Trade-sensitive employment: who are the affected workers?

More than 1 in 8 manufacturing jobs now relate to exports, creating openings for workers with above average skills; however, imports have displaced job prospects in industries with less skilled labor and more women and minorities

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Economic theory teaches that there are gains from trade, but the gains are net gains. Although the secular increase in both imports and exports as a percentage of Gross National Product is generally regarded as beneficial to the economy and increased exports have generated additional employment opportunities, these changes have been accompanied by reduced employment opportunities and adjustment burdens for workers in import-competing industries. The adaptation of workers in the import-competing industries to these new and changing demand conditions can involve extended periods of job search, retraining, and relocation and is likely to be costly. Based on our analysis, the adjustment burden falls more often on women, minorities, the less-educated, and the lower paid—the groups least able to afford it.

This article provides a detailed description of the demographic and occupational characteristics of employees in those industries that experienced the largest changes in employment opportunities as a result of trade during 1964–75. As was done by the Bureau of International Labor Affairs in exploring this issue,[1] our present analysis uses a disaggregated industrial perspective because (a) the impacts of trade often appear in specific and well-defied product categories; (b) trade policy decisions are usually made at an industry level; and (c) worker characteristics, necessary to accurately measure adjustment costs, vary substantially from industry to industry.

To the extent that worker characteristics differ between trade-enhanced industries and those adversely affected by trade, the labor adjustment costs will be greater. Furthermore, to the extent that industries which experienced the largest negative impact on job opportunities are characterized by relatively intensive use of unskilled labor, adjustment costs include reduced income for this already low-income group, as real wages fall in response to lower demand.[2]

Measuring the impact of trade

The following methodology was used to identify the impact of trade on employment opportunities by industry. The impact of imports on "employment opportunities" was measured by the number of jobs that would be required to produce the dollar value of the imports (including transportation margins and tariff duties) in

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the same industry in the United States. The impact of exports on job opportunities was measured by the number of jobs necessary to produce those exports.[3]

Estimates of the impact of manufacturing trade on domestic employment opportunities during 1964–75 were made on a detailed industry basis using the 367-sector U.S. input-output table, annual U.S. trade data, and labor-output ratios. The use of the input-output table made it possible to estimate both the direct and indirect impacts of trade on employment opportunities.[4] The direct impact on employment opportunities in an industry occurs when demand changes because of changes in industry exports or in imports of similar products. The indirect impact includes the effects on industries which supply inputs to industries whose products are directly affected by trade. For example, the indirect effect of automobile imports on the domestic production of steel is included in the estimates of the impact of trade on employment in the steel industry.

There can be no doubt that trade has become a more important influence on U.S. employment. Table 1 shows employment opportunities in manufacturing directly and indirectly related to manufactures exports during 1964–75. In 1964, approximately 1 in 14 manufacturing workers was involved in the production of manufactures exports. By 1974, more than 1 in 8 workers was involved either directly or indirectly in the production of manufactures exports. With the expansion of exports and related job opportunities, however, imports have grown, slowing employment growth or displacing workers in import-competing industries.

The net effect of these trade-related changes in employment opportunities is relatively small and is largely a function of the business cycle. However, the net effect masks the impact on workers because international trade theory predicts that workers in export- and import-competing sectors will possess different skills. Empirical studies have shown that the United States has a comparative advantage in the production of goods which intensively use skilled labor and a comparative disadvantage in the production of goods which intensively use unskilled labor. Over time, with the strengthening of the other major industrial countries and, most recently, the rapid growth of the upper-tier developing countries, the United States has met increased competition in more traditional industries which employ proportionately more unskilled labor. Alternatively, U.S. production and export of advanced technology products, such as aircraft and computers, which employ relatively more skilled labor, has historically led other nations.

The next segment of the analysis will identify those industries which had the largest change in employment opportunities as a result of changes in trade and examine the characteristics of the workers in those industries. Examination of workers' characteristics will identify the effects which changes in trade have had upon the composition of employment.

Table 1. Employment in manufacturing directly related to manufacturing exports

[thousands]

Year	Opportunities in manufacturing related to manufacturing exports	Manufacturing employment	Ratio
1964	1,236	17,274	14.0
1965	1,265	18,062	14.3
1966	1,369	19,214	14.0
1967	1,409	19,447	13.8
1968	1,509	19,781	13.1
1969	1,686	20,167	12.0
1970	1,723	19,349	11.2
1971	1,615	18,572	11.5
1972	1,648	19,090	11.6
1973	2,155	20,068	9.3
1974	2,641	20,046	7.6
1975	2,436	18,347	7.5

Tables 2 and 3 list the 20 manufacturing industries which had the largest positive and negative trade-related employment changes between 1964 and 1975.[5] The direct and indirect components of the net trade-related employment opportunities are also shown for each of these industries. In general, if the industry was favorably or unfavorably affected when direct and indirect effects were combined, it was affected both directly and indirectly in the same direction. Data for all industries are available on request.

Table 2 shows that the sector with the largest decline in employment opportunities was apparel with a decline of more than 103,000 between 1964 and 1975. Several other textile and apparel sectors were also among the 20 most adversely affected industries. Other industries that experienced large negative impacts included motor vehicles, steel, footwear (both rubber and nonrubber), and radio and television sets. Each of these sectors have applied for relief from import competition under Section 201 of the Trade Act of 1974.

Among the industries which had the largest increase in employment opportunities as a result of trade (table 3), aircraft equipment and computing machines stand out with gains ranging from more than 38,000 to 54,000 job opportunities. The other positively affected industries included several electrical and nonelectrical machinery sectors. Gains generally occurred among advanced technology industries; the few exceptions were in logging, veneer and plywood, and sawmills. These three industries each had negative net employment opportunities in 1964, but they registered an improvement over the period. The improvement in these sectors may not be surprising because they are dependent, directly or indirectly, on an abundance of arable land that is relatively plentiful in the United States. Improved performance in these sectors may be analogous to the recent improved export performance of U.S. agriculture.

Table 2. The 20 industries in which job opportunities were most adversely affected by trade between 1964 and 1975

I-O class[1]	Industry description	Net trade-related job opportunities		Change in net trade-related job opportunities between 1964 and 1975		
		1964	1975	Total	Direct	Indirect
1804	Apparel, purchased	−41,569	−144,932	−103,363	−87,048	−16,315
5903	Motor vehicles and parts	12,256	−63,939	−76,195	−54,299	−21,896
3701	Furnaces, steel products	10,055	−36,447	−46,502	−32,825	−13,677
3402	Nonrubber footwear	−8,570	−46,315	−37,745	−36,790	−957
6105	Motorcycles, bicycles, and parts	−7,150	−29,817	−22,667	−19,980	−2,687
5601	Radio and television sets	−5,581	−25,986	−20,405	−19,098	−1,307
1601	Broadwoven fabric mills	−22,688	−40,815	−18,127	7,810	−25,937
3202	Rubber footwear	−4,601	−15,292	−10,691	−10,377	−314
3101	Petroleum refining	−2,190	−12,395	−10,205	−9,843	−362
2307	Furniture and fixtures, n.e.c.	−3,101	−13,094	−9,993	−9,933	−66
5104	Office machines, n.e.c.	−700	−9,235	−8,535	−8,329	−206
3403	Other leather products	−7,337	−15,647	−8,310	−7,898	−412
5701	Electron tubes	359	−7,443	−7,802	1,022	−8,824
1802	Knit apparel mills	−3,186	−9,946	−6,760	0	−6,760
2801	Plastic materials and resins	9,923	3,531	−6,392	−5,493	−899
4802	Textile machinery	4,325	−1,805	−6,130	−5,519	−611
1903	Fabricated textiles, n.e.c.	4,149	−1,714	−5,863	−1,709	−4,154
4701	Machine tools, metal cutting types	9,388	3,558	−5,830	−6,161	331
2201	Wood household furniture	−96	−5,242	−5,146	1,324	−6,470
3201	Tires and inner tubes	1,722	−3,357	−5,079	−3,882	−1,197

[1] The concordance between I-O classifications and standard industrial classifications is published in *Survey of Current Business*, February 1974.

n.e.c. = Not elsewhere classified.

Table 4 compares the demographic, occupational, and industrial characteristics of the adversely affected industries with those of the trade-enhanced industries and with the overall average for the manufacturing sector. The weights used to construct these averages were the actual employment figures by industry in 1974. Most of the data were taken from the 1970 Census of Population.

The industries are compared on the basis of the following demographic characteristics: the sex, minority, and age composition of employment, employee family income, and employee earnings and education.[6] The occupational characteristics include the degree of unionization, employee skill levels, and industry skill mix. Industry characteristics include measures of the technical intensity of production and foreign direct investment activity. The basic data for each of these variables for each of the 20 adversely affected and 20 enhanced industries are available on request.

To the extent that these data reflect the characteristics of the workers who made trade-related employment changes during 1964–75, they reveal those groups that benefited from increasing trade and those that were forced to bear the burden of adjustment, principally through reduced job opportunities. And to the extent that these trends continue, the statistical comparison indicates the systematic effects of U.S. trade on the demand for specific types of labor inputs.[7] Following is a description of the findings for each group of characteristics.

Table 3. The 20 industries in which job opportunities were most favorably affected by trade between 1964 and 1975

I-O class[1]	Industry description	Net trade-related job opportunities		Change in net trade-related job opportunities between 1964 and 1975		
		1964	1975	Total	Direct	Indirect
6001	Aircraft	22,633	76,683	54,050	48,014	6,036
6004	Aircraft equipment, n.e.c.	33,246	78,542	45,296	19,507	25,789
5101	Computing machines	16,183	54,666	38,483	32,544	5,939
2001	Logging	−17,967	8,278	26,245	13,785	12,460
4503	Oil field machinery	6,410	26,915	20,505	19,313	1,192
4501	Construction machinery	30,094	47,720	17,626	16,267	1,359
5301	Electric measuring inst.	4,897	17,671	12,774	11,671	1,103
2002	Sawmills and planing mills	−31,566	−19,372	12,194	10,021	2,173
6002	Aircraft engines and parts	15,769	26,201	10,432	3,812	6,618
2402	Paper mills	−23,444	−13,154	10,290	9,518	772
4806	Special industrial machines	11,738	21,392	9,654	9,134	520
4901	Pumps and compressors	7,711	17,006	9,295	7,598	1,697
5304	Motors and generators	9,244	16,473	7,229	5,267	1,962
5503	Wiring devices	4,351	11,458	7,107	4,440	2,667
5703	Electronic components	15,371	21,990	6,619	5,138	1,481
5702	Semiconductors	4,984	11,182	6,198	4,961	1,237
2006	Veneer and plywood	−13,734	−7,669	6,065	4,806	1,259
4006	Fabricated plate work	6,664	11,926	5,262	4,401	861
5203	Refrigeration machines	5,932	11,120	5,188	6,154	−966
5000	Machine shop products	12,128	17,204	5,076	1,612	3,464

[1] The concordance between I-O classifications and standard industrial classifications is published in *Survey of Current Business*, February 1974.

n.e.c. = Not elsewhere classified.

Demographic characteristics

Sex. Women comprised an average of 41.1 percent of the work force in the adversely affected industries compared with 21.5 percent for the favorably affected industries. The proportion of women was highest in apparel (80 percent), knit apparel (69 percent), fabricated textiles (66 percent), and nonrubber footwear (62 percent). The lowest percentage of female workers was in steel (7 percent) among the adversely impacted industries, and in logging (4 percent), veneer and plywood (10 percent), construction machinery (10 percent), and fabricated plate (12 percent) among the trade-enhanced industries. Although there is some variance among the individual sectors, the adversely affected industries—particularly

those with the heaviest losses of job opportunities like apparel—employ a larger proportion of women than the trade-enhanced industries.

Minorities. Minority workers were defined as all nonwhite workers. The adversely affected industries had an average of 11.5 percent minority workers compared with 7.4 percent for the trade-enhanced industries and an average of 10.1 percent for all manufacturing. The average for the enhanced industries was 7.0 percent, with only three of the trade-enhanced sectors (logging, plywood, and sawmills) employing more than 7 percent minority workers. However, in 11 of the adversely affected industries, 10 percent or more of the work force was composed of minority workers. The highest percentages were in motor vehicles (14 percent) and steel (14 percent).

Age. There was little difference between the two sets of industries in the percentage of workers under age 25. Both had an average below that for all manufacturing.

The two trade-sensitive industry groups did differ in terms of the percentage of the labor force over age 50. The trade-enhanced industries had 24.4 percent of their labor force over age 50 compared with 28.0 percent for the adversely affected industries and 26.5 percent for all manufacturing. Eleven of the industries unfavorably affected by trade had a larger proportion of older workers than the manufacturing average. The highest percentages were in leather products (33 percent) and nonrubber footwear (31 percent). Only six of the industries favorably affected by trade had a proportion of older workers in excess of the manufacturing average. The smallest proportion of older workers was in computing machines, with only 9.7 percent of the labor force over age 50.

Income and earnings. Three different measures were used to compare the income and earnings of the labor forces in the two sets of industries. They were the percentage of the work force which had a total family income below the poverty level ($3,000) in 1969, the percentage of those working in the industry earning less than $10,000 in 1969, and the percentage earning less than $12,000 in 1969. The median income in manufacturing was $8,813 in 1969.

The unfavorably affected industries had a poverty rate of 9.8 percent compared with a poverty rate of 5.8 percent in the trade-enhanced industries. Nine of the industries adversely affected by trade had poverty rates which exceeded the manufacturing average compared with only three of the trade-enhanced sectors (logging, plywood, and sawmills). The highest poverty rates in the unfavorably affected industries were in other leather products (17.2 percent), apparel (15.4 percent), nonrubber footwear (13.7 percent), and other fabricated textiles (13.5 percent).

Table 4. Characteristics of workers and industries most affected by trade-related employment changes between 1964 and 1975

Item	Average of the 20 most favorably affected industries	Overall manufacturing average	Average of the 20 most adversely affected industries
Demographic characteristics of the labor force (in percent) [1]			
Women	21.5	29.4	41.1
Minorities	7.4	10.1	11.5
Under age 25	15.4	16.4	15.8
Over age 50	24.4	26.5	28.0
Family income below poverty level	5.8	7.0	9.8
Annual earnings under $10,000	72.1	77.4	81.7
Annual earnings under $12,000	83.5	87.2	89.7
High school education (4 years)	39.1	36.6	34.0
College education (4 years)	6.9	5.1	3.1
Occupational measures			
Unionized workers as a percentage of the labor force [2]	40.0	49.0	51.3
Skill measured as a percentage of the average wage in manufacturing (1973)	104.0	100.0	97.8
Skilled workers as a percentage of the labor force [3]	55.8	50.0	38.8
White-collar workers as a percentage of the labor force [3]	36.3	30.3	21.1
Industry characteristics			
Technical intensity (scientists and engineers as a percentage of the labor force [4]	6.87	3.20	2.29
Technical intensity (research and development as a percentage of sales) [5]	5.90	2.36	1.39
Foreign direct investment proxy (foreign dividends plus tax credits as a percentage of firm's assets) [4]	.53	.34 (median)	.52

[1] From *Census of Population, 1970, Subject Reports: Industrial Characteristics* (Department of Commerce, 1972).
[2] From Richard Freeman and James Medoff, "New Estimates of Private Sector Unionism in the United States," *Industrial and Labor Relations Review,* January 1979, pp. 143–74.
[3] From *Census of Population, 1970, Subject Reports: Occupations by Industry* (Department of Commerce, 1973).
[4] From C. Fred Bergsten, Tom Horst and Ted Moran, *American Multinationals and American Interests,* (Washington, Brookings Institution, 1978) table 3-2.
[5] From Regina Kelly, "The Impact of Technological Innovation on International Trade Patterns," Staff Economist Report, ER-24 (Department of Commerce, December 1977).

The high poverty rates in the unfavorably affected industries reflect the high percentage of their labor force with low earnings. An examination of the earnings distribution in 1969 shows that 81.7 percent of the work force in the adversely affected industries earned less than $10,000 and 89.7 percent earned less than $12,000. In nine of the 20 unfavorably affected industries more than 80 percent of the work force earned less than $10,000. The highest percentages were in nonrubber footwear (95.2 percent) and apparel (93.8 percent). In the trade-enhanced industries, 72.1 percent of the work force earned less than $10,000 and 83.5 percent less than $12,000. Other than the lumber-related industries, each of the trade-enhanced sectors had 78 percent or less of its work force earning under $10,000. The lowest percentages were in computing machines (56 percent) and aircraft (60 percent).

Education. The percentage of the labor force that had completed 4 years of high school and the percentage that had completed 4 years of college were used to measure educational attainment. On both measures, the labor force in the adversely affected sectors had a lower level of educational attainment than the average for all manufacturing. The 20 trade-enhanced sectors employed workers with above average educational attainment.

Thus, a pattern appears in virtually all employee characteristics between these two sets of industries. Workers in industries most enhanced by trade were less likely to be women or minorities and more likely to have more education and higher earnings than those in industries adversely affected by trade. These differences in characteristics, particularly in earnings patterns, suggest that those workers who have to bear the burden of both the short-run adjustment costs to changes in trade and the potential decline in their long-run earnings capacity are those least able to afford it.[8]

Occupational measures

Unionization. Roughly half of all production workers in the manufacturing sector are union members. In the 20 industries most adversely affected by trade, 51.3 percent of the production workers were unionized; among the industries in which trade had the most favorable impact, 40 percent were union members.

Some variation in the degree of unionization existed within the two trade-sensitive industry groups. Among the adversely affected industries, more than 60 percent of the production workers in the tire and inner tube, rubber footwear, motor vehicle, and steel industries were unionized, but less than 40 percent of the workers were organized in the apparel, knit apparel, broadwoven fabrics, nonrubber footwear, furniture, fabricated textiles, and machine tool industries. Among trade-enhanced industries, more than 60 percent of the production workers in the refrigeration, aircraft, aircraft engines and parts, and construction and oil field machinery industries were unionized.

Skill classification. The skill and occupational characteristics of the labor force were measured in three different ways. The wage in an industry as a percentage of the average wage in manufacturing was taken as an indication of the skill or human capital embodied in the labor force.[9] Two other skill measures were derived on an occupational basis from data taken from the 1970 census data. One expressed skilled employees, defined to include professionals, managers, sales, clerical, and craftworkers, as a percentage of total employment in the industry.[10] The other measure identified white-collar workers (all skilled workers except craftworkers) as a percentage of total employment.

On all three measures, the workers in adversely affected industries were less skilled than workers in the trade-enhanced industries and in the manufacturing sector as a whole. The wage in adversely affected industries was 97.8 percent of the average manufacturing wage compared with 104 percent for the favorably affected sectors. On an occupational basis, the adversely affected sectors had a labor force consisting of 38.8 percent skilled workers, overall manufacturing had 50.0 percent skilled workers, and trade-enhanced sectors, 55.8 percent. Similarly, only 21.1 percent of the workers in adversely affected sectors were white-collar workers compared with a manufacturing average of 30.3 percent and 36.3 percent in the trade-enhanced sectors. As a result of increased trade, therefore, domestic demand for skilled labor should increase and the demand for unskilled labor should decrease, other things being equal.

Industry characteristics

The technical intensity of an industry was measured alternatively as the proportion of scientists and engineers in the labor force or as expenditures on research and development as a percentage of sales. The scientist and engineer variable is taken from C. Fred Bergsten, Tom Horst, and Ted Moran, who derived it from 1970 census data.[11] Research and development as a percentage of sales on a product line basis was taken from Regina Kelly.[12]

Both measures showed the trade-enhanced industries to be more technically intensive than the adversely affected industries. The weighted average for those industries is more than twice the manufacturing average and three times larger than the weighted average for the adversely affected industries. These results are consistent with sophisticated econometric studies showing that U.S. comparative advantage lies in technology-intensive products.[13]

Foreign direct investment by an industry may reflect a tendency to take advantage of lower labor costs outside the United States. Such a practice may result in fewer U.S. job opportunities for less skilled workers.

The proxy for foreign direct investment is the value of foreign dividends plus tax credits as a percentage of firm assets. It is taken from Bergsten, Horst, and Moran. As table 3 shows, there is little difference between the two sets of industries as a whole. Even within the two groups of trade-sensitive industries, the differences do not appear to be systematic. Eleven of the adversely affected industries had a lower percentage than the median for all of the industries studied by Bergsten, Horst, and Moran. However, nine of the trade-enhanced industries also had a percentage below the median. Apparently there is little difference between the two groups of industries in their foreign direct investment activity, at least on the basis of this proxy evidence.

A focus for adjustment assistance

This analysis demonstrated the increased importance of trade in determining the level and composition of employment and identified those U.S. manufacturing industries most affected by trade during 1964–75. An input-output analysis was used to estimate the impact of trade on job opportunities in each industry, and the demographic and occupational characteristics of workers were compared to determine any pattern among industries most adversely affected by trade or among those most enhanced by trade.

The industrial sectors that experienced the largest negative impact on job opportunities employed more women and minorities and their work forces were less educated and less skilled than industries that benefited most from trade. In addition, workers in the adversely affected industries had lower earnings and were more likely to have a family income below the poverty level than those in trade enhanced industries.

To the extent that these data accurately reflect the characteristics of workers in industries most affected by trade during 1964–75, the brunt of the adjustment burden caused by trade was borne by workers with limited education and skills.[14] Because such workers generally have a higher frequency of unemployment and relatively less occupational and geographic mobility, the adjustment process could be long and costly.

Furthermore, adjustment may imply reduced wages in occupations most affected by import competition, because the workers available from contracting industries may be unable to meet the demand for labor in sectors expanding because of trade. For example, wage rates of unskilled workers may fall or not rise as quickly because of the decrease in overall demand for their services.

Thus, even though international trade produces gains, these gains are reduced for the Nation as a whole by the presence of adjustment costs—costs that fall most heavily on those workers least able to afford them.

Both equity and efficiency considerations dictate that the "losers" from trade should be compensated for the adjustment costs they must bear. The Trade Adjustment Assistance Program was designed for such purposes.[15] However, policies to reduce the losses suffered by dislocated workers may be more effective if they consider the characteristics of workers forced to make the adjustments.

The results of our analysis suggest that insight into the adjustment problems of workers adversely affected by trade can be gained by examining their demographic and occupational patterns. In particular, the extent of their adjustment burden can be determined by estimating earnings losses and by monitoring the overall re-employment experiences of displaced workers. Such information would be useful in the design of an improved trade adjustment assistance program. □

FOOTNOTES

[1] This analysis represents an extension of a project exploring the impact of foreign trade on domestic manufacturing employment conducted by the Bureau of International Labor Affairs (ILAB). Specifically, ILAB has attempted to estimate the total (direct and indirect) number of job opportunities associated with manufacturing exports and imports and to examine how those opportunities have changed over time. The model which is used by the Office of Foreign Economic Research in ILAB for estimating the effects of trade on employment has also been used to estimate the effects on employment of changes in trade policies, including the Tokyo Round of the Multilateral Trade Negotiations, the granting of Most-Favored-Nation status to the People's Republic of China, and the elimination of the Generalized System of Preferences.

[2] Numerous researchers have shown on a more aggregated basis that U.S. comparative advantage lies in products produced with relatively greater inputs of technology and skilled labor. For a summary of the literature see Robert M. Stern, "Testing Trade Theories," in Peter Kenen, ed., *International Trade and Finance: Frontiers of Research* (New York, Cambridge University Press, 1975). For a recent analysis of the structure of U.S. trade, see the *President's Report on U.S. Competitiveness,* Office of Foreign Economic Research, Department of Labor, December 1980.

[3] Changes in employment opportunities should not be equated with changes in employment. Among other factors, actual job losses (layoffs) depend upon general economic conditions. Estimating job opportunities involves projecting demand and production behavior—what would have happened if exports or imports had *not* changed as they did? Employment may be increasing as part of a general economic upswing so that the decline in employment opportunities would correspond to a smaller increase in employment rather than a decline. Similarly, a decline in aggregate employment opportunities due to trade does not necessarily mean that aggregate employment in the economy as a whole declines by the same magnitude.

[4] The estimates of the impact of trade on manufacturing employment opportunities were derived from the 367-sector input-output table constructed by the Bureau of Economic Analysis of the Department of Commerce for 1967, updated for price and productivity changes. The estimates were obtained by allocating imports, on tariff line (TSUSA) basis, and exports, classified according to Schedule B, to the appropriate input-output sectors and then deflating by sector to express them in 1967 dollars. Imports were adjusted by cost-insurance-and-freight margins to obtain the dollar values actually spent on imports by U.S. residents. Exports were expressed in f.o.b. values. These changes in imports and exports by industry were then run through the input-output table to obtain the total, direct, and indirect changes in output by industry. The employment requirements for these sectoral outputs were computed using average output-employment ratios for each sector updated through 1975. It should be stressed that the estimation technique is not a general equilibrium analysis but rather a set of demand or impact estimates made under the restrictive set of assumptions central to all input-output analyses.

[5] A complete description of the methodology used to identify the industries most significantly affected by trade is given in "The Impact of Changes in Manufacturing Trade on Sectoral Employment Patterns—Progress Report," Office of Foreign Economic Research, Bureau of International Labor Affairs, U.S. Department of Labor, in *Trade and Employment,* National Commission for Manpower Policy, Special Report No. 30, November 1978. The paper lists the assumptions underlying the analysis and points out the possible limitations of the methodology. The paper also describes several tests which were conducted to determine the sensitivity of the estimates to variations in exchange rates and cyclical changes in the pattern of trade.

[6] A study by Daniel Mitchell compared a similar set of demographic characteristics associated with workers in industries directly affected by exports and imports in 1965 and 1970. His study tested the hypothesis that a significant increase in the labor intensity of U.S. imports relative to exports occurred over the period. However, he did not consider either indirect employment impacts or the skill levels and occupational characteristics of trade-impacted sectors. See Daniel J. B. Mitchell, "Recent Changes in the Labor Content of U.S. International Trade," *Industrial and Labor Relations Review,* April 1975, pp. 355–77.

[7] Because the input-output table was more disaggregated than the corresponding census data, roughly to the three and four-digit level of the Standard Industrial Classification, the demographic characteristics of the industries are usually the characteristics of a broader industrial grouping.

[8] Though many of these characteristics are jointly determined, for example, education and earnings, the systematic differences in all characteristics are important in indicating the nature of the affected industries and potential adjustment problems in the labor market. Losses of displaced workers include the earnings lost not only during the period of unemployment following layoff, but also throughout the worker's career as a result of the obsolescence of skills and on-the-job training. See Louis Jacobson, "Earnings Losses of Workers Displaced From Manufacturing Industries," in *The Impact of International Trade and Investment on Employment* (Department of Labor, Bureau of International Labor Affairs, 1978).

[9] This measure of skill, after discounted to obtain a stock measure, has been used in several empirical investigations of the structure of trade. See, for example William Branson and Nikolaos Monayias, "Factor Inputs in U.S. Trade," *Journal of International Economics,* May 1977, pp. 111–32.

[10] Except for the inclusion of service workers in the unskilled category, this measure is similar to a skill index constructed from 1960 Census data. See Helen Waehrer, "Wage Rates, Labor Skills and United States Foreign Trade," in Peter Kenen and David Lawrence, eds., *The Open Economy: Essays on International Trade and Finance* (New York, Columbia University Press, 1968).

[11] C. Fred Bergsten, Tom Horst, and Ted Moran, *American Multinationals and American Interests* (Washington, The Brookings Institution, 1978).

[12] Regina Kelly, "The Impact of Technological Innovation on International Trade Patterns," Staff Economic Report, ER-24 (Department of Commerce, 1977).

[13] See Stern, "Testing Trade Theories."

[14] These results are consistent with the factor-endowment theory of international trade. The theory predicts that U.S. exports should utilize skilled labor and capital equipment relatively intensively in production and its imports should utilize primarily unskilled labor. Thus, as trade expands, U.S. industries utilizing unskilled labor are the most vulnerable to foreign competition.

[15] The Trade Adjustment Assistance Program was established by the Trade Act of 1974. It attempts to aid firms and workers who are adversely affected by international trade. A more modest program had been established under the Trade Expansion Act of 1962. For a discussion of the application of the 1962 program, see James E. McCarthy, "Contrasting experiences with trade adjustment assistance," *Monthly Labor Review,* June 1975, pp. 25–30. For a discussion of the experience under the current program, see C. Michael Aho and Thomas Bayard, "The U.S. Trade Adjustment Assistance Program after Five Years," *The World Economy,* November 1980, pp. 359–76.