

The Effect of Imports on U.S. Manufacturing Wages

by David A. Brauer

The benefits of international trade have been recognized at least since Adam Smith emphasized them in *The Wealth of Nations* more than 200 years ago. Yet while trade is advantageous for the economy as a whole and exports help to support earnings and employment, foreign imports may put downward pressure on earnings and employment in domestic import-competing industries. In the United States, the ratio of manufacturing imports to domestic supply doubled between 1975 and 1985. During the same period, and in the years since, the real hourly earnings of U.S. manufacturing workers have stagnated. This article examines whether the increased penetration of imports has been a major factor behind the sluggish growth of manufacturing wages in the United States.

In investigating the connection between import flows and manufacturing wages, this article looks at both aggregate and industry-level data, focusing particularly on the period since 1975. The analysis reveals that when other factors known to influence wages are taken into account, increased exposure to imports has had a very modest tendency to result in lower wages within industries.¹ Specifically, the increase in imports

appears to have reduced the level of *aggregate* manufacturing wages by ½ percent to 1 percent between 1975 and 1985.

Although imports affected wages adversely, other factors accounted for the bulk of aggregate wage movements. Productivity growth slowed sharply between 1973 and 1982, limiting employers' ability to boost real wages. Rapidly declining unionization rates, especially after 1980, reduced the bargaining power of much of the work force. Rapid labor force growth combined with several recessions to increase the unemployment rate, exerting downward pressure on wages. Export growth was also slow during this period. Finally, many workers were not fully compensated for the inflation arising from energy shocks in 1973 and 1979.

While the aggregate impact of imports on wages has been rather small, this study does find systematic evidence that the influence of imports on wage determination has increased over time. In addition, it highlights the importance of industry characteristics in determining the direction and magnitude of this effect. In industries producing nondurable goods, increases in imports have been associated with significant reductions in wages. By contrast, in industries producing durable goods, increased import penetration does not appear to have adversely affected wage movements, at least through the mid-1980s. Indeed, if anything, the evidence suggests that in the most heavily unionized durable goods industries, wages initially tended to increase in response to import competition.

The first section of the article gives an overview of the data. It is followed by a discussion of the possible theoretical connections between an industry's exposure

¹These results are consistent with those found in earlier research. For instance, see Richard B. Freeman and Lawrence F. Katz, "Industrial Wage and Employment Determination in an Open Economy," in John M. Abowd and Richard B. Freeman, eds., *Immigration, Trade, and the Labor Market* (Chicago: University of Chicago Press, 1991). John Abowd and Thomas Lemieux find that increases in the import penetration ratio depressed union members' real wages in the United States, though not in Canada ("The Effects of International Competition on Collective Bargaining Outcomes: A Comparison of the United States and Canada," National Bureau of Economic Research, Working Paper no. 3352, May 1990).

to competition from imports and the wages earned by its workers, together with an analysis of changes in the relationship between imports and wages over time. Next, the article presents results showing the impact of a given increase in imports on a typical worker's wages. A detailed comparison of the data at two points in time—1975 and 1985—is used to analyze the effect of increases in imports on wages within industries.

An overview of the data

The United States manufacturing sector has become increasingly integrated with the international economy. Chart 1 shows a clear upward trend in the import penetration ratio, defined as imports divided by the sum of imports and domestic shipments, between 1958 and 1989.² This ratio increased from 5.4 percent in 1970 to 6.6 percent in 1975, 8.6 percent in 1980, and 13.1 percent in 1985, according to figures calculated from the National Bureau of Economic Research (NBER) Immigration, Trade, and Labor Market Data Files.³ The chart also shows that until 1980 the ratio of exports to output exhibited a clear upward trend. In the early 1980s, however, the value of the dollar rose sharply, encouraging imports and discouraging exports. Thus, in the first half of the 1980s, the export ratio declined to a level only slightly greater than that of the mid-1970s. After the dollar's value peaked in 1985, the import penetration ratio stabilized, and the export-to-output ratio resumed its upward trend.

The increase in the import penetration ratio since the early 1970s has been accompanied by stagnating real wages and employment. Table 1 summarizes developments in manufacturing wages since 1960, for all industries as well as for durable and nondurable goods sectors separately. The first two columns illustrate the path of real hourly manufacturing wages. After rising at an annual rate of 1.5 percent from 1960 through 1973, real wages were flat during the late 1970s and declined throughout the 1980s. The stagnation in real wages reflects in part a shift in compensation to nonwage

²Note that import penetration ratios represent just one way of viewing foreign competitive pressures. They are not, for instance, directly affected by foreign investment in domestic manufacturing facilities. (In fact, other things being equal, a foreign producer's move to replace imports with goods produced at a U.S. facility would *reduce* measured import penetration.) Import penetration ratios also do not capture possible differences in quality between domestically produced and imported goods. These considerations, along with others, could have consequences for wages and employment beyond the results presented here.

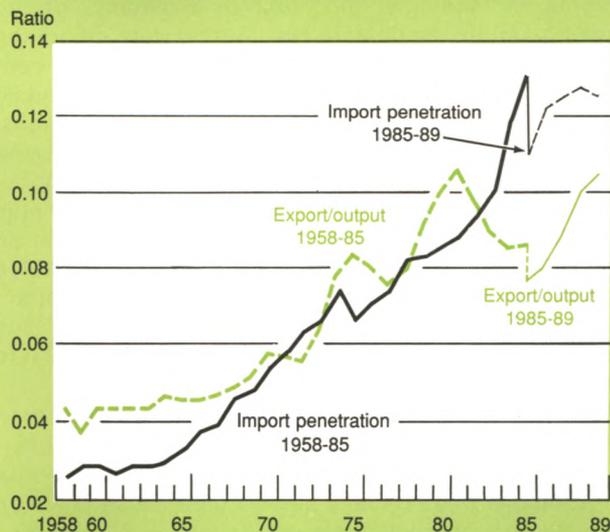
³The NBER Data Files cover 428 manufacturing industries, each observed annually between 1958 and 1985. For further details, see the appendix to this article. In addition, see John M. Abowd, "The NBER Immigration, Trade, and Labor Markets Data Files," National Bureau of Economic Research, Working Paper no. 3351, May 1990.

forms such as medical and pension benefits and higher payroll taxes. Nonetheless, the real hourly compensation received by manufacturing workers (columns 3 and 4) leveled off in the 1980s, after growing rapidly during the 1960s and early 1970s and more slowly in the late 1970s. The last two columns suggest that the stagnation in real wages reflects factors other than a slowdown in labor productivity growth, since productivity grew at a healthy pace, particularly in durable goods manufacturing, during the 1980s.

The downward trend in manufacturing employment since the late 1970s is documented in Table 2. Both the average level of employment over the course of a business cycle (column 1) and the peak level of employment during the cycle (column 2) were lower during the 1980s than earlier. In addition, the average annual employment growth rate (column 3), measured from trough to peak, was much slower in the 1980s than in previous expansions. Although other factors, such as labor-saving technological change and declining demand for some goods, may be partially responsible, the weak performance of manufacturing employment has coincided with the increase in import penetration ratios and therefore merits examination along with the effect of imports on wages.

Chart 1

Manufacturing Import Penetration and Export-Output Ratios



Sources: Data for 1958-85 are from National Bureau of Economic Research Immigration, Trade and Labor Market Data Files; data for 1985-89 are based on U.S. Department of Commerce official statistics.

Table 1

Manufacturing Wages and Productivity, 1960-89

	Real Hourly Wages†		Real Hourly Compensation		Productivity‡	
	(1) Level	(2) Average Annual Increase (Percent)	(3) Average Index (1982=100)	(4) Average Annual Increase (Percent)	(5) Average Index (1982=100)	(6) Average Annual Increase (Percent)
All industries						
1960-69	8.19	1.5	80.0	2.1	66.8	2.9
1970-73	8.95	1.5	91.2	1.6	80.8	3.8
1974-79	9.19	0.0	98.1	1.1	91.1	1.6
1980-89	8.77	-0.9	99.6	-0.0	114.2	4.0
Durable goods						
1960-69	8.72	1.3	80.0	2.0	72.6	2.7
1970-73	9.50	1.6	91.2	1.6	85.5	3.2
1974-79	9.79	0.0	98.2	1.1	94.9	1.2
1980-89	9.28	-1.0	99.2	-0.1	119.4	4.7
Nondurable goods						
1960-69	7.44	1.5	80.3	2.2	59.3	3.0
1970-73	8.17	1.2	91.2	1.4	74.5	4.9
1974-79	8.29	-0.0	97.5	1.0	85.9	2.1
1980-89	8.03	-0.5	100.0	0.2	107.1	3.0

Sources: Bureau of Labor Statistics, *Employment and Earnings* and *Handbook of Labor Statistics*. Productivity figures for 1980 through 1989 are from Bureau of Labor Statistics, *Productivity and Costs* release, March 6, 1991.

†1982-84 dollars.

‡Output per hour of all persons.

The growing influence of imports on manufacturing wages

This section presents evidence that imports have become increasingly important determinants of the wages paid by manufacturers. Before turning to the evidence, however, it may be helpful to review the conceptual linkage between the two. In principle, increased product market competition should lead to lower wages, lower employment, or both. (For a more detailed discussion, see the accompanying box.) Whether the competition stems from imports or any other source, it puts downward pressure on the price of a product. From an employer's perspective, this effect diminishes the value of any worker's contribution to output, and consequently fewer workers will be hired at the prevailing wage rate. The decline in labor demand may in turn exert downward pressure on the wage rate.

In an environment of unionized labor and less than perfectly competitive product markets, workers generally receive "rents," or above-market wages and benefits. Employers are usually able to pass these costs on to customers through their pricing policies. Increased competition from imports, however, can make it difficult to continue passing wage costs through, because demand for a firm's product becomes more sensitive to price changes. Nevertheless, the precise effect of increased competition on wages and employment will

Table 2

Manufacturing Employment, 1960-89

	(1) Average Employment (Thousands)	(2) End Year Employment (Thousands)	(3) Average Annual Growth Rate† (Percent)
All industries			
1960-69	18,092	20,168	2.7
1970-73	19,324	20,155	4.0
1974-79	19,772	21,040	3.5
1980-89	19,307	19,426	0.9
Durable goods			
1960-69	10,378	11,863	3.5
1970-73	11,175	11,882	5.9
1974-79	11,710	12,746	4.5
1980-89	11,410	11,422	1.1
Nondurable goods			
1960-69	7,714	8,305	1.6
1970-73	8,159	8,294	1.7
1974-79	8,081	8,312	2.0
1980-89	7,900	8,004	0.6

Source: Bureau of Labor Statistics, *Employment and Earnings*.

†Trough to the final year of each interval. Trough years—1961, 1971, 1975, and 1983—represent the lowest overall level of manufacturing employment during the interval.

Box: Conceptual Issues

Analyzing the effect of greater product market competition on a fully competitive labor market with no hiring and firing costs is a straightforward exercise. For any group of workers possessing a particular set of attributes (skills and abilities, experience, location, and so forth), employers take the market-determined wage rate as given.[†] They then hire up to the point where the marginal worker's contribution to output (which, in the absence of increasing returns to scale, declines as additional workers are hired) equals the wage rate. Increased product market competition, regardless of its source, will typically result in a lower product price, which is equivalent to a reduction in the value of the marginal worker's contribution to output. Consequently, with the wage rate given, employers will respond by hiring fewer workers than they had previously. Aside from the reduction in employment, increased competition can result in a lower wage rate if the reduction in demand for workers by all employers is sufficiently large relative to the size of the relevant labor market.

In reality, few of the assumptions of perfect labor market competition are satisfied. Modifying these assumptions usually changes the results. One significant alteration, however, leaves the results unchanged. Workers often earn more in their current jobs than they could in the next-best alternative job for which they are qualified. Employers may pay an above-market wage in order to reduce the rate at which their current workers, especially the most productive, quit, thus avoiding recruiting and training costs.[‡] Higher wages can also serve to attract better quality workers or, according to the "efficiency wage" hypothesis, to encourage greater effort.[§] Under these circumstances, employers will probably respond to

increased competition by first reducing employment, just as they did in the case of perfect markets. Industry wages could also fall if the decline in employment causes the industry's demand for workers to fall.

A more interesting case involves industries where firms and workers, the latter often represented by unions, share the gains derived from market power. A union can seek an above-market wage and benefits package because it knows that increased labor costs can be passed on to customers through higher prices.^{||} In these circumstances, the introduction of competition is likely to directly reduce demand for the firm's product, resulting in a downward shift in the associated demand curve for labor. As in the case of perfect markets, this scenario will lead to reduced wages, lower employment, or a combination of the two.^{††} The introduction of competition from imports may also increase the responsiveness of product demand to price changes, so that over time it will become increasingly difficult for employers to pass increases in labor costs through to their customers.

The relative effect of the new competition on wages and employment depends on the specific objectives and attributes of the employer, the industry, and, where present, the union. In an industry characterized by rapid technological change and increasing product demand, the effect of imports may not be obvious (although earnings and/or employment increases will be smaller than they would have been had imports not increased). In general, however, employers will attempt to reduce their labor costs, either gradually through attrition and reductions in the rate of increase in wages and benefits or aggressively through large-scale layoffs, plant closings, and demands for nominal wage concessions. Some unions will offer such concessions to preserve employment in the face of new competition; others will seek to preserve existing wage levels at the risk of some members' losing their jobs.

[†]Strictly speaking, the wage rate should take into account nonwage costs such as payroll taxes and employer contributions to health insurance and retirement plans.

[‡]See Steven C. Salop, "A Model of the Natural Rate of Unemployment," *American Economic Review*, vol. 69 (March 1979), pp. 117-25.

[§]For a formal model of the relationship between wages and worker quality, see Andrew Weiss, "Job Queues and Layoffs in Labor Markets with Flexible Wages," *Journal of Political Economy*, vol. 88 (June 1980), pp. 526-38. Several theories have been proposed to explain the effect of higher wages on effort. Under the "shirking" hypothesis, high wages serve as an extra incentive, prompting the employee to work harder in order to avoid dismissal. See Carl Shapiro and Joseph E. Stiglitz, "Equilibrium Unemployment as a Worker Discipline Device," *American Economic Review*, vol. 74 (June 1984), pp. 433-44. For an alternative explanation that emphasizes sociological phenomena, see George A. Akerlof, "Labor Contracts as Partial Gift Exchange," *Quarterly Journal of Economics*, vol. 97 (November 1982), pp. 543-69.

^{||}Technically, the union members are earning "rents." Even in firms without a union, employers may offer to share rents with their employees in order to prevent unionization. Such actions could be justified by the employer's desire to preserve the freedom to manage without interference from a union.

^{††}The experience of recently deregulated industries is instructive in this context. One study suggests that when the trucking industry was regulated, union drivers operating in the regulated portion of the industry received substantial rents. After five years of deregulation, however, these rents were largely dissipated. See Nancy Rose, "Labor Rent Sharing and Regulation: Evidence from the Trucking Industry," *Journal of Political Economy*, vol. 95, no. 6 (December 1987), pp. 1146-78.

Box: Conceptual Issues (Continued)

It is even conceivable that import competition could, in certain declining industries, result in short-run wage increases.^{##} When a unionized industry with relatively few dominant firms has long-lasting immobile or industry-specific facilities and equipment, a permanent decline in demand resulting from imports will initially be met entirely through reductions in hours and employment because of the high cost of selling or shutting down capacity. With import competition imposing an upper limit on the industry's productive capacity, any temporary increase in demand will result in increased utilization of labor. Because management has lost the option of expanding capacity, it will be less able to resist union wage demands, and consequently wages could rise in the short run. In the long run, however, as the existing capital stock wears out and plant closings become likely, management's bargaining power will be restored, resulting in downward pressure on wages in addition to employment losses.

These considerations suggest that in the short run, increased import penetration, to the extent that it signifies increased competition, should have a negative impact on employment but an uncertain effect on aggregate or industry wages. Over time, however, we would expect to observe an increasingly strong negative impact on earnings. If unions at first perceive increased import competition to be temporary, they may be unable to

^{##}Colin Lawrence and Robert Z. Lawrence, "Manufacturing Wage Dispersion: An End Game Interpretation," *Brookings Papers on Economic Activity*, 1:1985, pp. 47-116.

justify long-lasting wage concessions to their members. But as it becomes clear that industries will continue to face competition from imports, and that consequently labor costs must be contained in order to preserve jobs, concessions will become increasingly acceptable. Furthermore, in partially unionized industries, the high-wage unionized firms will probably face greater employment losses than nonunion firms even if imports have no effect on wages at any firm; consequently, industry-wide average wages will decline. Finally, if relatively high-wage unionized industries suffer proportionally greater employment losses as a result of imports, aggregate average manufacturing wages will decline even if the average wage within industries is unaffected.

This analysis of the conceptual issues assumes that imports or other sources of product market competition are determined independently of wages and employment. Nonetheless, the existence of above-market wages and profits in an industry may serve as a signal to potential competitors (both foreign and domestic) that entry can be profitable. The higher the wage, relative to a competitive level, the more vulnerable the industry becomes to competition. Under these circumstances, we would expect to observe a positive correlation between import penetration and wages.^{##}

^{##}For evidence on this issue, see Lawrence F. Katz and Lawrence H. Summers, "Industry Rents: Evidence and Implications," *Brookings Papers on Economic Activity: Microeconomics*, 1989, pp. 209-75.

depend on the specific objectives of both unions and employers. For instance, some unions, when faced with declining demand, will fight to preserve their wage advantage at the expense of employment, while others will offer wage concessions in order to save their members' jobs. It has even been suggested that in some industries, wages might initially increase in response to increased import competition.⁴

The short-term impact of import competition on wages may therefore be weak or even perverse. Over time, however, noncompetitive systems for wage determination should be eroded by competitive forces. If imports entail increased competition, they should become increasingly important determinants of wages. One way to test this assertion is to examine the distribution of wages by industry. If imports become more

⁴Lawrence and Lawrence, "Manufacturing Wage Dispersion: An End Game Interpretation." This argument is developed more completely in the box.

important in wage determination, the degree of import penetration within an industry should become more closely associated with the wages paid by the industry. Chart 2 summarizes the evidence on this issue, using data for 1958 to 1985 drawn from the NBER Data Files for 125 manufacturing industries identified by three digits in the Standard Industrial Classification (SIC) Code.⁵

The solid line in Chart 2 illustrates the simple correlation, by industry, between hourly wages and the import penetration ratio for each year between 1958 and 1984. It shows that during the 1960s the correlation coefficient was negative but small (absolute value less than .1) and not significantly different from zero. In the 1970s and

⁵The SIC code is a system of categorizing industries by type of product. Industries are aggregated at levels ranging from the least detailed (one-digit) to very detailed (seven-digit). These and all subsequent calculations in this article are carried out at the three-digit level. Examples of three-digit industries include meat products (201), logging (241), and household appliances (363).

early 1980s, however, the connection between high imports and low wages became much stronger, with the absolute value of the correlation coefficient rising from an average of .153 between 1970 and 1975 to .213 during 1976-82 and .298 in 1983-85.

In addition to the simple correlations, a series of annual multiple regression equations are estimated. These relate production workers' hourly earnings to the import penetration ratio while controlling for other factors that can influence wages.⁶ The control variables include the ratio of exports to output, value added per hour worked (a measure of productivity), and the production workers' unionization rate.⁷ The regression coefficients for the import penetration ratio are plotted as the dotted line in Chart 2. They were uniformly negative and over time tended to increase in magnitude. In the latter half of the period, all else equal, every percentage point increase in an industry's import pen-

⁶Results of similar regressions using estimated compensation, which includes nonwage labor costs as well as wages, can be found in David Brauer, "The Effect of Import Competition on Manufacturing Wages," Federal Reserve Bank of New York, Research Paper no. 9030, September 1990. They are generally similar to the results shown here.

⁷The export-to-output ratio is included in light of the observation that export-intensive industries tend to offer high wages. See Lawrence F. Katz and Lawrence H. Summers, "Industry Rents: Evidence and Implications," *Brookings Papers on Economic Activity: Microeconomics* 1989, pp. 209-75. The use of output per hour as an alternative productivity measure does not materially affect the results.

etration ratio was associated with a drop of about $\frac{1}{4}$ to $\frac{1}{3}$ of 1 percent in hourly wages. By contrast, before 1973 the relationship between imports and wages was weak and not statistically significant.

Aggregate effects

The results summarized above suggest that imports have become more important in wage determination. The next issue to be investigated is the specific impact of a given increase in import penetration on a typical factory worker's wage. One way to examine this effect is to estimate a single equation for hourly wages, using all twenty-seven annual observations available for each industry from 1958 through 1984.⁸ This approach is used in Table 3, which shows a number of equations designed to estimate the average effect of imports on wages in all manufacturing industries (column 1), durable goods producers (column 2), and nondurable goods producers (column 3). In these equations, both wages and value added are measured in real (inflation-

⁸For a slightly different approach using the same data, see Freeman and Katz, "Industrial Wage and Employment Determination." They found that over time a 10 percent annual reduction in industry revenues due to increased import penetration resulted in a modest 0.5 percent reduction in earnings for production workers, with imports having a somewhat stronger impact in the early 1980s than earlier. Their results also showed that the effect of imports on earnings was strongest in highly unionized industries. This finding suggests that when competition was less, unions were more successful than nonunion workers in capturing a portion of monopoly rents.

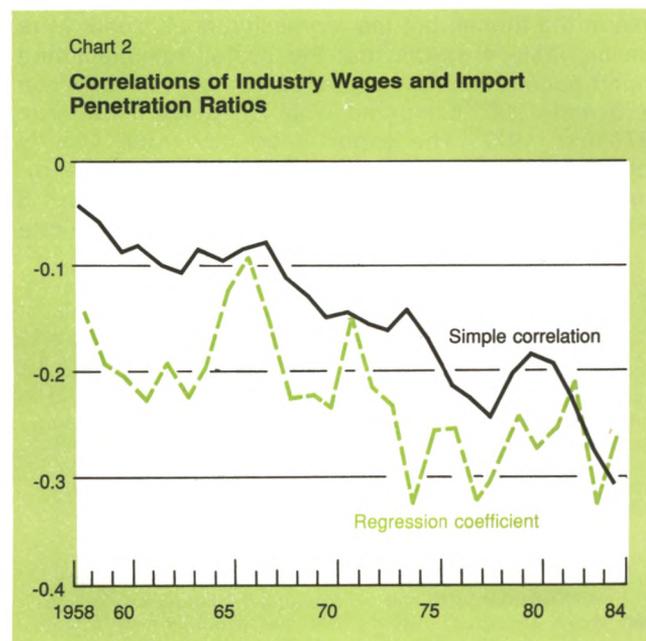


Table 3

Determinants of Real Wages by Three-Digit Industry, 1958-84

Dependent variable: log production workers' real hourly earnings

	(1) All Industries	(2) Durable Goods	(3) Nondurable Goods
Intercept	1.004 (23.78)	1.471 (36.32)	.945 (29.33)
Import penetration ratio	-.326 (14.35)	-.199 (5.88)	-.309 (9.18)
Exports/output	.130 (5.79)	.040 (1.79)	.231 (2.93)
Percent unionized	.003 (9.39)	.001 (1.62)	.005 (18.05)
Log value added per hour	.245 (26.53)	.165 (12.01)	.267 (33.25)
Adjusted R ²	.952	.944	.934

Notes: Regression equations also include year and three-digit industry dummies. Absolute t statistics are given in parentheses.

adjusted) terms.⁹ The equations include a series of dummy variables intended to capture unmeasured fixed industry effects, such as the characteristics of individual workers, that are not related to the import penetration ratio or the other directly observed variables. The equations also include a series of year dummy variables intended to control for cyclical influences on real earnings, long-term wage trends, and shocks affecting consumer prices. Overall, with 125 industries observed each year, the equation is based on 3,375 observations.

The equation including all industries (column 1) indicates that, all else equal, a 10 percentage point increase in the import penetration ratio in a typical industry during the 1958-85 period was associated with a wage reduction of about 3.3 percent. A similar increase in the ratio of exports to output resulted in an increase in real wages of about 1.3 percent. As expected, both unionization and productivity had a positive impact on earnings. The estimated effect of import penetration on wages generally held up under a number of alternative specifications.¹⁰ The inclusion of lagged export and import penetration ratios yielded a long-run wage reduction of about 4 percent in response to a 10 percentage point increase in the import penetration ratio.

The significance of the regression results is best understood through an example. The import penetration ratio in the women's clothing industry rose from around 10 percent in the mid-1970s to approximately 25 percent in the mid-1980s, while real hourly wages fell by about 10 percent. The result in column 1 suggests that the increase in imports was responsible for about half of the real wage reductions observed in the industry. This estimate assumes, however, that all other factors affecting wages paid by this industry were independent of the increase in import penetration and that the relationship between imports and wages was equal in all industries and in all years.

Interestingly, the results were somewhat different when the wage equation was estimated separately for durable and nondurable goods. Results for the durable

goods sector, shown in column 2 of Table 3, indicate that the response of wages to the import penetration ratio was less than for manufacturing as a whole, although it remained negative and statistically significant. By contrast, the results in the nondurable goods sector, shown in column 3 of the same table, were quite similar to those for overall manufacturing. In other words, the relationship between imports and wages was stronger for nondurable than for durable goods producers. Some possible reasons for this divergence will be discussed below.

Because the evidence presented in Chart 2 suggests that imports are exerting a growing influence on wages, one might question the reliability of estimates that assume a stable import effect. An alternative way to look at the effect of imports on wages (and employment) is to compare the wage and employment changes between two periods experienced by industries that faced considerable competition from imports with the changes experienced by industries that did not.¹¹

The specific periods chosen for comparison are 1983-85 and 1975-77. The use of three-year periods minimizes the effects of onetime events that may have affected an industry in any particular year. The three-year period also avoids difficulties associated with the staggered expiration of union contracts. The periods selected represent roughly comparable stages in the business cycle. One major difference between them is that during the latter period the dollar's value was both high and rising.¹² According to the results illustrated in Chart 2, the simple correlation between import penetration and wages was stronger during the latter period than in the former, but the regression coefficients were similar. Table 4 shows that the overall manufacturing import penetration ratio averaged 11.7 percent between 1983 and 1985, compared with 7.0 percent between 1975 and 1977. The export ratio also rose slightly between the two periods. In 1983-85, average real earnings were 3.5 percent lower, and real compensation 1.5 percent lower, than in 1975-77. The unionization rate

⁹In both cases, nominal values are deflated by the consumer price index. The use of other deflators common to all industries, such as the GNP deflator or the producer price index for manufacturing, did not affect the results. Unfortunately, it was impossible to construct price series for the output of each industry.

¹⁰For further details, see Brauer, "The Effect of Import Competition." One alternative specification replaced the year dummies with the manufacturing unemployment rate and a time trend in order to separate cyclical effects from broad long-term trends. Another substituted output per hour for value added per hour as the productivity measure. In addition, estimated real hourly compensation, including nonwage benefits, replaced the real wage as the dependent variable. None of these exercises materially affected the estimates of the import effect.

¹¹Previous work along these lines found no systematic effect of imports on wages or employment. See Gene M. Grossman, "The Employment and Wage Effects of Import Competition in the United States," *Journal of International Economic Integration*, vol. 2, no. 1 (Spring 1987), pp. 1-23. Grossman studied nine industries in which imports increased significantly between 1967 and 1979. He found that import competition had a significant negative impact on hourly wages in only two industries (ball bearings, radio and television) and caused a large loss of jobs only in the radio and television industry. Two other industries (nuts and bolts, hardware veneer) experienced moderate employment losses.

¹²The real trade-weighted dollar, as measured by the Board of Governors of the Federal Reserve System, averaged 94.7 (March 1973=100) between 1975 and 1977, and 125.8 between 1983 and 1985. Within periods, the dollar's value fell from 93.9 in 1975 to 93.0 in 1977, but rose from 117.1 in 1983 to 131.9 in 1985.

also fell between the two periods.

Table 5 summarizes regressions that relate the percent change in real wages by industry between the two periods to the change in the import penetration ratio while controlling for changes in exports, changes in productivity, and unionization.¹³ The coefficient on the import ratio suggests that a 10 percentage point increase in an industry's import penetration ratio yielded a reduction in hourly wages of about 0.9 percent to 1.6 percent, the precise value depending on how unionization was specified. Given the increase in the average import penetration ratio between the two periods, this effect translates to a 0.4 percent to 0.8 percent reduction in aggregate earnings.¹⁴ The effect of imports on wages was statistically significant, however, only in the equation shown in column 1. The evidence is

¹³Regressions and tabulations in this section apply to all 141 three-digit manufacturing industries (including the miscellaneous categories) for which data on imports and exports exist.

¹⁴For an alternative approach to estimating the effect of imports on aggregate wages, see Wayne Vroman and John M. Abowd, "Disaggregated Wage Developments," *Brookings Papers on Economic Activity*, 1:1988, pp.313-38. Using data from the 1964-79 period, they found that a 10 percent increase in nonpetroleum import prices yielded about a 1 percent increase in aggregate earnings. Since higher import prices, all else equal, reduce the vulnerability of U.S. industries to foreign competition, this result is consistent with the findings presented here.

therefore somewhat inconclusive but suggests that imports adversely affect earnings. The estimated effect of changes in exports on wages was positive but very small and statistically insignificant. Thus, while industries in which a large fraction of output is exported tend to pay higher wages, we cannot conclude that an increase in the export-to-output ratio within an industry will lead to increased wages. As expected, higher unionization rates (in terms of both the initial level and the change) had a positive impact on wages, as did higher productivity.

To obtain a more precise measure of the impact of increasing imports, the industries are divided into those experiencing above-average, and those experiencing below-average, increases in import penetration.¹⁵ Table 6 illustrates the initial conditions within these groups, with group averages weighted by employment. For manufacturing as a whole, the differences between the groups with above-average and below-average increases in imports were minor, with two notable exceptions. Estimated labor costs per unit of value added, shown in the next to last column, were somewhat higher in the group of industries that subsequently faced significant increases in imports. The high-import industries were also less capital intensive, as sug-

¹⁵For further detail, see Brauer, "The Effect of Import Competition," especially Table 9.

Table 4

Summary Statistics for Manufacturing 1975-77 and 1983-85

	1975	1976	1977	1975-77 Average	1983	1984	1985	1983-85 Average
Average hourly earnings (nominal)	5.03	5.42	5.89	5.45	9.00	9.41	9.94	9.45
Average hourly earnings (real)	9.29	9.47	9.67	9.48	9.02	9.11	9.30	9.14
Average hourly compensation (nominal)	6.00	6.53	7.16	6.56	11.12	11.61	12.17	11.63
Average hourly compensation (real)	11.09	11.41	11.75	11.42	11.14	11.24	11.38	11.25
Total employment (thousands)	16,706	17,211	17,997	17,305	17,002	17,419	17,050	17,157
Import penetration ratio (percent)	6.6	7.1	7.4	7.0	10.0	11.9	13.1	11.7
Export ratio (percent)	8.4	8.1	7.6	8.0	9.0	8.5	8.6	8.7
Unionization rate	47.7	47.0	46.3	47.0	37.2	35.6	n.a.	36.4†

Source: All nominal figures are based on the National Bureau of Economic Research Immigration, Trade, and Labor Market Data Files.

Notes: Hourly earnings, compensation, and unionization rates are for production workers. Employment refers to all workers. Real earnings and compensation are in 1982-84 dollars, deflated using the consumer price index.

†1983-84 average.

Table 5

Determinants of Real Wage Change

Dependent variable: percent change in real wages, by industry 1983-85 versus 1975-77

	(1)	(2)	(3)
Intercept	-2.883 (1.77)	-12.780 (6.17)	-10.641 (5.63)
Change in import penetration ratio	-0.160 (2.23)	-0.093 (1.38)	-0.098 (1.48)
Change in export ratio	0.082 (0.44)	0.010 (0.05)	0.013 (0.07)
Change in percent union	0.177 (1.83)		0.239 (2.71)
Percent union, 1975-77		0.168 (5.08)	0.179 (5.50)
Percent change in value added per hour	0.178 (5.41)	0.200 (6.69)	0.186 (6.27)
Adjusted R ²	.228	.335	.364

Notes: Equations are based on 141 observations. Absolute t statistics are given in parentheses.

gested by the capital-per-worker figures in the last column.

Similar breakdowns within the durable and nondurable sectors are revealing. They show that in the durable goods sector, import penetration increased sharply in relatively high-wage, heavily unionized, and capital-intensive industries such as automobiles, steel, and construction equipment.¹⁶ By contrast, in the nondurable goods sector, the industries most heavily affected by imports were characterized by low wages, low unionization rates, and strongly labor-intensive production.

Table 7 shows changes in wages, unit labor costs, unionization, and the ratio of capital to labor, calculated on the assumption that the employment distribution across industries was unchanged within each group. Thus, these figures abstract from changes in group averages caused by shifts in employment. Real wages and unit labor costs declined in all categories, but for manufacturing as a whole the decline was only slightly greater in industries facing more than a 5 percentage point increase in the import penetration ratio than in

¹⁶The computer and electronic components industries, which thrived despite the increase in imports, are important exceptions to the overall pattern.

Table 6

Characteristics of Industries 1975-77

	(1) Employment (Thousands)	(2) Real Hourly Wage†	(3) Percentage Unionized	(4) Import Penetration Ratio	(5) Estimated Unit Labor Cost‡	(6) Capital to Labor Ratio§
All industries	17,205	9.44	47.0	.068	.5429	21.9
Change in import penetration ratio, 1975-77 to 1983-85						
Less than 5 percentage points	10,759	9.54	46.1	.042	.5260	24.0
Greater than 5 percentage points	6,446	9.30	48.3	.108	.5687	18.3
Durable goods	10,007	10.23	51.2	.073	.5722	19.4
Change in import penetration ratio, 1975-77 to 1983-85						
Less than 5 percentage points	5,512	9.61	47.4	.045	.5720	16.6
Greater than 5 percentage points	4,495	10.99	55.9	.108	.5725	22.9
Nondurable goods	7,197	8.36	41.0	.060	.5025	25.2
Change in import penetration ratio, 1975-77 to 1983-85						
Less than 5 percentage points	5,247	9.46	44.6	.037	.4749	31.8
Greater than 5 percentage points	1,950	6.02	33.5	.108	.5612	7.7

Note: Employment refers to all workers; hourly wage and percentage unionized, to production workers only.

†1982-84 dollars, deflated by consumer price index.

‡Ratio of estimated compensation to value added.

§Capital stock, in constant dollars, divided by total employment.

those experiencing a below-average increase in imports.¹⁷

The differences in the response of wages to changes in imports for durable and nondurable goods are striking. For durable goods, real wages actually fell by only 2.1 percent in the high-import group, while they dropped 2.9 percent in the low-import group. In nondurable goods, by contrast, real wages fell by over 7 percent in those industries facing above-average increases in imports, compared with a decline of only 2.4 percent in the low-import group.

As noted, these figures are based on fixed employment weights and ignore shifts in the employment mix between the two periods. Column 6 of Table 7 shows that total employment rose in industries with below-average increases in imports but declined sharply in industries with more than a 5 point increase in the import penetration ratio. The data in column 1 suggest that imports apparently had little direct downward impact on average wages paid by *industries* producing durable goods. Average wages earned by *workers* in this sector, however, could have been further reduced through the elimination of jobs in high-wage industries with strong import growth.

Evidence on this point is provided in Table 7. Column 7 computes the change in simple average wages in each sector without correcting for the shifting of jobs between industries over time. For manufacturing as a whole, actual average real wages fell by 3.7 percent, compared with the 2.9 percent decline shown in column 1. The difference between these figures implies that employment shifts were apparently responsible for a further 0.8 percent reduction in aggregate wages. Employment shifts had their greatest impact in the high-import industries producing durable goods. With employment shifts taken into account, average real wages in this group declined by 5.2 percent, compared with the decline of just 2.1 percent under constant employment shares. In the nondurable goods sector, by contrast, employment shifts had virtually no effect on average wages in the high-import group, despite the pronounced loss of jobs.

The data using constant employment shares shown in column 1 are consistent with the Table 3 regressions, which suggested a stronger and more significant relationship between industry wages and import penetration for nondurable than for durable manufacturing. As a further test, Table 8 repeats the regressions performed in columns 1 and 2 of Table 5, separating the sample into durable and nondurable goods industries.¹⁸

¹⁷Part of the decline in aggregate wages is probably due to the weakening of unions, but industries that experienced import growth and those that did not were equally affected by falling unionization rates. See Richard B. Freeman and James L. Medoff, *What Do Unions Do?* (New York: Basic Books, 1984).

¹⁸The column 3 specification, with both the initial unionization rate and its change included, yields results very similar to those in which only the initial unionization rate is included.

Table 7

Wage Changes Assuming Constant Employment Distribution, 1975-77 to 1983-85

	(1) Real Wage	(2) Percentage Unionized	(3) Import Penetration Ratio	(4) Estimated Unit Labor Cost	(5) Capital to Labor Ratio	(6) Memo: Employment Change	(7) Wage Change Including Employment Shifts
All industries	-2.9	-10.3	5.2	-2.8	27.4	-0.9	-3.7
Change in import penetration ratio, 1975-77 to 1983-85							
Less than 5 percentage points	-2.6	-10.8	1.8	-2.6	20.5	3.2	-3.2
Greater than 5 percentage points	-3.2	-9.6	10.3	-3.1	41.1	-7.9	-4.7
Durable goods	-2.5	-11.0	5.1	-0.8	32.5	0.3	-4.2
Change in import penetration ratio, 1975-77 to 1983-85							
Less than 5 percentage points	-2.9	-11.4	1.8	-0.5	17.8	4.1	-2.8
Greater than 5 percentage points	-2.1	-10.4	8.4	-1.0	45.3	-4.4	-5.2
Nondurable goods	-3.5	-9.4	5.2	-5.9	21.6	-2.6	-2.8
Change in import penetration ratio, 1975-77 to 1983-85							
Less than 5 percentage points	-2.4	-10.1	1.1	-5.3	22.1	2.3	-3.6
Greater than 5 percentage points	-7.1	-8.0	13.9	-7.1	17.0	-15.9	-7.2

Notes: Columns 1, 4, 5, 6, and 7 show percent changes; columns 2 and 3 show percentage point changes.

Table 8

Determinants of Real Wage Change

Dependent variable: percent change in real wages, 1983-85 versus 1975-77

	Durable Goods		Nondurable Goods	
	(1)	(2)	(3)	(4)
Intercept	-8.701 (4.51)	-13.295 (7.23)	-0.964 (0.52)	-12.625 (4.23)
Change in import ratio	0.228 (2.21)	0.236 (2.55)	-0.325 (3.51)	-0.232 (2.40)
Change in export ratio	0.021 (0.12)	-0.036 (0.23)	0.233 (0.60)	0.104 (0.27)
Change in percent unionized	-0.209 (1.40)		0.362 (2.88)	
Percent unionized, 1975-77		0.145 (4.34)		0.169 (2.89)
Percent change in value added per hour	0.202 (4.63)	0.213 (5.42)	0.160 (3.60)	0.200 (4.62)
Adjusted R ²	.242	.391	.361	.361

Notes: Equations (1) and (2) are based on 72 observations. Equations (3) and (4) are based on 69 observations. Absolute t statistics are given in parentheses.

For nondurable goods the impact of changes in imports on industry wages was negative and significant: a 10 percentage point increase in the import penetration ratio yielded an estimated 2.3 percent to 3.2 percent reduction in wages. For durable goods, however, a similar increase in imports would have resulted in a wage increase of approximately 2.3 percent.

The latter result is somewhat puzzling and contrasts with some other results in the literature.¹⁹ It is, however, consistent with the hypothesis discussed in the box that increasing import penetration can, at least initially, be associated with increasing wages in industries that are highly unionized, concentrated, and declining. One sim-

¹⁹Freeman and Katz, "Industrial Wage and Employment Determination," found that over time wages fell more in response to imports in highly unionized industries than in industries with low unionization rates. Contrasting results can be found in David A. Macpherson and James B. Stewart, "The Effect of International Competition on Union and Nonunion Wages," *Industrial and Labor Relations Review*, vol. 43, no. 4 (April 1990). Macpherson and Stewart, using data on individual workers between 1975 and 1981, found that wages were less sensitive to imports in highly unionized industries than in industries with lower unionization rates. These authors did find that increases in the import penetration ratio reduced union members' relative wage advantage within industries. Abowd and Lemieux, "The Effects of International Competition," reported similar findings for the United States, but found that increases in imports had no significant impact on union wages in Canada.

Table 9

Determinants of Real Wage Change

Dependent Variable: Percent Change in Real Wage 1983-85 versus 1975-77

	All Manufacturing		Durable Goods		Nondurable Goods	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-3.149 (2.42)	-11.262 (5.58)	-8.355 (4.85)	-10.765 (4.90)	-0.965 (0.52)	-13.084 (3.90)
Change in import penetration ratio	-0.908 (4.92)	-0.423 (1.84)	-0.651 (2.89)	-0.339 (1.13)	-0.636 (1.94)	-0.117 (0.30)
Change in export ratio	0.009 (0.05)	-0.007 (0.04)	-0.085 (0.55)	-0.079 (0.51)	0.208 (0.53)	0.108 (0.27)
Change in percent unionized	0.206 (2.26)		-0.075 (0.57)		0.358 (2.85)	
Percent unionized, 1975-77		0.130 (3.15)		0.077 (1.63)		0.179 (2.68)
Change in imports times percent unionized in 1975-77	2.021 (4.36)	0.856 (1.50)	2.113 (4.27)	1.373 (2.01)	0.888 (0.99)	-0.313 (0.31)
Percent change in value added per hour	0.189 (6.13)	0.203 (6.80)	0.251 (6.18)	0.239 (5.89)	0.157 (3.52)	0.201 (4.59)
Adjusted R ²	.318	.341	.397	.417	.361	.352

Notes: Equations (1) and (2) are based on 141 observations. Equations (3) and (4) are based on 72 observations. Equations (5) and (6) are based on 69 observations. Absolute t statistics are given in parentheses.

pie way to test this effect is to include the interaction between the increase in the import penetration ratio and the initial unionization rate in the wage change regressions. The term for the import penetration ratio could be interpreted as the hypothetical effect of imports on wages in the absence of unionization. A positive coefficient on the interaction term, if combined with a negative coefficient on the pure import penetration term, would indicate that the downward pressure on wages stemming from increased competition from imports could, for a time, be resisted or offset by unions.

Results shown in Table 9 lend support to this conjecture. For all manufacturing, the interaction term was positive and, in one case, statistically significant, with the pure import penetration term magnified relative to the results of Table 5. Consequently, the 4.7 point increase in the import penetration ratio would apparently, in the absence of union resistance, have led to a 2 percent to 4 percent decline in aggregate wages. For durable goods, the interaction term was positive and significant, and more importantly, the pure import penetration term was now negative and, in one case, statistically significant. Thus, it appears that even among durable goods producers, increasing imports would, in the absence of unions, have exerted downward pressure on wages. Such pressure, however, was offset by the tendency of unions to resist wage cutting in the face of declining demand. This tendency appears to explain import competition's weak impact on wages in industries producing durable goods. For nondurable goods, by contrast, the interaction term was not statistically significant and its inclusion added nothing to the explanatory power of the equation. In these industries, union resistance to downward pressure on wages from import competition has been less evident.

Conclusions

There appears to be a statistically significant and grow-

ing inverse relationship between import penetration and earnings, both across industries at a point in time and within industries over time. The effect of imports on aggregate manufacturing wages, however, appears to be small. The doubling in the overall import penetration ratio between 1975 and 1985 reduced average hourly earnings in manufacturing by only about ½ percent to 1 percent.

The effect of imports on wages differs sharply by industry. In the durable goods sector, which tends to be high-wage, capital-intensive, and heavily unionized, wage losses in industries experiencing high import growth were no greater than in other industries. This finding suggests that on the whole unions in these industries resisted wage reductions. Still, employment losses suffered by these generally high-wage industries appear to have put downward pressure on overall average manufacturing earnings. In the nondurable goods sector, low-wage, labor-intensive industries that experienced increased import penetration saw severe wage losses.

Nonetheless, the bulk of the decline in real wages since the early 1970s should be attributed to factors other than increased imports. Real wages declined even in industries that did not experience significant increases in imports. Most notably, from the mid-1970s to the mid-1980s, wage growth was depressed by slow productivity growth, declining unionization rates, the upward trend in unemployment, and stagnant exports, while energy shocks boosted prices.

Finally, the adverse effects of import penetration must be balanced against benefits to the overall economy from international trade. Increased competition from imports contributed to the reduction of costs to consumers. The increase in the overall import penetration ratio generally occurred in the context of expanding international trade, with export ratios resuming their rise in the late 1980s. And although the issue is not discussed in detail in this study, results presented here suggest that increased exports may be associated with higher wages.

Data Appendix

Much of the analysis in this article is based on the National Bureau of Economic Research (NBER) Trade, Immigration, and Labor Markets Data Files, which provide information on 428 manufacturing industries by four-digit Standard Industrial Classification code. This information includes wages and employment (both for production workers and for all workers), industry trade flows, unionization rates, and value added per worker. The data set covers 1958 through 1986, although import and export data are only available through 1985 and unionization data through 1984. Because of questions concerning the reliability of four-digit classifications, the data have been aggregated to the three-digit level. This step yields 143 observations for each year, two of which (SIC 214, tobacco stemming and redrying; SIC 347, metal coatings and engravings) lack information on imports or exports and are not used further. The data set does not include information on the individual characteristics of workers.

Hourly earnings are calculated by dividing the total annual payroll for production workers by total hours, then deflating to 1982-84 dollars using the consumer price index. Both the payroll and hours variables in the NBER data set are based on the Annual Survey of Manufacturers. Hourly compensation is estimated by multiplying

hourly earnings by the ratio of total compensation to total wages as reported in the National Income and Product Accounts. Because the figures in the National Income and Product Accounts are only reported at the two-digit level, with the exception of the motor vehicle industry (SIC 371), it is assumed that the ratio of compensation to wages is constant across three-digit industries within any two-digit classification.

Import and export data for 1972-85 come from the Bureau of Labor Statistics trade monitoring system. For 1958-71 the NBER obtained raw data from the Census Bureau publication "US Commodity Exports and Imports as Related to Output," then adjusted the data using the Bureau of Labor Statistics method for import and export classification. The import penetration ratio is defined as imports divided by the sum of imports plus output. Output refers to the value of industry shipments, in millions of dollars, as reported in the Annual Survey of Manufacturers. The export ratio is defined as the ratio of exports to output. The unionization rate is for production workers and is based on observations from the May Current Population Survey in 1974, 1980, and 1984, with linear interpolation to obtain estimates for other years. Productivity is defined as value added per production worker hour, with value added taken from the Annual Survey of Manufacturers.