratio of imported inputs purchased from agriculture, mining, raw materials, and manufacturing industries to total inputs purchased from these industries plus industry labor costs.

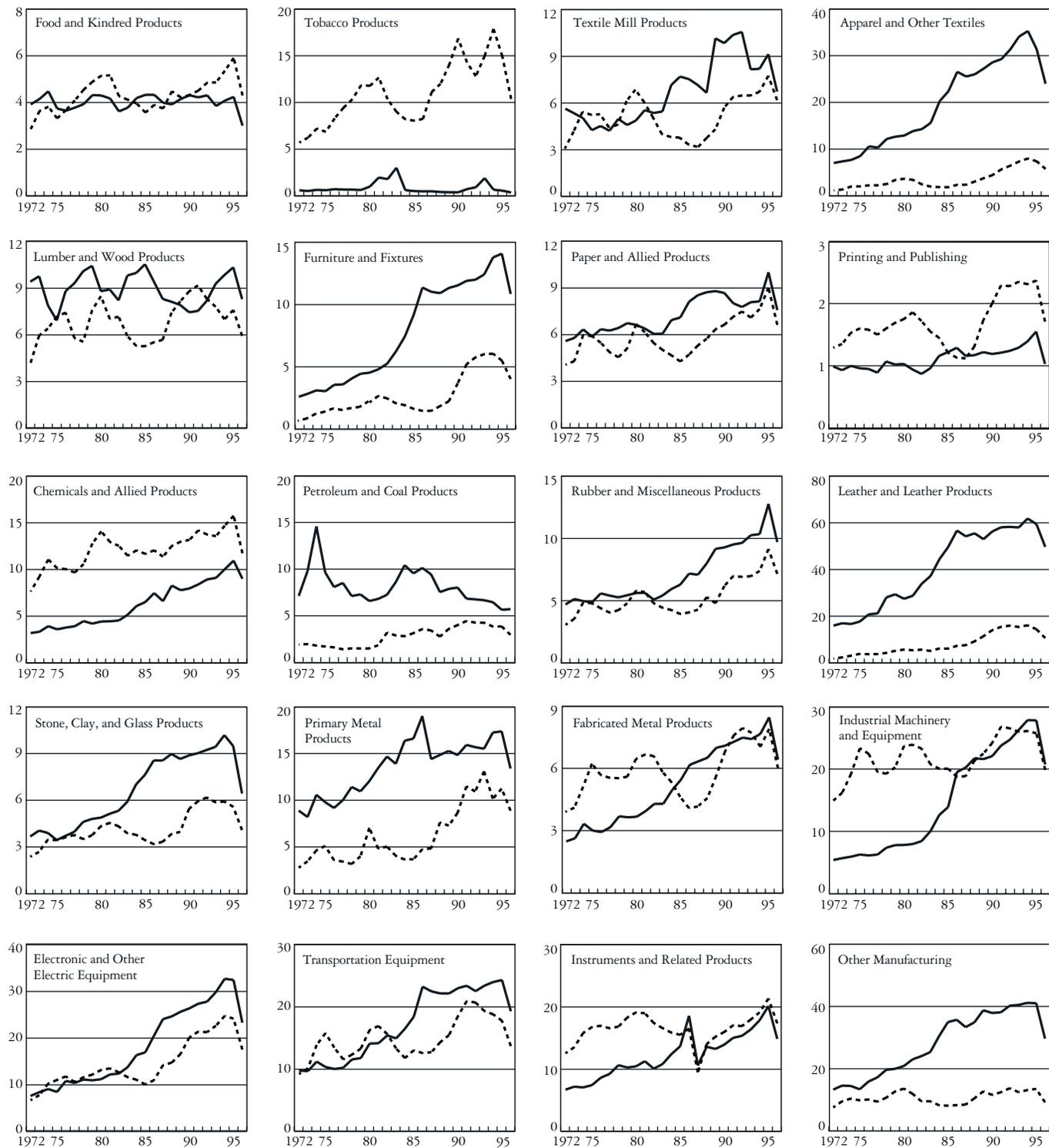
Specific information on industry concordances for the data series for each country is available on request from the authors.

APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A1

EXPORT SHARE AND IMPORT SHARE OF MANUFACTURING BY INDUSTRY: UNITED STATES  
Percent

Export Share - - - -  
Import Share ————



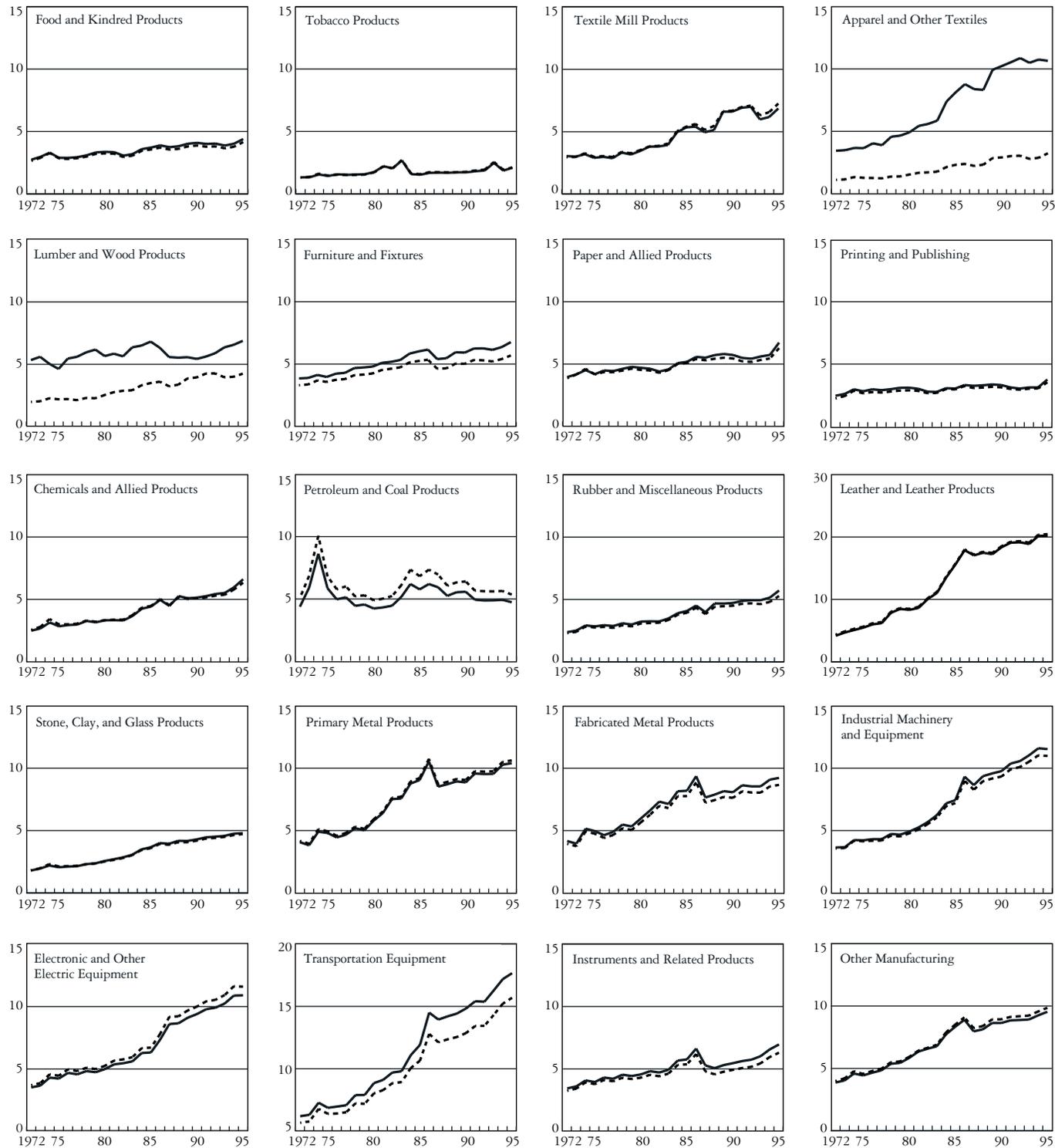
APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A2

IMPORTED INPUT SHARE OF MANUFACTURING BY INDUSTRY: UNITED STATES

Percent

Input-Output Structure  
 1982 - - -  
 1987 - - -



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A3

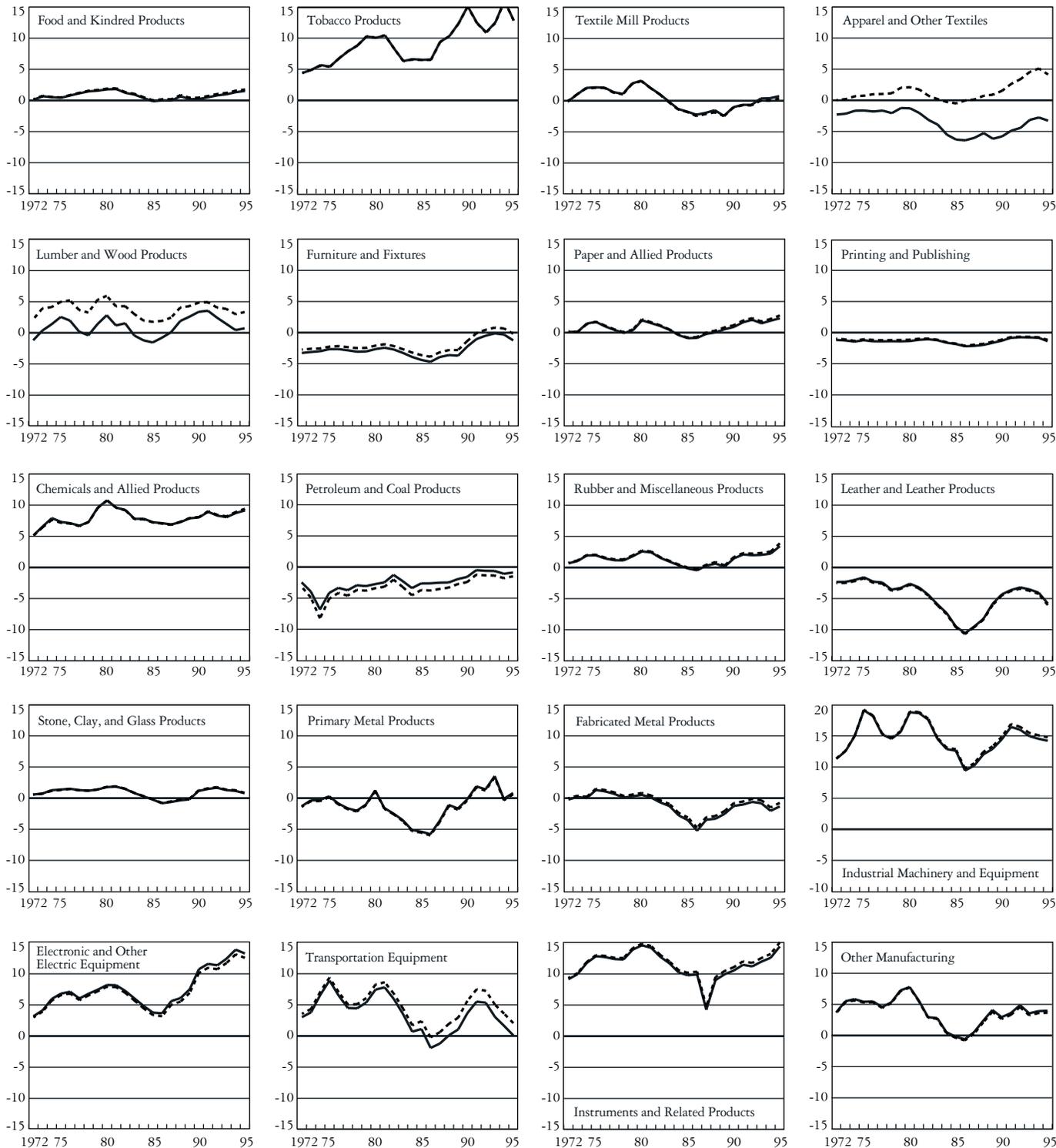
NET EXTERNAL ORIENTATION OF MANUFACTURING BY INDUSTRY: UNITED STATES

Percent

Input-Output Structure

1982 - - - -

1987 ———



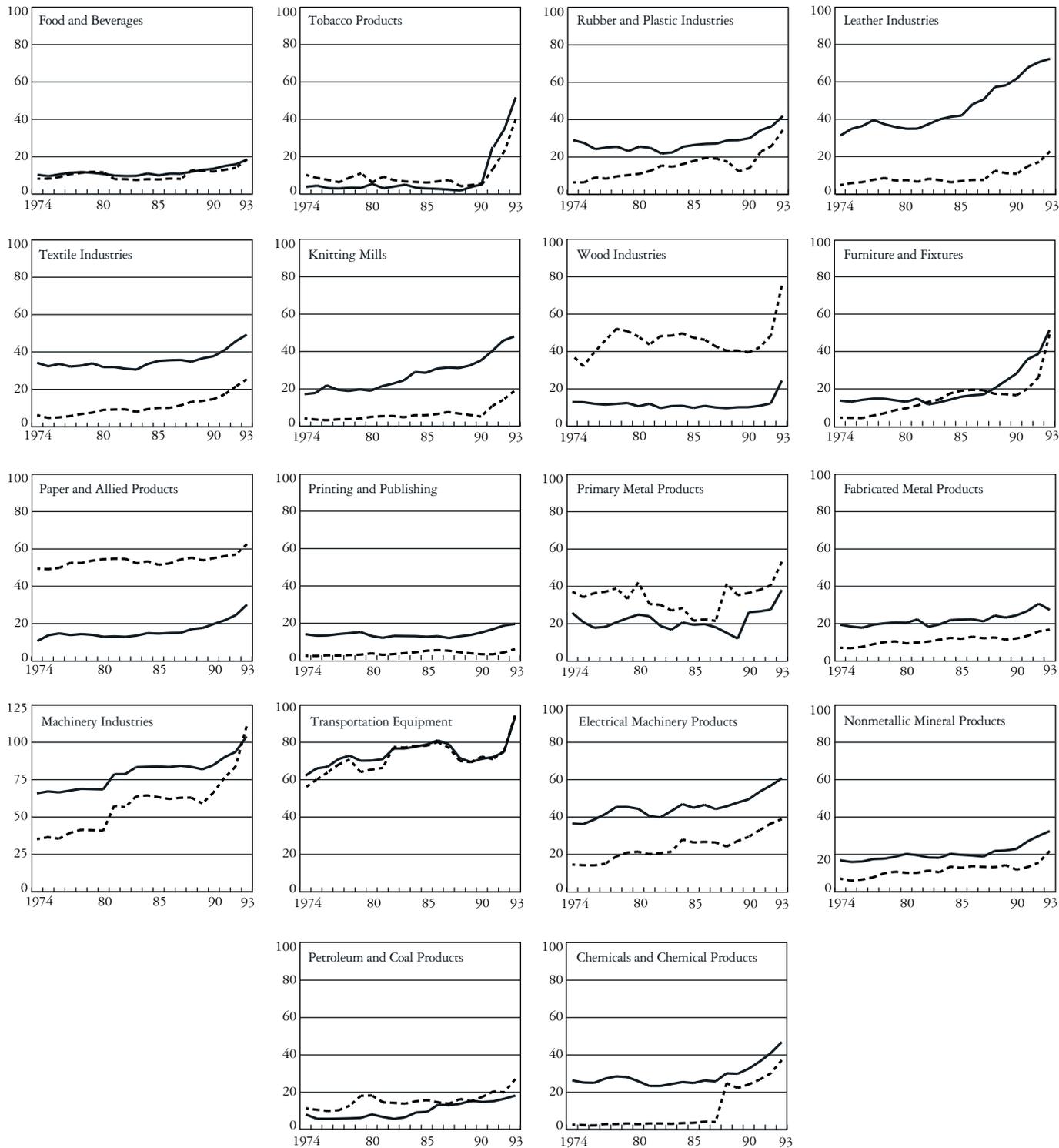
APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A4

EXPORT SHARE AND IMPORT SHARE OF MANUFACTURING BY INDUSTRY: CANADA

Percent

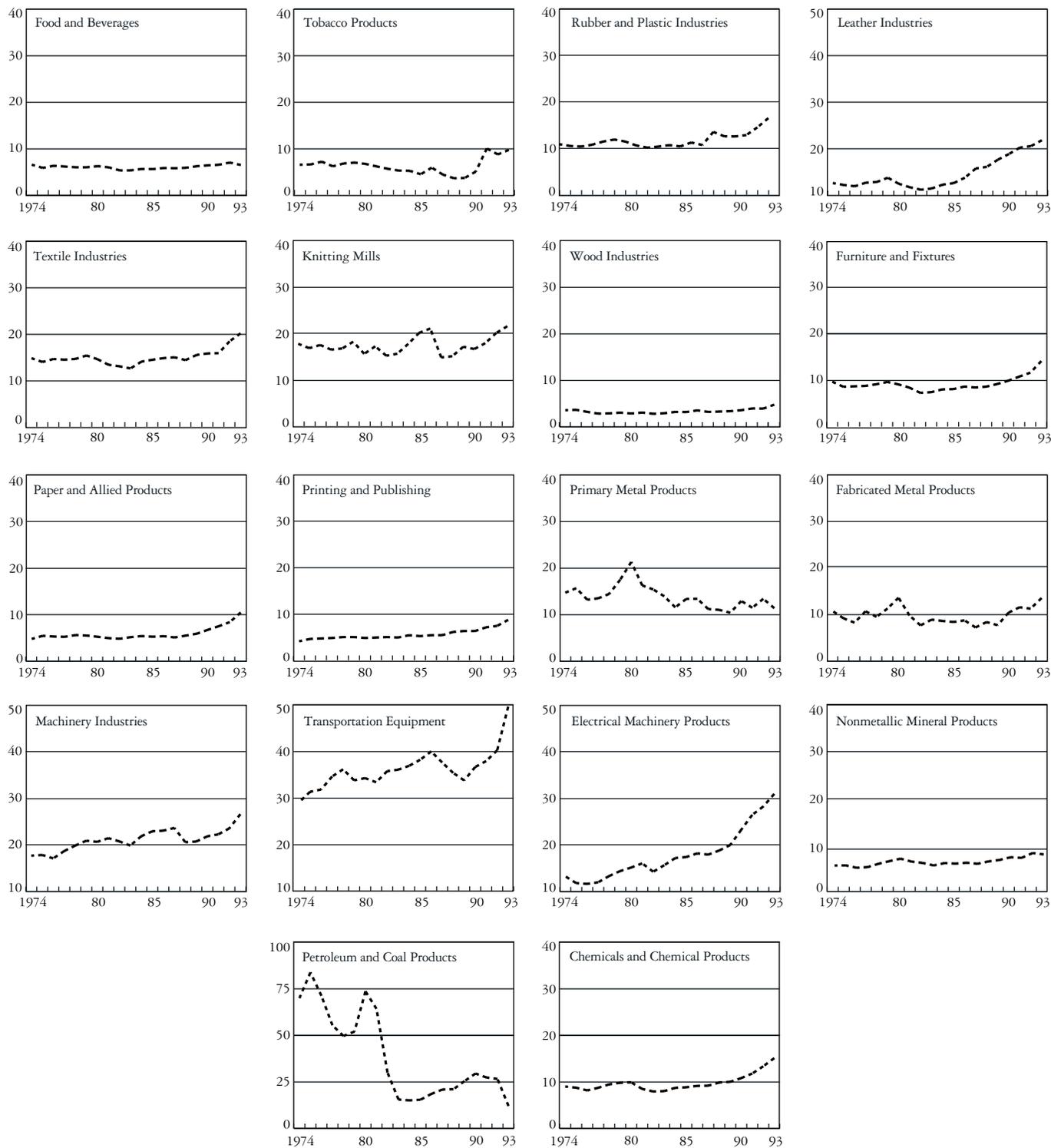
Export Share - - -  
Import Share —



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A5

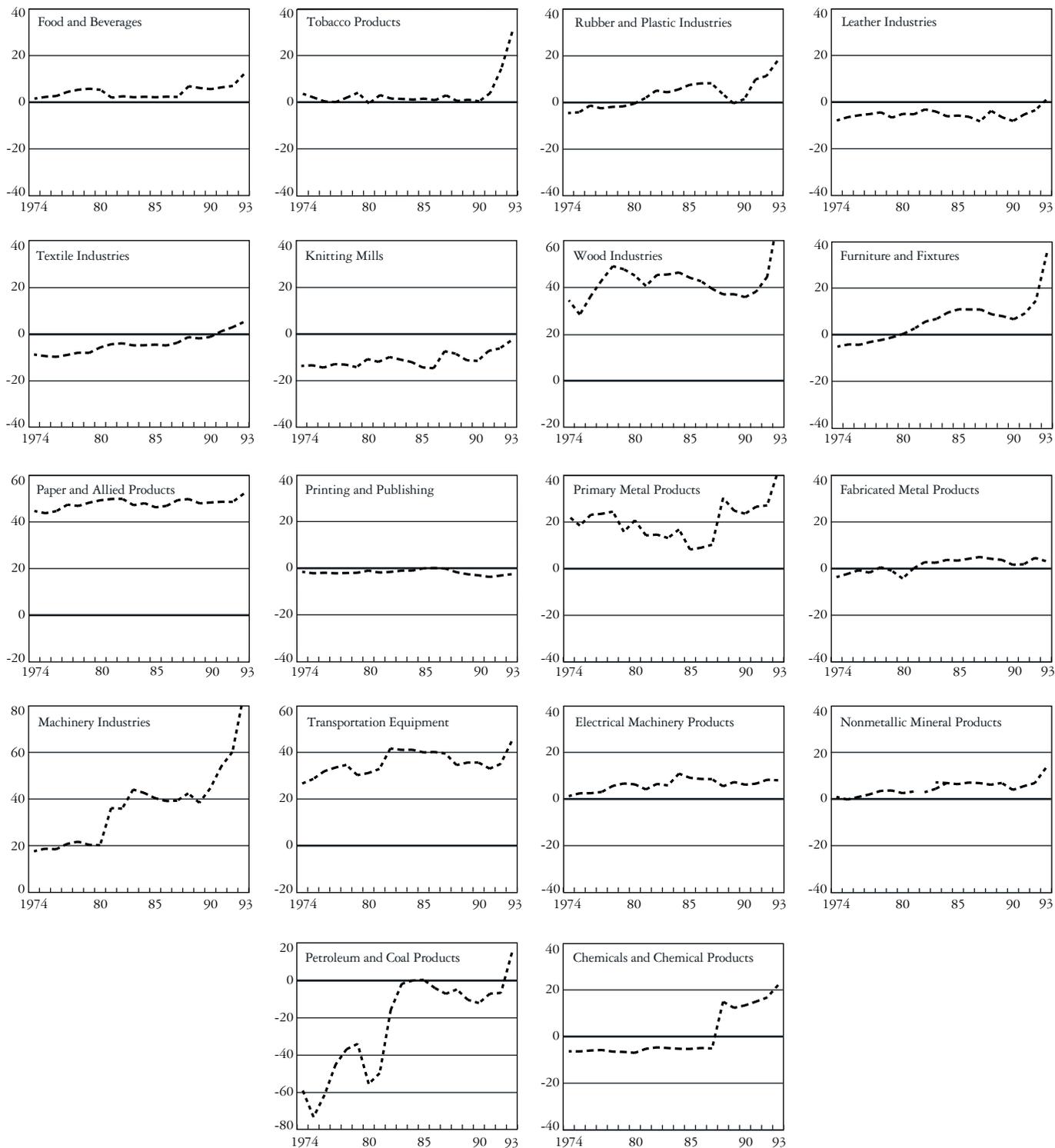
IMPORTED INPUT SHARE OF MANUFACTURING BY INDUSTRY: CANADA  
Percent



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A6

NET EXTERNAL ORIENTATION OF MANUFACTURING BY INDUSTRY: CANADA  
Percent

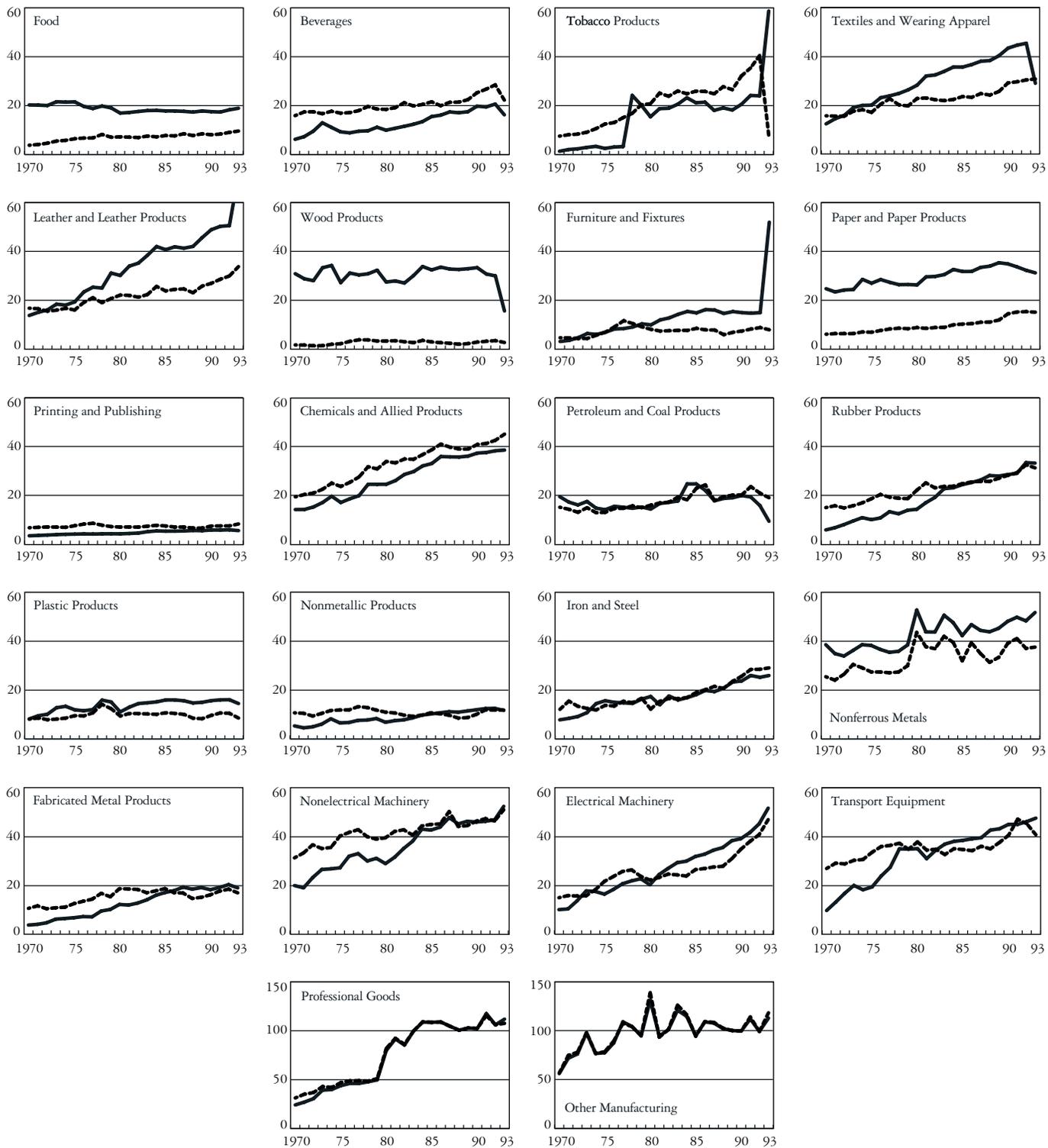


APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A7

EXPORT SHARE AND IMPORT SHARE OF MANUFACTURING BY INDUSTRY: UNITED KINGDOM  
Percent

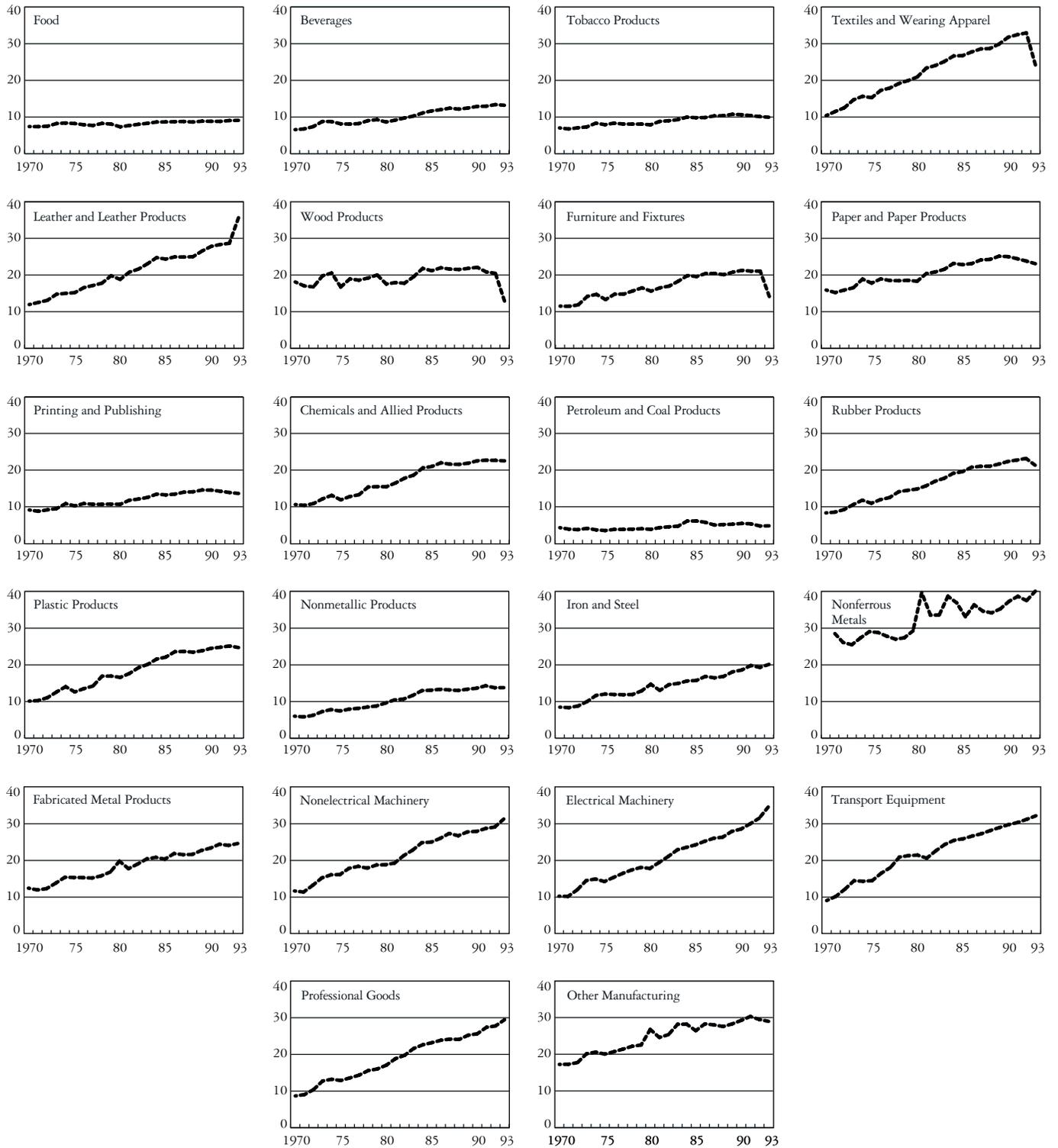
Export Share - - - -  
Import Share - - - -



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A8

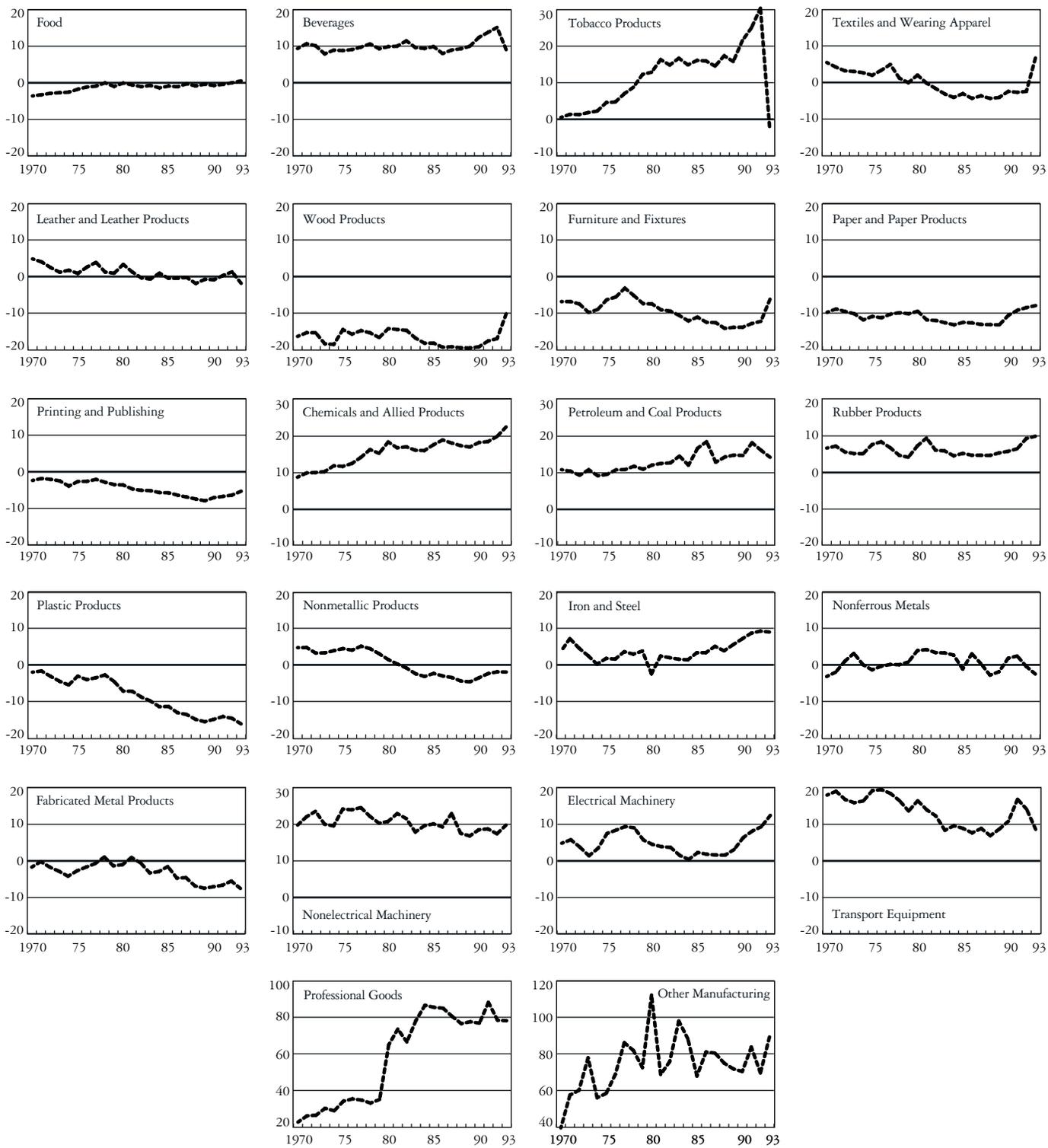
IMPORTED INPUT SHARE OF MANUFACTURING BY INDUSTRY: UNITED KINGDOM  
Percent



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A9

NET EXTERNAL ORIENTATION OF MANUFACTURING BY INDUSTRY: UNITED KINGDOM  
Percent

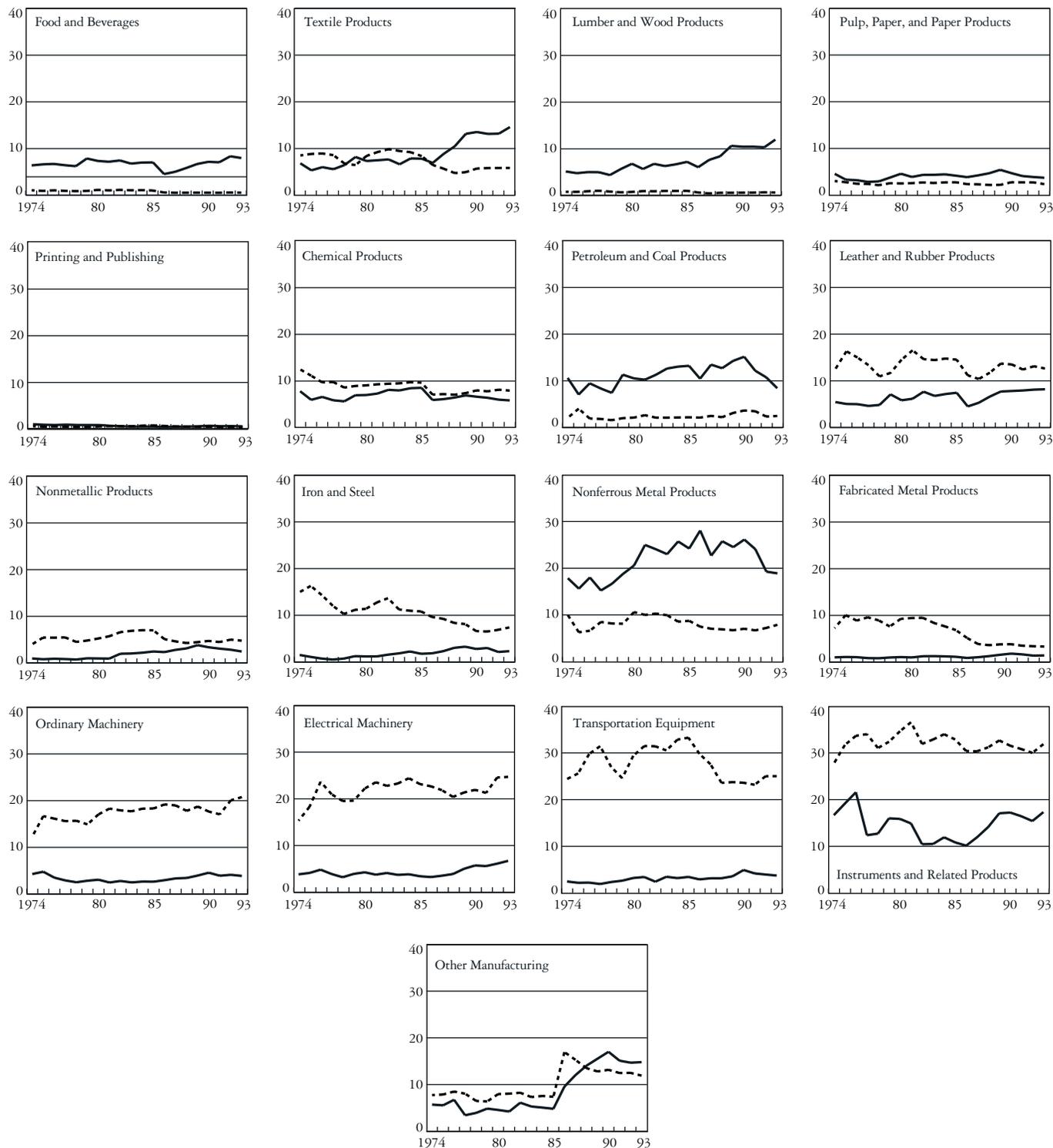


APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A10

EXPORT SHARE AND IMPORT SHARE OF MANUFACTURING BY INDUSTRY: JAPAN  
Percent

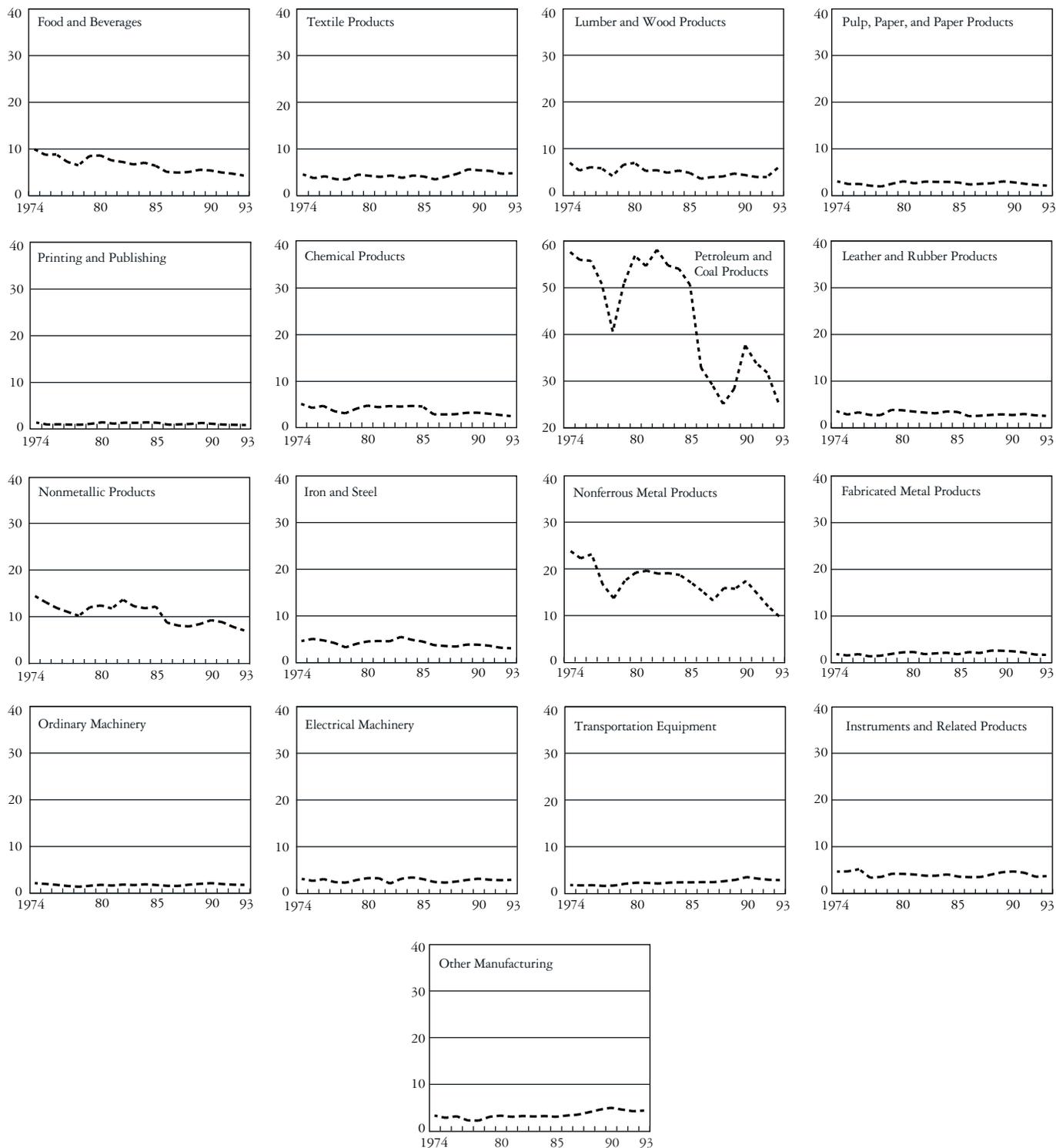
Export Share - - - -  
Import Share - - - -



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A11

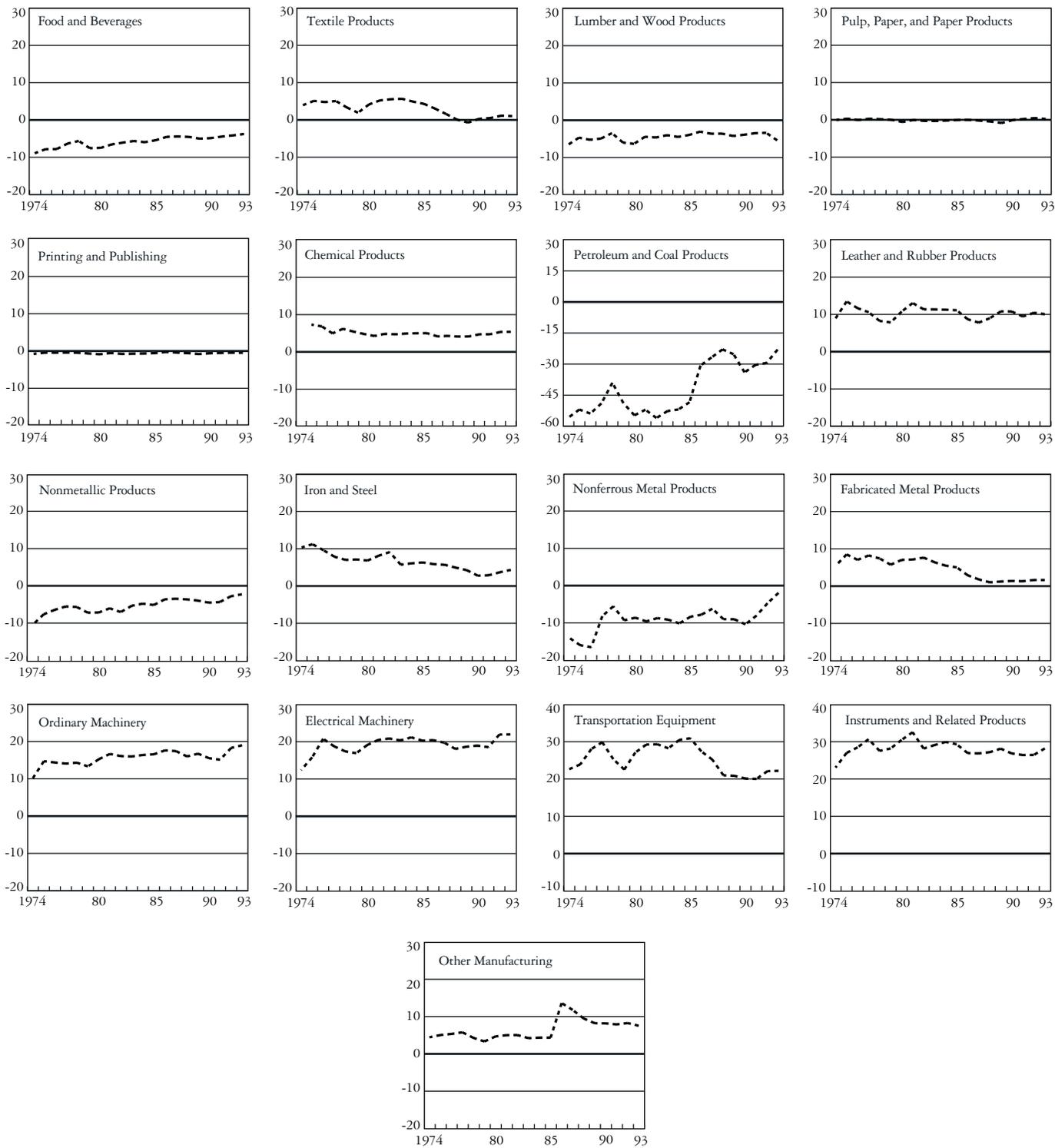
IMPORTED INPUT SHARE OF MANUFACTURING BY INDUSTRY: JAPAN  
Percent



APPENDIX: DATA SOURCES AND EXTERNAL ORIENTATION MEASURE RESULTS BY COUNTRY (Continued)

Chart A12

NET EXTERNAL ORIENTATION OF MANUFACTURING BY INDUSTRY: JAPAN  
Percent



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## ENDNOTES

*José Campa is assistant professor of economics and international business at the Stern School of Business, New York University. Linda Goldberg is an economist at the Federal Reserve Bank of New York. The authors thank Keith Crockett for excellent research assistance. Robert Feenstra and seminar participants at the Federal Reserve Bank of New York and the Stern School of Business, New York University, provided useful comments.*

1. Harrigan (1996) provides an overview of the literature on openness to trade and examples of the measure's application.
2. Our net measure does not explicitly address the role of multinational activity and long-term licensing arrangements in each industry. A priori, the relationship between foreign production and an industry's external orientation (and possibly exposure to exchange rate movements) is ambiguous. In some cases, foreign production substitutes for sales to foreign markets of domestically produced goods. In other cases, the presence of foreign production activity encourages increased trade of intermediate and related products.
3. Specific details regarding the data for each country are provided in the appendix. We use the latest available year of data for each country in our analysis, that is, 1995 for the United States, 1994 for the United Kingdom, and 1993 for Canada and Japan.
4. The measures of export share, imported input share, and net external orientation are shown in the charts in the appendix. Feenstra and Hanson (1996) combine import data and data on material purchases to calculate

an alternative, but qualitatively similar, measure of imported inputs for U.S. industries.

5. For machinery industries, the export share and import share in 1993 were greater than 100 percent because of the re-export of imported goods. The re-export phenomenon, along with the practice of outsourcing various components, swells the size of imports relative to domestic consumption of particular goods categories.
6. As noted earlier, these four industries also have relatively high export shares in the United States, the United Kingdom, and Canada.
7. For Japan, one strong form of globalization occurs through foreign direct investment. Goldberg and Klein (1997) show that Japanese direct investment in Southeast Asian countries tends to increase both Japanese imports from these countries and Japanese exports to these countries. Japanese direct investment in Latin American economies does not appear to have the same effect.
8. To make comparisons across countries, we convert the original data for each country into a sample of fifteen uniformly defined industries across the four countries.
9. For example, see Campa and Goldberg (1995, 1996, and 1997), who examine the effects of real exchange rate movements on industry investment and labor market outcomes across the United States, the United Kingdom, Canada, and Japan.

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