The behavior of the Producer Price Index in a global economy

The relationship between industry price change and the globalization levels of import penetration and net import penetration was negatively significant in both 1997 and 2002; however, between export intensity and domestic price change, a corresponding relationship was not consistent

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Over the last 20 years, the U.S. economy has become increasingly global. This trend was particularly strong in the manufacturing sector where, based on current dollar figures, imports as a percentage of domestic supply of manufacturing products grew from 14.3 percent in 1987 to 27.3 percent in 2010, while exports as a percentage of total manufacturing output grew from 8.2 percent to 17.3 percent over the same period.[1] Values of these measures and other statistics[2] indicating the magnitude and growth of globalization for each year from 1997 to 2002 can be found in appendix A.

The Producer Price Index (PPI) measures the average changes in prices that domestic establishments receive for their output. When a producer agrees to report prices for the PPI, a set of unique items with corresponding terms of sale (for example, type of buyer, size of shipment, etc.) is selected using probability proportional to size (PPS). As a result, the PPI includes export prices in its product indexes to the extent they are selected during this PPS process.[3] As of January 2011, only 2.2 percent of the weight value of all manufacturing items included in the PPI reflected transactions for items sold only to foreign buyers or to foreign buyers at a different price than the same items sold to domestic buyers. An additional 13.7 percent of the manufacturing item weight reflected transactions for items producers sold to both domestic and foreign buyers at the same price. Although these percentages are based on proportions of weight value of all PPI manufacturing items rather than on proportions of all manufacturing output, they are comparable to the values in the previous paragraph, indicating that exports are included in the PPI sample in roughly the same proportions as they currently exist in the economy for manufacturing industries. The PPI does not price imports, since they are not the output of a domestic establishment.

Despite that the scope of the PPI limits its direct pricing of global transactions, in order to remain competitive, domestic firms may consider global demand and supply factors when they set prices. As a result, the PPI may indirectly reflect the impact of changes in imports and exports. The goal of this article is to present the results of a new approach to analyzing the behavior of domestic prices in a global economy.

The relationship between industry prices and globalization levels has been the subject of a number of studies that primarily focused on imports. Auer and Fischer examined the impact of imports from low-wage countries on U.S. inflation rates by using data from 1997 to 2006 in 325 six-digit North American Industry Classification System (NAICS)[4] manufac-

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turing industries.[5] The results of this study indicated that imports from these low-wage countries decreased U.S. manufacturing prices by about 2 percent each year over the study period. Chen, Imbs, and Scott investigated how increases in trade affected prices in eight European countries.[6] They used data from 21 aggregate manufacturing industries sectors from 1988 to 2000. Their results estimated that European Union manufacturing prices fell by 2.3 percent over the period because of an increase in imports. In another study, Thompson calculated price-marginal cost ratios at the three-digit Standard Industrial Classification level for two time periods in the early and late 1970s by using Canadian manufacturing establishment level data and related those price-marginal cost ratios to trade data for the same two time periods.[7] The results of this analysis showed a slightly positive relationship between changes in the level of imports and price-marginal cost ratios in concentrated industries. The authors postulated that some of the unexpected results may have been from the level of aggregation of the data.

Approach

Monthly PPI industry and commodity[8] data are available at a detailed product level as well as at various aggregation levels. The Bureau of Economic Analysis (BEA) and the Census Bureau publish import and export data monthly by using the Standard International Trade Classification[9] structure, and the International Trade Commission publishes data by using the Harmonized Tariff Schedule[10] coding structure. Providing a detailed analysis of the timing and level of price changes in PPIs compared with changes in imports and exports would be difficult using these sources because neither of the import and export data coding structures matches the PPI coding structures. In addition, the factors that affect prices often vary at the detailed product level, suggesting the need for an in-depth knowledge of product-specific economic factors. Because of these complications, analysis at this detailed level would need to be limited to the details of a few industries and would not support conclusions about the PPI in general.

The basic building block for the PPI sample is the NAICS six-digit industry level. In January 2011, the PPI calculated industry-level price indexes for 676 industries in the agriculture, construction, mining, manufacturing, and services sectors of the economy. The Census Bureau publishes a wide range of statistics at the NAICS industry level every 5 years in its Economic Census as well as a more limited number of statistics annually. BEA publishes industry make and use data, including import and export values at the six-digit NAICS industry level in its Benchmark Input-Output (I-O) Accounts, which are compiled every 5 years.

BEA also publishes import and export data at the two- or three-digit NAICS level in its annual I-O tables. In addition, BEA publishes both quarterly and monthly import and export data by end-use category and commodity at an aggregation level that is above the NAICS industry level. Therefore, choosing between using industry level data that are available only every 5 years and using the higher level aggregate data that are available more frequently was necessary.

Analysis of data from a six-digit industry approach would allow a clearer perspective, since each six-digit industry within a NAICS three-digit category would likely face a unique set of economic factors. One of the conclusions in Thompson's study was that the use of aggregate data may have affected the study results.[11] Consequently, one may learn more by examining variations across six-digit industries in just two time periods than by looking at variations across three-digit NAICS annually.

As a result, the analysis in this article is based on BEA data from the 1997 and 2002 Benchmark I-O tables and from the 1997 and 2002 Economic Census, along with PPI annual average indexes for 1997 and 2002. (Note: The 2007 Benchmark I-O Accounts tables were not available when I conducted this research, so more recent data could not be used.) In some cases, multiple six-digit NAICS were combined in the I-O tables in either 1997 and/or 2002. In those cases, data from the other sources were combined so that accurate comparisons could be made. After those adjustments, data were available for 257 manufacturing industries. The complete list of industries can be found in appendix B.

Since the trend toward globalization affects the manufacturing sector most strongly, I limited the analysis to this sector in order to manage the amount of data required. This choice was in line with the other studies that also focused solely on manufacturing.

I approached this study's analysis by constructing the following three measures that alone or combined might indicate the level of industry globalization and then comparing the values of those statistics with price changes calculated using the corresponding industry PPIs:

- Import penetration = imports/(domestic production + imports – exports).
- Export intensity = exports/domestic production.
- Net import penetration = (imports – exports)/(domestic production + imports).

Overall levels of imports to the United States and exports from the United States during each of the selected years as well as changes in those measures over the period were considered possible measures. However, since a change in the value of import and export levels reflects changes in price as well as quantity, comparisons between changes in these data elements and price index changes might be misleading. In addition, all three studies cited earlier used import penetration rather than the absolute level of imports. In addition to examining import penetration, Thompson included exports as part of her analysis by calculating export intensity.[12] As a result, I adopted analysis of export intensity for this article, as well.

Given the assumption that higher imports of a product led to increased supply, price change seemed more likely to correlate negatively with import penetration levels or changes in those levels. On the other hand, high or increasing export levels seemed probable to indicate increased demand and a positive correlation seemed more likely between the export measures and price change. Since most industries have both imports and exports, I calculated the additional industry statistic net of import penetration for use in this article.

Since the value of the net import penetration measure would be positive when imports were greater than exports and negative when exports were larger, the expectation was that the level and changes in this measure would be negatively correlated with price change.

The 1997 and 2002 values were calculated for these statistics. For industries with an extremely low level of imports and/or exports in 1997, a small change in the level of imports or exports in 2002 could result in a very large percent change, possibly skewing analysis. As a result, I measured change by calculating the difference between the 1997 and 2002 levels rather than calculating the percent change for these statistics.

The cost of materials may be indirectly affected by globalization because increased use of imported materials may decrease costs. Furthermore, change in this measure was expected to be an important contributor to industry price change, with a positive relationship expected. As a result, I used data from the Economic Census to calculate the change in cost of materials between 1997 and 2002 for each industry.

Many different factors not directly related to the trend toward globalization may also affect each industry's price change. Identifying and quantifying all of these potential factors are beyond the scope of this article.

Table 1 summarizes the data values for some of those statistics across the 257 manufacturing industries studied. Appendix B lists the 1997 and 2002 import penetration and export intensity values by industry.

Table 1. All manufacturing industries data summary, 1997–2002

Statistic	Average (percent)[1]	Standard deviation	High (percent)[1]	Low (percent)[1]	Number of negative values	Number of positive values < 5	Number of positive values ≥ 5
1997–2002 price change	1.41	10.80	85.97	–56.20	72	80	105
1997 import penetration	19.80	16.33	82.64	.00	—	65	192
2002 import penetration	23.17	19.25	96.63	.00	—	58	199
1997–2002 import penetration difference[2]	3.37	7.52	39.10	–37.45	56	111	90
1997 export intensity	14.26	13.70	66.06	.00	—	67	190
2002 export intensity	12.98	13.98	97.66	.00	—	75	182
1997–2002 export intensity difference[2]	–1.28	8.05	38.18	–56.82	132	118	27
1997 net import penetration	5.70	15.27	77.00	–59.85	104	63	90
2002 net import penetration	10.49	16.97	87.10	–36.48	87	51	119
1997–2002 net import penetration difference[2]	4.79	8.15	46.00	–18.81	60	99	98
1997–2002 cost of materials percent change	.20	23.98	99.65	–72.91	136	22	99

[1] Values are in percentages, except for differences, which are levels.

[2] For industries with an extremely low level of imports and/or exports in 1997, a small change in the level of imports or exports in 2002 could result in a very large percent change for export intensity and import penetration, possibly skewing analysis. As a result, change was measured by calculating differences rather than percent change for these statistics.

NOTE: Dash indicates data not applicable.

SOURCES: Bureau of Economic Analysis, Census Bureau, and U.S. Bureau of Labor Statistics.

Analysis

Presumably, a number of unique factors in addition to globalization would affect the level of price change for most individual industries. As mentioned earlier, given the number of industries and potential independent variables, attempting to build a full regression model for price change that applied to all industries did not seem realistic. As a result, the goal of this analysis was only to determine whether a relationship existed between any of the globalization measures and changes in industry PPIs. The first step of analysis was to run single-variable regressions, with the PPI price change as the dependent variable and with each of 10 independent variables found in the statistic column of table 2. The results of the regressions are displayed in table 2.

The results indicated that domestic price change in an industry was negatively correlated with both the 1997 and 2002 import penetration levels in that industry, perhaps indicating that to remain competitive, domestic producers responded to the introduction of imports by lowering their own prices. The 1997 and 2002 levels of net import penetration also were negatively correlated with price change. The net import penetration regressions, however, had smaller coefficients, slightly higher standard errors, and lower explanatory power than the import penetration equations. This result perhaps indicates that increases in exports in an industry do not directly offset the negative influence of imports on price change. As expected, a positive relationship was also found between the change in cost of materials and change in price, although the coefficient is very small. In addition, no significant relationship was found between price change and the differences in the levels of import penetration, export intensity, and net import penetration over time, i.e., between 1997 and 2002.

The regression results also showed that domestic price change was negatively correlated with export level. This relationship was contrary to the results for import penetration and net import penetration and seemed counterintuitive, since the expectation was that the higher demand coming from exports would cause higher prices. The results were particularly surprising, since export transactions are directly priced in the PPI. An examination of the detailed data, however, sheds some light on this phenomenon, showing that industries tend to have similar levels of both imports and exports. For example in 1997, only 6 of the 66 industries in which exports accounted for less than 5 percent of domestic production had an import penetration level of more than 10 percent and only 9 of the 62 industries in which exports accounted for more than 20 percent of domestic production had an import penetration level of less than 20 percent. Although the United States may have both imports and exports of the same product, a number of different products are included in every industry, so the mix of imported products in an industry would likely be different from the mix of exported products. In addition, individual industries that include products from more than one processing stage may use global production processes. Firms in an industry may be exporting less processed intermediate materials and then importing the more processed intermediate product.

Using multiple independent variables with price change as the dependent variable, I ran additional regres-

Table 2. Relationship between industry price change and globalization statistics, 1997–2002

Statistic	Coefficient	Standard error	*R*-square
1997 import penetration	[1]–0.139	0.041	0.044
2002 import penetration	[1]–.122	.034	.044
1997–2002 import penetration difference	–.145	.089	.006
1997 export intensity	[2]–.092	.049	.014
2002 export intensity	[1]–127	.048	.027
1997–2002 export intensity difference	–.118	.084	.004
1997 net import penetration	[3]–.103	.044	.021
2002 net import penetration	[3]–.091	.039	.020
1997–2002 net import penetration difference	–.034	.083	<.001
1997–2002 cost of materials percent change	[1].001	<.001	.064

[1] Significant at .01 level.
[2] Significant at .10 level.
[3] Significant at .05 level.

NOTES: All models were tested for heteroscedasticity, and no problems were found.
SOURCE: U.S. Bureau of Labor Statistics.

sions. The results are displayed in table 3. In models 1 and 2, both import penetration and export intensity were the independent variables. Model 1 used 1997 data and model 2 used 2002 data. With the use of the two independent variables, the relationship between price change and import levels remained significant in both regressions with a coefficient of –0.144 for 1997 import levels and a coefficient of –0.108 for 2002 import levels. The relationship between price change and export levels was not significant in either year, but in 1997, the coefficient was quite small but positive. For models 3 and 4, cost of materials change was added as an independent variable. Import penetration levels remained significant but with a somewhat smaller negative coefficient, and the cost of materials change was also significant. For models 5 and 6, import penetration difference and export intensity difference were also added, but neither was significant. In addition, the added variable did not result in any major change in the significance of the other independent variables. I also ran a model using only import penetration difference and export intensity difference as the independent variables, but neither one had a significant relationship with price. Consequently, the results were not included in the table. Models 7 and 8 include net import penetration difference and cost of materials percent change, along with 1997 and 2002 net import penetration levels, respectively. Change in price was negatively correlated with net import penetration levels and positively correlated with cost of materials change, as was the case with the single variable regression models. Again, the explanatory power of import penetration seemed to exceed that of net import penetration. The relationship between price change and the net import penetration difference was not significant.

Thus far, analysis has clearly shown an overall negative relationship between price and import penetration at the industry level, as expected. On the other hand, expectations that a positive relationship would exist between industry export intensity and price change were not supported. The unexpected outcome with respect to exports may be a result of the existence of nonglobal industry-specific economic factors, which were considered out of scope for this study because of the difficulty of obtaining the data. As mentioned earlier, the unpredicted results may also be related to the fact that industries with the highest exports also often have high imports, so the impact of imports on industry prices may have overshadowed the impact of exports. To investigate this possibility, I created two sets of industries, one with exports and negative or zero net import penetration and the other with exports and positive net import penetration, and then performed an

Table 3. Results of multiple independent variable regressions with industry price change, 1997–2002

Independent variables	1	2	3	4	5	6	7	8
1997 import penetration	[1]–0.144 (.050)	—	[2]–0.109 (.050)	—	[2]–0.104 (.051)	—	—	—
2002 import penetration	—	[2]–.108 (.045)	—	[3]–.083 (.045)	—	[2]–.104 (.051)	—	—
1997–2002 import penetration difference	—	—	—	—	–.002 (.109)	.102 (.124)	—	—
1997 export intensity	.011 (.060)	—	.006 (.059)	—	<–.001 (.063)	—	—	—
2002 export intensity	—	–.031 (.062)	—	–.012 (.061)	—	–.007 (.063)	—	—
1997–2002 export intensity difference	—	—	—	—	–.054 (.107)	–.047 (.103)	—	—
1997 net import penetration	—	—	—	—	—	—	[3]–.075 (.043)	—
2002 net import penetration	—	—	—	—	—	—	—	[3]–.075 (.043)
1997–2002 net import penetration difference	—	—	—	—	—	—	–.041 (.080)	–.167 (.387)
1997–2002 cost of materials percent change	—	—	[1].001 (<.001)	[1].001 (<.001)	[1].001 (<.001)	[1].001 (<.001)	[1].001 (<.001)	[1].001 (<.001)
R-square	.044	.048	.092	.091	.094	.094	.079	.080
F	5.88	6.45	8.56	8.45	5.18	5.18	7.27	4.39
$p > F$	.003	.002	<.001	<.001	<.001	<.001	<.001	.001

[1] Significant at .01 level.
[2] Significant at .05 level.
[3] Significant at .10 level.

NOTES: All models were tested for heteroscedasticity, and no problems were found. Dash indicates data not applicable.
SOURCE: U.S. Bureau of Labor Statistics.

analysis on each industry subset. Ideally, the strong export set of industries would include only those with exports and no imports, but this category did not include enough industries, with none in 1997 and only eight in 2002. As a result, the definition for the strong export subset of industries was expanded to include all industries with zero or negative net import penetration in 1997. For each of the industry subsets, I ran single variable regressions along with multiple independent variable regressions that included both import penetration and export intensity. Tables 4 and 5 display the results of these regressions.

The results of the single variable regressions did not support the theory that a positive relationship would exist between export intensity and domestic price change. The coefficients for the set of industries with zero or negative net import penetration showed that domestic price change had a significant negative relationship with 2002 import penetration and with import penetration difference. The coefficients for all the other globalization measures were also negative but not significant. Price change for the set of industries with positive net import penetration change had a significant negative relationship with 1997 and 2002 import penetration, export intensity, and net import penetration levels, with coefficient size that was similar to that of the full set of industries and *R*-squares that were generally larger.

The results of the multiple independent variable regressions that included both import penetration and export

Table 4. Relationship between industry price change and globalization statistics for industry subsets, 1997–2002

Statistic	Net import penetration ≤ 0			Net import penetration > 0		
	Coefficient	Standard error	*R*-square	Coefficient	Standard error	*R*-square
1997 import penetration	–0.165	0.103	0.023	[1]–0.143	0.044	0.071
2002 import penetration	[2]–.188	.083	.044	[1]–.109	.037	.057
1997–2002 import penetration difference	[3]–.329	.172	.032	–.029	.098	.001
1997 export intensity	–.038	.070	.003	[1]–.225	.072	.064
2002 export intensity	–.096	.076	.014	[1]–.170	.059	.055
1997–2002 export intensity difference	–.139	.126	.011	–.068	.115	.003
1997 net import penetration	–.107	.115	.008	[3]–.134	.057	.038
2002 net import penetration	–.196	.130	.020	[3]–.083	.045	.024
1997–2002 net import penetration difference	–.055	.127	.002	–.003	.110	.000

[1] Significant at .01 level.
[2] Significant at .05 level.
[3] Significant at .10 level.

NOTES: All models were tested for heteroscedasticity, and no problems were found.
SOURCE: U.S. Bureau of Labor Statistics.

Table 5. Results of multiple independent variable regressions with industry price change, 1997–2002

Independent variable	Net import penetration ≤ 0		Net import penetration > 0	
1997 import penetration	[1]–0.428 (.195)	—	–0.094 (.065)	—
2002 import penetration	—	[1]–0.391 (.167)	—	–0.066 (.052)
1997 export intensity	.210 (.132)	—	–.109 (.108)	—
2002 export intensity	—	.212 (.152)	—	–.097 (.083)
R-square	.044	.060	.078	.066
F	2.57	3.56	5.93	4.93
p > *F*	.081	.032	.003	.009

[1] Significant at .05 level.

NOTES: All models were tested for heteroscedasticity, and no problems were found. Dash indicates data not applicable.
SOURCE: U.S. Bureau of Labor Statistics.

intensity were not conclusive. For the set of industries with zero or negative net import penetration, the coefficients for both 1997 and 2002 export intensity were positive and relatively large but they were not significant. Although the export results were not significant, they may support the idea that a positive relationship could exist between export intensity and domestic prices that is offset by the negative relationship between prices and import penetration. The coefficients for import penetration were negative and much larger than the coefficients for the corresponding regressions for the entire set of industries, and they were significant. For the set of industries with positive net import penetration, all the coefficients were negative but insignificant.

A SIGNIFICANT NEGATIVE RELATIONSHIP exists between industry price change over the period 1997 to 2002 and the levels of import penetration and net import penetration in both the starting and ending years. No consistent evidence of a corresponding relationship was found between export intensity and domestic price change.

Further research opportunities

When 2007 BEA I-O data become available, additional analysis could be applied to the relationships between price change and globalization statistics over a longer time length. Additional research could also be done to understand better the relationship between price change and globalization statistics in industries with significant amounts of both imports and exports. This additional research may require the use of detailed product-level import and export data that are available from the International Trade Commission. Since these data are available more frequently, they could also be used to create monthly or quarterly time series analyses. □

Notes

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[1] Interactive Access to Industry Economic Accounts Data, Input-output accounts, Use Table, The Use of Commodities by Industries after Redefinitions (1998–2002, 2010), Sector level; Historical Benchmark I-O, Use Table, The Use of Commodities by Industries after Redefinitions (1987,1997), Sector level (Bureau of Economic Analysis), **http://www.bea.gov/iTable/iTable.cfm?ReqID=5&step=1**.

[2] Interactive Access to Industry Economic Accounts, Domestic Product and Income, Table 1.1.5 Gross Domestic Product, Annual 1997–2002 (Bureau of Economic Analysis), **http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1**.

[3] For more information on the process the PPI uses to select producers and items, visit **http://stats.bls.gov/opub/hom/homch14.htm#data_sources_and_collection_methods**.

[4] The U.S. Census Bureau administers the North American Industry Classification System (NAICS). For more information about NAICS, visit **http://www.census.gov/eos/www/naics/index.html**.

[5] Raphael Auer and Andreas M. Fischer, "The Effect of Low Wage Import Competition on U.S. Inflationary Pressure," *Journal of Monetary Economics*, May 2010, pp. 491–503.

[6] Natalie Chen, Jean Imbs, and Andrew Scott, "Competition, Globalization and the Decline of Inflation," CEPR Discussion Paper no. 4695 (paper presented at Centre for Economic Policy Research, London, October 2004), **http://www.cepr.org/pubs/dps/DP4695.asp**.

[7] Aileen J. Thompson, "Import Competition and Market Power: Canadian Evidence," *North American Journal of Economics and Finance*, May 2002, pp. 40–55.

[8] PPI industry data are found in table 5, and commodity data are found in table 6 of the PPI Detailed Report at the BLS website, **http://stats.bls.gov/ppi/ppi_dr.htm**.

[9] The United Nations Statistics Division administers the Standard International Trade Classification (SITC) structure. For more information about the SITC, visit **http://unstats.un.org/unsd/class/family/family2.asp?Cl=14**.

[10] The U.S. International Trade Commission administers the Harmonized Tariff Schedule coding structure. For more information on the Harmonized Trade Schedule, visit **http://hts.usitc.gov/**.

[11] Thompson, "Import Competition and Market Power," p. 20.

[12] Thompson, "Import Competition and Market Power," p. 11.

APPENDIX A: Globalization and growth

Table A–1. Measures of globalization magnitude and growth, 1997–2002

Measure	1997	1998	1999	2000	2001	2002
Manufacturing imports as percentage of domestic supply of manufactured good	15.0	15.7	17.0	19.3	19.5	20.0
Exports as percentage of total manufacturing output	13.6	13.3	13.0	13.8	13.6	13.0
Imports as percentage of gross domestic product	12.7	12.7	13.4	14.8	13.6	13.4
Exports as percentage of gross domestic product	11.5	10.8	10.6	11.0	10.0	9.4
Imports and exports as percentage of gross domestic product	24.1	23.5	24.0	25.8	23.6	22.9

SOURCE: Bureau of Economic Analysis.

APPENDIX B: Industry import penetration and export intensity

Table B–1. Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
311111	Dog and cat food manufacturing	1.8	6.7	1.6	5.3
311119	Other animal food manufacturing	1.0	3.0	1.4	5.9
31121	Flour milling and malt manufacturing	3.8	11.4	4.7	11.0
311225	Fats and oils refining and blending	1.5	5.2	1.1	2.8
31122AC	Soybean and other oilseed processing	13.1	20.6	12.4	20.8
311230	Breakfast cereal manufacturing	1.8	1.9	2.8	4.7
31131	Sugar manufacturing	13.7	2.5	9.1	2.6
311320	Chocolate and confectionery manufacturing from cacao beans	43.2	22.9	37.2	10.0
311330	Confectionery manufacturing from purchased chocolate	.0	.0	1.9	3.0
311340	Nonchocolate confectionery manufacturing	10.8	4.7	16.3	4.4
31141	Frozen food manufacturing	5.1	4.6	5.2	3.3
31142	Fruit and vegetable canning, pickling, and drying	8.1	5.6	8.5	6.3
311513	Cheese manufacturing	3.3	1.1	4.0	1.2
311514	Dry, condensed, and evaporated dairy product manufacturing	5.8	9.7	5.0	9.0
31151AC	Fluid milk and butter manufacturing	.2	.5	.7	.5
311520	Ice cream and frozen dessert manufacturing	.1	2.0	.2	1.4
311615	Poultry processing	.1	4.7	.3	4.2
31161AC	Animal (except poultry) slaughtering, rendering, and processing	4.2	7.9	5.7	8.0
31171	Seafood product preparation and packaging	13.4	3.4	16.9	3.8
31181	Bread and bakery product manufacturing	2.4	1.4	3.5	1.6
31182	Cookie, cracker, and pasta manufacturing	2.2	1.1	2.2	1.2
311830	Tortilla manufacturing	.0	.0	.0	.2
31191	Snack food manufacturing	4.4	8.2	4.1	6.5
311920	Coffee and tea manufacturing	6.5	2.9	10.5	4.7
311930	Flavoring syrup and concentrate manufacturing	36.2	5.1	39.4	3.6
31194	Seasoning and dressing manufacturing	6.6	3.5	8.2	4.0
31199	All other food manufacturing	5.5	11.7	8.0	10.7
312110C	Soft drink and ice manufacturing	1.8	.9	2.6	.8
312120	Breweries	7.0	2.0	11.3	1.5
312130	Wineries	23.5	4.7	27.1	4.3
312140	Distilleries	23.3	5.5	27.5	4.1
3122A0C	Tobacco product manufacturing	3.5	14.2	2.8	5.6
3131	Fiber, yarn, and thread mills	5.8	4.7	10.4	8.3
313210	Broadwoven fabric mills	21.5	11.2	47.4	40.8
31322	Narrow fabric mills and schiffli machine embroidery	21.8	25.7	33.2	40.0
313230	Nonwoven fabric mills	9.9	15.9	8.1	12.7
31324	Knit fabric mills	9.9	5.6	28.4	16.8
31331	Textile and fabric finishing mills	.1	.2	.1	.2
313320	Fabric coating mills	16.5	25.0	22.4	23.5
314110	Carpet and rug mills	8.6	6.7	11.1	4.6

Table B–1. Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
31412	Curtain and linen mills	19.9	5.2	36.5	5.3
31491	Textile bag and canvas mills	13.3	3.1	18.3	3.2
31499	All other textile product mills	33.6	19.8	27.8	13.9
3151	Apparel knitting mills	13.6	8.0	27.5	6.8
3152	Cut and sew apparel manufacturing	50.7	10.6	67.6	10.8
3159	Apparel accessories and other apparel manufacturing	43.9	25.7	61.5	23.0
316110	Leather and hide tanning and finishing	26.7	21.8	65.8	50.8
3162	Footwear manufacturing	82.6	15.5	91.3	20.6
3169	Other leather and allied product manufacturing	70.4	20.2	80.1	25.5
3211	Sawmills and wood preservation	21.0	8.1	21.6	6.3
321219	Reconstituted wood product manufacturing	19.7	6.0	28.1	4.5
32121AC	Veneer and plywood manufacturing	14.2	8.4	20.5	7.2
32121BC	Engineered wood member and truss manufacturing	8.2	5.3	12.9	2.1
32191	Millwork	5.0	2.4	7.7	1.6
321920	Wood container and pallet manufacturing	5.7	1.5	8.2	2.3
321991	Manufactured home (mobile home) manufacturing	.0	.2	.3	.4
321992	Prefabricated wood building manufacturing	1.5	3.2	4.2	1.1
321999	All other miscellaneous wood product manufacturing	29.8	6.8	31.8	4.4
322110	Pulp mills	44.5	47.1	45.5	46.0
3221A0C	Paper and paperboard mills	14.2	9.8	15.1	6.6
32221	Paperboard container manufacturing	1.4	3.3	1.8	3.3
32222AC	Coated and laminated paper, coated and laminated packaging paper, and plastics film manufacturing	7.0	9.3	8.5	14.2
32222BC	All other paper bag and coated and treated paper manufacturing	16.7	11.4	23.9	10.1
32223	Stationery product manufacturing	4.6	6.3	6.0	7.4
322291	Sanitary paper product manufacturing	3.1	6.5	7.9	7.6
322299	All other converted paper product manufacturing	4.1	1.4	14.8	7.9
32311	Printing	1.8	2.0	2.3	2.2
32312	Support activities for printing	.2	.9	.2	1.1
324110	Petroleum refineries	7.6	5.3	11.0	4.6
324121	Asphalt paving mixture and block manufacturing	.9	.6	.6	.7
324122	Asphalt shingle and coating materials manufacturing	1.9	2.0	1.2	2.2
324191	Petroleum lubricating oil and grease manufacturing	.1	.8	.2	.7
324199	All other petroleum and coal products manufacturing	1.8	32.1	2.8	27.8
325110	Petrochemical manufacturing	9.0	7.9	8.1	9.2
325120	Industrial gas manufacturing	2.0	3.5	2.1	2.7
325130C	Synthetic dye and pigment manufacturing	27.4	21.8	25.2	25.1
32518	Other basic inorganic chemical manufacturing	15.1	17.4	24.1	23.2
32519	Other basic organic chemical manufacturing	20.3	23.6	22.1	24.6
325211	Plastics material and resin manufacturing	11.6	21.8	14.6	25.4
325212	Synthetic rubber manufacturing	13.5	21.4	20.4	28.0

Table B–1. **Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002**

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
32522	Artificial and synthetic fibers and filaments manufacturing	11.3	13.1	13.8	12.6
32531	Fertilizer manufacturing	18.0	21.3	22.5	17.9
325320	Pesticide and other agricultural chemical manufacturing	8.5	13.5	12.1	12.0
3254	Pharmaceutical and medicine manufacturing	26.8	12.2	32.5	10.1
325510	Paint and coating manufacturing	2.9	6.7	3.3	6.8
325520	Adhesive manufacturing	2.7	5.1	4.9	9.5
32561	Soap and cleaning compound manufacturing	3.9	6.6	5.1	6.8
325620	Toilet preparation manufacturing	8.5	10.2	10.9	8.8
325910	Printing ink manufacturing	9.1	8.1	6.5	11.4
325920	Explosives manufacturing	11.8	12.4	11.2	13.8
32599	All other chemical product and preparation manufacturing	12.4	13.1	11.2	13.8
326110C	Plastics packaging materials and unlaminated film and sheet manufacturing	7.4	10.7	7.6	8.9
32612	Plastics pipe, pipe fitting, and unlaminated profile shape manufacturing	7.3	10.1	5.8	5.5
326130	Laminated plastics plate, sheet (except packaging), and shape manufacturing	.0	.0	.0	.8
326160	Plastics bottle manufacturing	3.2	3.2	4.5	4.0
32619AC	Other plastics product manufacturing	8.6	7.4	11.2	8.3
3261A0C	Urethane and polystyrene foam product manufacturing	.0	.0	.0	.1
32621	Tire manufacturing	20.3	10.3	29.1	14.2
326220	Rubber and plastics hoses and belting manufacturing	17.3	12.3	27.2	25.0
326290C	Other rubber product manufacturing	13.6	7.4	10.8	7.5
32711AC	Pottery, ceramics, and plumbing fixture manufacturing	43.9	10.2	53.1	18.6
32712	Clay building material and refractories manufacturing	21.7	13.3	42.5	17.3
327211	Flat glass manufacturing	16.3	13.1	18.6	20.7
327213	Glass container manufacturing	10.1	3.2	13.5	3.6
32721AC	Glass products, except containers	16.3	13.1	20.0	13.8
327310	Cement manufacturing	12.3	.7	13.8	.7
327320	Ready-mix concrete manufacturing	.0	.0	.0	.1
32733	Concrete pipe, brick, and block manufacturing	.4	.4	.9	.4
327390	Other concrete product manufacturing	6.8	1.6	10.1	1.1
3274A0C	Lime and gypsum product manufacturing	3.0	1.2	2.0	1.7
327910	Abrasive product manufacturing	17.1	9.6	32.3	17.6
327991	Cut stone and stone product manufacturing	38.5	2.7	43.2	1.8
327992	Ground or treated mineral and earth manufacturing	9.3	10.0	9.6	7.9
327993	Mineral wool manufacturing	5.5	9.1	7.3	7.7
327999	All other miscellaneous nonmetallic mineral product manufacturing	8.8	7.9	15.0	12.4
33111	Iron and steel mills and ferroalloy manufacturing	19.1	6.0	20.6	6.4

Table B–1. Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
3312	Steel product manufacturing from purchased steel	23.7	6.7	21.1	5.8
33131AC	Alumina refining and primary aluminum production	29.7	8.0	32.9	3.8
33131BC	Aluminum product manufacturing from purchased aluminum	9.2	12.8	12.7	11.7
331411	Primary smelting and refining of copper	25.9	12.6	44.9	6.2
331419	Other nonferrous metal primary smelting and refining	59.1	28.4	64.2	23.3
33142	Copper rolling, drawing, extruding, and alloying	14.6	9.8	15.9	11.8
33149	Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying	12.3	14.8	18.0	24.2
33151	Ferrous metal foundries	3.5	2.8	3.1	2.2
33152	Nonferrous metal foundries	.2	.1	.0	.1
332114	Custom roll forming	.0	.0	.0	.0
33211ABC	Forging and stamping, except custom roll forming	.5	3.1	1.1	1.5
33221AC	Cutlery, utensil, pot, and pan manufacturing	30.6	9.3	31.4	10.3
33221BC	Handtool manufacturing	21.5	11.5	28.2	13.8
332310C	Plate work and fabricated structural product manufacturing	2.3	3.7	4.7	2.2
33232	Ornamental and architectural metal products manufacturing	.9	1.1	2.1	1.3
332410	Power boiler and heat exchanger manufacturing	10.2	31.1	30.2	17.8
332420	Metal tank (heavy gauge) manufacturing	3.7	13.7	9.3	8.2
33243	Metal can, box, and other metal container (light gauge) manufacturing	2.7	2.5	2.9	3.0
332510	Hardware manufacturing	21.6	13.7	29.5	18.6
3326	Spring and wire product manufacturing	13.9	10.0	19.7	9.4
332710	Machine shops	.0	.0	.0	.5
33272	Turned product and screw, nut, and bolt manufacturing	12.2	6.2	12.7	5.9
3328	Coating, engraving, heat treating, and allied activities	.0	.0	.0	.1
33291	Metal valve manufacturing	19.7	14.4	26.9	17.4
332991	Ball and roller bearing manufacturing	24.3	13.4	22.6	15.9
332996	Fabricated pipe and pipe fitting manufacturing	2.5	2.7	.0	.0
33299AC	Ammunition manufacturing	3.9	21.0	10.1	12.0
33299BC	Arms, ordnance, and accessories manufacturing	12.2	17.6	19.7	12.8
33299CC	Other fabricated metal manufacturing	24.6	17.0	33.4	20.8
333111	Farm machinery and equipment manufacturing	24.5	23.6	27.0	22.5
333112	Lawn and garden tractor and home lawn and garden equipment manufacturing	4.3	9.1	.6	.5
333120	Construction machinery manufacturing	25.6	25.8	34.3	29.3
33313	Mining and oil and gas field machinery manufacturing	17.9	60.9	13.5	34.1
333220	Plastics and rubber industry machinery manufacturing	45.1	26.2	45.0	30.7
333295	Semiconductor machinery manufacturing	28.0	42.9	24.3	33.3
33329AC	Other industrial machinery manufacturing	41.6	29.2	29.4	20.6
333314	Optical instrument and lens manufacturing	59.8	59.5	96.6	97.7

Table B–1. Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
333315	Photographic and photocopying equipment manufacturing	53.1	22.4	69.7	41.4
333319	Other commercial and service industry machinery manufacturing	4.5	6.2	5.3	4.4
33331AC	Vending, commercial, industrial, and office machinery manufacturing	37.6	29.0	36.5	20.0
333414	Heating equipment (except warm air furnaces) manufacturing	4.5	8.8	12.1	5.3
333415	Air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing	12.6	18.4	15.7	15.4
33341AC	Air purification and ventilation equipment manufacturing	23.0	25.9	20.9	11.1
333511	Industrial mold manufacturing	19.5	10.2	19.7	11.0
333514	Special die and tool, die set, jig, and fixture manufacturing	8.7	5.1	8.6	4.8
333515	Cutting tool and machine tool accessory manufacturing	17.1	14.7	18.2	13.8
33351AC	Metal cutting and forming machine tool manufacturing	51.8	31.2	61.0	49.4
33351BC	Rolling mill and other metalworking machinery manufacturing	6.4	4.4	2.5	3.2
333611	Turbine and turbine generator set units manufacturing	26.4	66.1	28.6	30.5
333618	Other engine equipment manufacturing	22.0	33.9	30.9	32.6
33361AC	Mechanical power transmission equipment and gear manufacturing	36.9	31.3	40.2	21.5
33391AC	Pump and pumping equipment and measuring and dispensing pump manufacturing	55.2	77.5	17.8	20.7
333912	Air and gas compressor manufacturing	27.8	33.3	28.3	30.9
33392	Material handling equipment manufacturing	18.5	14.3	17.4	11.4
333991	Power-driven handtool manufacturing	33.4	21.6	41.9	15.5
333993	Packaging machinery manufacturing	22.7	18.6	27.6	15.8
333994	Industrial process furnace and oven manufacturing	17.7	24.1	38.5	57.9
33399AC	Other general purpose machinery manufacturing	43.1	53.1	54.0	59.9
33399BC	Fluid power process machinery	15.0	11.1	17.4	11.3
334111	Electronic computer manufacturing	12.8	16.5	30.1	17.2
334112	Computer storage device manufacturing	65.7	34.4	65.2	24.7
33411AC	Computer terminals and other computer peripheral equipment manufacturing	61.1	31.1	70.9	32.2
334210	Telephone apparatus manufacturing	24.9	25.7	38.8	30.9
334220	Radio and television broadcasting and wireless communications equipment manufacturing	15.3	21.5	39.7	15.1
334290	Other communications equipment manufacturing	23.8	16.3	15.3	8.5
334310	Audio and video equipment manufacturing	79.8	45.6	84.1	38.4
334411	Electron tube manufacturing	34.2	48.3	28.6	51.8
334412	Bare printed circuit board manufacturing	46.9	41.1	25.3	25.8
334413	Semiconductor and related device manufacturing	35.6	34.5	34.0	44.6
33441AC	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	46.9	41.1	52.9	38.2
334510	Electromedical and electrotherapeutic apparatus manufacturing	23.7	30.4	31.7	26.3

Table B–1. Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
334511	Search, detection, navigation, guidance, aeronautical, and nautical system and instrument manufacturing	3.4	7.1	4.8	8.7
334512	Automatic environmental control manufacturing for residential, commercial, and appliance use	13.8	7.6	23.6	8.9
334513	Instruments and related products manufacturing for measuring, displaying, and controlling industrial process variables	31.8	39.1	52.5	58.2
334514	Totalizing fluid meter and counting device manufacturing	19.9	9.4	18.3	6.1
334515	Instrument manufacturing for measuring and testing electricity and electrical signals	22.0	38.6	33.7	49.9
334516	Analytical laboratory instrument manufacturing	26.4	41.9	33.5	39.1
334517	Irradiation apparatus manufacturing	30.4	31.0	37.1	32.9
33451AC	Watch, clock, and other measuring and controlling device manufacturing	47.6	34.2	48.8	29.4
334613	Magnetic and optical recording media manufacturing	35.3	41.6	58.2	30.8
33461AC	Software, audio, and video media reproducing	6.8	9.0	6.6	4.6
335110	Electric lamp bulb and part manufacturing	30.7	21.7	41.6	18.8
335121	Residential electric lighting fixture manufacturing	23.7	6.7	36.4	6.8
335122	Commercial, industrial, and institutional electric lighting fixture manufacturing	23.7	6.7	36.4	6.8
335129	Other lighting equipment manufacturing	23.7	6.7	36.4	6.8
33521	Small electrical appliance manufacturing	45.1	21.2	66.3	22.7
335221	Household cooking appliance manufacturing	33.8	9.3	40.1	7.3
335222	Household refrigerator and home freezer manufacturing	9.9	13.9	20.2	12.2
335224	Household laundry equipment manufacturing	9.6	15.9	11.9	13.4
335228	Other major household appliance manufacturing	28.8	10.2	17.6	9.4
335311	Power, distribution, and specialty transformer manufacturing	18.1	11.7	31.1	9.3
335312	Motor and generator manufacturing	28.1	23.6	44.6	27.1
335313	Switchgear and switchboard apparatus manufacturing	13.0	7.8	26.1	15.0
335314	Relay and industrial control manufacturing	25.0	16.9	33.8	19.6
335911	Storage battery manufacturing	30.5	17.1	35.4	16.4
335912	Primary battery manufacturing	15.8	23.9	15.5	15.6
33592	Communication and energy wire and cable manufacturing	19.0	18.9	24.5	17.4
33593	Wiring device manufacturing	19.8	17.7	18.7	17.8
335991	Carbon and graphite product manufacturing	21.1	21.5	24.3	23.5
335999	All other miscellaneous electrical equipment and component manufacturing	36.9	35.0	42.0	38.8
33611	Automobile and light duty vehicle manufacturing	31.7	9.7	39.1	10.7
336120	Heavy duty truck manufacturing	18.8	17.5	19.1	12.8
336211	Motor vehicle body manufacturing	6.3	9.7	5.9	11.4
336212	Truck trailer manufacturing	3.8	7.9	8.7	9.3
336213	Motor home manufacturing	1.8	5.4	2.1	3.8
336214	Travel trailer and camper manufacturing	2.3	7.2	2.7	6.3
3363	Motor vehicle parts manufacturing	22.1	18.9	24.7	17.7
336411	Aircraft manufacturing	13.6	53.0	22.3	40.4
336412	Aircraft engine and engine parts manufacturing	36.8	40.1	46.0	55.6

Table B–1. Continued—Percentage of import penetration and export intensity by industry, 1997 and 2002

2002 NAICS code	Industry description	1997 import penetration	1997 export intensity	2002 import penetration	2002 export intensity
336413	Other aircraft parts and auxiliary equipment manufacturing	28.0	52.9	32.7	59.2
336510	Railroad rolling stock manufacturing	14.4	12.9	12.1	12.1
336611	Ship building and repairing	.1	9.1	.4	7.4
336612	Boat building	14.7	13.4	13.4	10.3
336991	Motorcycle, bicycle, and parts manufacturing	50.2	27.6	55.2	20.3
336992	Military armored vehicle, tank, and tank component manufacturing	9.7	65.7	16.2	35.3
336999	All other transportation equipment manufacturing	6.8	5.8	3.4	3.4
337110	Wood kitchen cabinet and countertop manufacturing	3.2	.3	4.1	.3
337121	Upholstered household furniture manufacturing	8.7	2.6	14.0	1.8
337122	Nonupholstered wood household furniture manufacturing	31.7	10.2	44.4	5.6
337127	Institutional furniture manufacturing	26.1	7.0	35.2	9.6
33712AC	Metal and other household furniture manufacturing	27.8	4.2	45.5	4.3
337212	Custom architectural woodwork and millwork manufacturing	.0	.0	6.9	1.5
337215	Showcase, partition, shelving, and locker manufacturing	4.4	3.1	24.2	5.3
33721AC	Office furniture manufacturing	6.3	2.6	1.8	.8
337910	Mattress manufacturing	.8	1.3	1.1	1.2
337920	Blind and shade manufacturing	14.9	1.8	20.3	1.0
339111	Laboratory apparatus and furniture manufacturing	2.3	10.3	3.6	6.0
339112	Surgical and medical instrument manufacturing	17.9	19.4	26.6	20.6
339113	Surgical appliance and supplies manufacturing	9.8	17.5	16.5	15.6
339114	Dental equipment and supplies manufacturing	13.1	16.9	18.4	18.5
339115	Ophthalmic goods manufacturing	39.3	17.8	38.4	17.9
339116	Dental laboratories	.0	.0	.0	.2
33991	Jewelry and silverware manufacturing	49.9	7.9	66.8	23.8
339920	Sporting and athletic goods manufacturing	29.2	17.1	31.6	10.4
33993	Doll, toy, and game manufacturing	77.1	17.6	83.1	17.0
33994	Office supplies (except paper) manufacturing	25.1	13.5	31.2	10.7
339950	Sign manufacturing	1.0	1.1	1.7	1.7
339991	Gasket, packing, and sealing device manufacturing	20.5	14.5	25.3	16.2
339992	Musical instrument manufacturing	49.7	24.7	43.4	14.0
339994	Broom, brush, and mop manufacturing	23.2	6.3	30.4	6.6
33999AC	All other miscellaneous manufacturing	34.7	17.9	33.5	11.4

SOURCES: Bureau of Economic Analysis, Census Bureau, and U.S. Bureau of Labor Statistics.