
Estimating the Impact of Increased Trade on the Employment of Union and Nonunion Workers

Statistical Model

Virtually all the fundamental forces described in chapter 4 have an impact on domestic output (i.e., shipments), on imports, and on exports (in constant dollars), and also on the number of union and nonunion workers employed. We have data on all these, and it is possible to utilize regression analysis to estimate quantitatively the average employment-shifting effects of industry changes in imports and exports (or any other of these variables) on changes in the employment of union versus nonunion workers (controlling for changes in the other variables) and thus to obtain estimates concerning whether trade changes in themselves are important factors associated with the changes in the number of union versus nonunion workers.

A useful way of proceeding is to begin with the identity that the number of workers employed domestically in the i th industry, L_i (where the number of industries goes from $i = 1$ to $i = n$), is equal to the industry's output, O_i , multiplied by the number of workers employed per unit value (in constant dollars) of the industry's output (the industry's labor coefficient, l_i). This can be expressed as the equation

$$L_i = O_i l_i \quad (5.1)$$

Changes in the number of workers in the industry over time, ΔL_i , can be approximated by totally differentiating equation 5.1:

$$\Delta L_i = \Delta O_i l_i + \Delta l_i O_i \quad (5.2)$$

Such economic forces as those discussed in the last chapter—increased trade, technological change, a greater consumption preference for services, and an increase in the supply of more educated workers relative to less educated workers—all affect both output and labor coefficients (and thus employment) across industries, with the observed changes in these variables being the net outcome of the interactions among these and other forces. To focus on the role of changes in trade on employment and to also control for the effects of changes in total domestic spending in an industry on the industry's imports, output, O_i , can be expressed as equal to domestic spending, A_i , on the output of the industry (either that which is produced by domestic or by foreign firms) minus imports, M_i , of an industry's products that are produced abroad plus exports, X_i , from the domestic industry. Thus, changes in L_i over time can be approximated as

$$\Delta L_i = l_i(\Delta A_i - \Delta M_i + \Delta X_i) + (A_i - M_i + X_i)\Delta l_i \quad (5.3)$$

In our regression analysis based on equation 5.3, we take into account the well-established lack of perfect substitutability of imports and domestic counterparts measured in A_i . (This relationship is stressed in the so-called new trade theory.) Consequently, any change in fundamental transfer costs and tariffs that alters imports and their domestic counterparts (in A_i) will have effects on the L_i producing the A_i that depend on the degree of substitutability. We will let the data tell us how differences in both M_i and A_i affect L . We will not insist that each of them has the same effect (i.e., l_i), which we should if we really believed that imports and domestic goods in A_i were perfect substitutes.

The regression equation used to estimate the relationships between changes in industry imports and exports and changes in union and nonunion employment is the linear relationship

$$\Delta L_{iu} = \alpha + \beta_1 \Delta A_i + \beta_2 \Delta M_i + \beta_3 \Delta X_i + \beta_4 \Delta l_i + e_i \quad (5.4)$$

where ΔL_{iu} is the change in the number of union workers employed in industry i during a particular time period (ΔL_{in} is the change in the number of nonunion workers employed in the industry during the same period) and the partial regression coefficients β_1 , β_2 , and β_3 indicate, respectively, the relationship between changes in domestic spending (ΔA_i), imports (ΔM_i), and exports (ΔX_i) on changes in union (or nonunion) employment (with different values for the β s being permitted), holding the other variables constant.

With regard to the fourth term, β_4 , I am primarily interested in estimating the effect of changes in labor coefficients on the number of union and nonunion workers employed rather than in estimating how the changes in labor coefficients differed among the various components of domestic

spending and spending by foreigners on domestic goods. Therefore, β_4 indicates the employment effect of a change in the industry's total labor coefficient (Δl_i) as influenced by such economic forces as technological change in the industry, changes in relative factor prices, and changes in relative factor supplies. I also introduce a constant term, α , into the regression equation to capture the effect on employment of omitted variables that are not closely associated with changes in the volume of international trade or in the equation's other independent variables. The last term in the equation, e_i , is assumed to be a well-behaved error term.¹

Regressions are undertaken with not only changes in the number of all union and all nonunion workers employed as the dependent variables but also changes in the employment of union and nonunion workers who have either 12 or fewer years of education (i.e., basically educated workers) or 13 or more years of schooling (i.e., more-educated workers). In the latter instances, changes in the labor coefficients for basically educated or more-educated workers are used as the fourth independent variable to control for technological change in an industry.

Because regression equation 5.4 is based on equations 5.1 and 5.3, we expect positive partial regression coefficients for β_1 , β_3 , and β_4 ; that is, the greater the industry increases in domestic spending and exports during a time period, the greater the increases in industry union and nonunion employment, while the smaller the decreases in industry labor coefficients, the smaller the decreases in union and nonunion employment. A negative coefficient is expected for β_2 ; that is, the larger the increase in industry imports, the larger the expected negative adjustment-pressure impact on industry union and nonunion employment.

The question of prime interest is whether the negative adjustment impact of increases in imports and positive adjustment impact of increases in exports on union and nonunion employment are simply proportionate to the relative importance of union and nonunion workers in the

1. It should be noted that the outputs (shipments) of US industries and industry imports in the basic regression (equation 5.4) comprise both final goods and goods used as intermediate inputs in the production of the final goods. Thus, in the auto industry (1987 3-digit SIC industry 371), e.g., shipment values include the value of steering and suspension parts (1987 4-digit SIC 3714) as well as the final value of automobiles (1987 4-digit SIC 3711), which also includes the value of the steering and suspension parts.

If integrated firms producing autos make the steering and suspension parts themselves rather than purchasing them from other firms producing these parts and report to the Commerce Department only the value of their final product, autos, rather than also the production values of all the intermediate inputs for which the Commerce Department also collects information, the comparability of shipment values and industry labor coefficients over time would be affected simply by vertical integration in an industry, e.g., the purchase of the plant producing steering and suspension parts by the firm assembling the final automobiles. However, the Census Bureau asks firms to report separately the value of products that are transferred to other manufacturing plants for further product processing.

labor force or whether the decrease (or increase) in employment of union workers associated with increases in imports (or exports) is disproportionately greater (or less) than for nonunion workers. Furthermore, if trade does have disproportionate effects, how important is the trade factor in accounting for the decrease during the specific two periods in the number of union workers?

Data Issues

We utilize sample data on union and nonunion membership by industry (mainly at the 3-digit level of the US Commerce Department's Standard Industrial Classification, or SIC) and level of education from the US Census Bureau's Current Population Surveys. These data are supplemented with industry data on employment, shipments, and trade from the US Bureau of Labor Statistics, input-output tables prepared by the US Bureau of Economic Analysis, and the various economic censuses undertaken by the US Department of Commerce. The complete data set covers 137 industries composed of 74 manufacturing industries, 56 service industries, and 7 industries involving agriculture, mining, or construction during the two periods 1977–87 and 1987–97.²

Although a complete analysis of the relationships between trade and employment clearly requires the inclusion of industries producing services as well as goods, there are significant data problems concerning the reliability and uniformity of the coverage of international trade in services during the study period.³ Unlike goods transactions, international service transactions usually generate no official records or customs documentation and involve many different forms of delivery. To compile statistics on international service transactions, the US government relies largely on periodic surveys of companies engaged in such activities. The difficulty of determining which firms and individuals are involved in cross-border trade in services and the relatively high costs of the surveys have resulted in the data on trade in services being much less complete and accurate than the data on trade in goods. Furthermore, the failure (largely for cost reasons) to revise earlier data, other than for a few years, after a new survey has been undertaken causes serious comparability problems over time with the data on international service transactions.

Unlike all the goods sectors, many service sectors in the data set list

2. See appendix A for a more detailed description of the data sources and appendix B for a complete list of the industries in the basic data set.

3. See Kester (1992, chap. 5) for a detailed description of the methods used to collect data on US services trade and discussions of the problems associated with these data.

trade only on the export side.⁴ Yet because product differentiation exists within service sectors as well as within goods sectors, one expects “love-of-variety” preferences (discussed below) on the part of consumers to lead to two-way trade in service industries whenever transportation costs or other factors do not rule out trade completely. Recording only exports for many service sectors may be because of the greater difficulty in tracking imports of services or perhaps to political pressures to reduce the recorded size of the US trade deficit. I believe that the data are most reliable if both imports and exports are recorded in a particular service sector at the outset of a period. Therefore, the data set used for the regressions covering both goods and services includes only those service sectors in which trade is reported for both the import and export sides at the beginning and end of a period.

This procedure and the exclusion of sectors in which there are no recorded imports or exports reduce the number of industries included in the regressions covering both goods and services to 92 industries in the 1977–87 period (74 manufacturing, 12 services, and 6 primary-product industries) and 97 in the 1987–97 period (74 manufacturing, 17 services, and 6 primary-product industries).⁵ However, as is further explained in discussing the regression results, questions still remain about the reliability of the data having this limitation on the nonmanufacturing industries included in the data set. Therefore, regressions are also undertaken on manufacturing industries alone, where the data seem more reliable. It is the results from this analysis of the manufacturing sector that are emphasized in the study.

Another issue that arises is whether to treat the employment effects of changes in an industry’s trade on a net basis or to take independent account of both imports and exports in the same industry. One reason for such two-way trade is that product categories are often so broad (e.g., electrical machinery, electrical equipment, and electrical supplies) that some of the different products within a particular product class are used as intermediate inputs in producing other products within the same commodity classification. Consequently, output (including export) increases of the final goods are associated with import increases of the intermediate goods. Differences in home and foreign comparative-cost conditions among various goods within a product category also lead to both exports and imports within the same product group.

The “new” trade theory, which replaces the perfect-competition assumption of traditional trade theory with the assumption that markets

4. For the 1977–87 period, only export trade is reported in 55 percent of the 56 service sectors in the data set. No exports or imports are reported in another 23 percent of the service sectors.

5. As was mentioned above, the number of sectors in the complete database is 137.

are imperfectly competitive, provides additional explanations for the existence of two-way international trade—even within the very detailed product descriptions used by customs officials. One part of this theory assumes that imperfect competition arises because of differentiated products. Within particular well-defined product classifications (e.g., a refrigerator, a personal computer, or a restaurant meal), there are many varieties of the product that differ from each other for reasons other than price (e.g., color, speed versus memory, or style of cooking).

If individuals like to consume many varieties of a product (so-called love-of-variety behavior), the existence of both imports and exports within a specific product classification is easily explained. Residents of a country wish to purchase both home-produced and foreign-produced varieties of a particular product (e.g., a car made in the United States and a car made abroad), even if the varieties of the product do not differ in price. Thus, when the demand for a product increases because of a general increase in national income or a technological improvement that affects all varieties, both the domestic output of the product (including that part that is exported) and imports of it increase.

I include both the exports and imports of each industry in the regressions as appropriate in this environment rather than just the industry differences between these two variables (i.e., net exports). Thus, the analysis here properly does not impose the condition that the employment effect of a given increase in an industry's exports is the same (but the opposite in sign) as an equivalent increase in the industry's imports (as would be appropriate if the goods were perfect substitutes and the markets were perfectly competitive).

Summary Statistics

Table 5.1 reports the industry mean and standard deviation of the various dependent (left-hand-side) and independent (right-hand-side) variables used in the regression analysis of the 74 industries making up the manufacturing sector for the periods 1977–87 and 1987–97. Table 5.2 does the same for those industries included in the combined goods and services industry grouping in which there are both imports and exports at the outset of the period covered.

Among the relationships brought out in tables 5.1 and 5.2 are the significant declines in union membership in both the 1977–87 and 1987–97 periods, especially during the first period and particularly in manufacturing industries, in contrast to sizable increases in the employment of nonunion workers, especially in services. As was noted above, the decline in union membership occurred largely among workers with a high school education or less, with unionization among individuals with more education actually increasing except in manufacturing between 1977 and

Table 5.1 Summary statistics for manufacturing, 1977–87 and 1987–97

Variable	Period	Industry mean ^a	Standard deviation ^a
Dependent variables			
Industry change in employment (thousands of workers)			
All	1977–87	-10.69	80.92
	1987–97	8.63	71.01
Union	1977–87	-35.73	46.88
	1987–97	-15.59	21.94
Nonunion	1977–87	25.04	67.72
	1987–97	24.22	62.94
Basically educated union	1977–87	-34.50	43.41
	1987–97	-16.79	20.91
Basically educated nonunion	1977–87	1.27	39.18
	1987–97	1.02	38.18
More-educated union	1977–87	-1.46	7.47
	1987–97	1.20	9.02
More-educated nonunion	1977–87	22.03	43.64
	1987–97	23.20	42.02
Independent variables			
Industry change in output components (billions of 1987 dollars)			
Change in domestic spending	1977–87	6.58	13.05
	1987–97	26.26	107.12
Change in imports	1977–87	2.72	6.20
	1987–97	8.77	37.04
Change in exports	1977–87	0.74	2.49
	1987–97	2.49	4.07
Change in labor coefficients (thousands of workers per 1 billion 1987 dollars of industry shipments)			
All workers	1977–87	-2.74	7.10
	1987–97	-1.35	2.29
Basically educated workers	1977–97	-1.54	1.68
More-educated workers	1977–87	-0.20	4.56
	1987–97	0.19	1.18

a. Based on 74 manufacturing industries.

Source: Author's calculations.

Table 5.2 Summary statistics for goods and services sectors, 1977-87 and 1987-97

Variable	Period	Sector or industry mean ^a	Standard deviation ^a
Dependent variables			
Sector or industry change in employment (thousands of workers)			
All	1977-87	14.42	149.66
	1987-97	58.30	224.49
Union	1977-87	-33.57	49.27
	1987-97	-11.86	39.56
Nonunion	1977-87	47.99	133.97
	1987-97	70.16	211.69
Basically educated union	1977-87	-33.74	43.99
	1987-97	-15.37	20.90
Basically educated nonunion	1977-87	5.22	71.34
	1987-97	7.93	89.41
More-educated union	1977-87	0.00	11.32
	1987-97	3.52	28.31
More-educated nonunion	1977-87	41.36	84.81
	1987-97	62.23	145.37
Independent variables			
Sector or industry change in output components (billions of 1987 dollars)			
Change in domestic spending	1977-87	7.16	19.27
	1987-97	23.84	96.65
Change in imports	1977-87	2.04	7.04
	1987-97	7.41	32.65
Change in exports	1977-87	.70	2.44
	1987-97	2.48	4.06
Change in sector or industry labor coefficient (thousands of workers per 1 billion 1987 dollars)			
All workers	1977-87	-2.24	7.08
	1987-97	-1.35	6.25
Basically educated workers	1977-87	-2.33	3.13
	1987-97	-1.57	2.41
More-educated workers	1977-87	0.09	4.41
	1987-97	0.22	4.28

a. Based on 74 manufacturing, 12 services, and 6 primary-product industries.
Based on 74 manufacturing, 17 services, and 6 primary-product industries.

Source: Author's calculations.

1987. The considerable worsening of the US trade balance, especially between 1987 and 1997, is also clearly shown in the tables.

Another variable of interest is the change in the average industry labor coefficient (i.e., l_i), the average number of workers (in thousands) employed per \$1 billion of shipments in the industries included in the data set. In table 5.2, the labor coefficient decreases for all workers of 2.24 and 1.35 for the 1977–87 and 1987–97 periods, respectively, for the goods and services industries in the dataset represent declines of 20 and 13 percent, respectively. The labor coefficient can decrease both because of labor-saving technological changes and because of increases in wages relative to the returns to nonlabor productive factors, the latter development bringing about the substitution of capital and other factors for labor. Because the decreases are mainly in the labor coefficients for less-educated labor (with the coefficient for more-educated workers actually rising in one of the periods) and the wages of less-educated workers fell significantly relative to those of more-educated workers in both periods, technological changes appear to be the main cause of the decline in labor coefficients.

Regression Results

The results of the regression analysis are presented in tables 5.3 to 5.7. The analysis proceeds in three stages. First, tables 5.3 and 5.4 report the partial regression coefficients from regressing changes in domestic expenditures, imports, exports, and labor coefficients across industries on both changes in the number of union workers and changes in the number of nonunion workers during two periods, 1977–87 and 1987–97. The regressions are run separately for two sets of industries: first, for manufacturing industries alone, and then for manufacturing industries plus all agricultural, mining, and services industries in which there are both imports and exports (traded goods and services) during the period covered.

Table 5.3 reports the estimated regression coefficients for the four independent variables and the constant term for the eight separate regression equations involved in these combinations of changes in union workers and nonunion workers during the two periods and for the two sets of industries. Table 5.3 also reports the standard errors associated with the estimated coefficients (and the levels of statistical significance that these indicate), a measure of the overall significance of the regressions (F -statistic), a measure of the regression equation's goodness of fit (R^2), and the number of industries included in each regression.

Table 5.4 shows comparable regression results at an even finer level of industry detail, namely, dividing union and nonunion workers in each industry into those who are basically educated (12 or fewer years of schooling) and those who are more-educated (13 or more years of schooling).

Table 5.3 Employment changes by union status regressed on changes in domestic spending, imports, exports, and labor coefficients, 1977–87 and 1987–97

Union status	Domestic spending	Imports	Exports	Labor coefficient	Constant	R ²	F-statistic
Manufactured goods^d							
Union workers							
1977–87	1.70 ^a (0.51)	-6.84 ^a (0.89)	3.14 (2.73)	0.08 (0.82)	-30.44 ^a (4.64)	0.49	16.45
1987–97	1.14 ^a (0.21)	-3.23 ^a (0.60)	-2.30 ^a (0.65)	2.02 ^b (0.96)	-8.82 ^a (2.56)	0.43	13.14
Nonunion workers							
1977–87	5.62 ^a (0.59)	-4.45 ^a (1.02)	2.99 (3.13)	3.26 ^a (0.94)	6.88 (5.33)	0.68	36.02
1987–97	3.77 ^a (0.47)	-10.87 ^a (1.34)	6.74 ^a (1.44)	8.40 ^a (2.13)	15.14 ^a (5.69)	0.66	33.51
Traded goods and services^e							
Union workers							
1977–87	0.75 ^b (0.30)	-3.76 ^a (0.77)	6.23 ^b (2.50)	1.11 (0.81)	-33.12 ^a (4.88)	0.26	7.55
1987–97	-0.09 (0.15)	0.20 (0.45)	-0.49 (1.24)	1.51 ^b (0.71)	-8.07 ^c (4.83)	0.08	1.94
Nonunion workers							
1977–87	3.27 ^a (0.71)	-3.31 ^c (1.85)	24.77 ^a (5.96)	11.82 ^a (1.94)	40.44 ^a (11.79)	0.43	16.40
1987–97	2.71 ^a (0.77)	-8.28 ^a (2.27)	8.50 (6.30)	-2.09 (3.62)	43.04 (24.51)	0.17	4.68

a. Coefficients significantly different from zero at the 1 percent level.

b. Coefficients significantly different from zero at the 5 percent level.

c. Coefficients significantly different from zero at the 10 percent level.

d. The number of observations of manufactured goods for all years was 74.

e. The number of observations for traded goods and services in 1977–87 was 92, and for 1987–97 was 97.

Note: Numbers in parentheses are standard errors.

Source: See appendix A.

Including this education factor with the other industry characteristics yields the 16 regression results reported in table 5.4.

For the second stage of the regression analysis, table 5.5 presents calculations indicating whether the expected negative (or positive) impact of import (or export) increases on union and nonunion workers are proportional to the relative number of union and nonunion workers employed across the industries at the outset of a period. When import

Table 5.4 Employment changes by education level and union status regressed on changes in domestic spending, imports, exports, and labor coefficients, 1977–87 and 1987–97

Union status	Domestic spending	Imports	Exports	Labor coefficient	Constant	R ²	F-statistic
Manufactured goods^d							
Basically educated union workers							
1977–87	1.17 ^b (0.48)	-6.13 ^a (0.83)	2.84 (2.22)	-0.46 (1.60)	-28.80 ^a (5.18)	0.48	15.95
1987–97	0.61 ^a (0.20)	-1.63 ^a (0.58)	-3.60 ^a (0.62)	2.69 ^b (1.17)	-5.54 ^c (2.80)	0.44	13.45
Basically educated nonunion workers							
1977–87	2.39 ^a (0.04)	-2.39 ^a (0.78)	2.98 (2.09)	7.43 ^a (1.51)	8.58 ^c (4.87)	0.44	13.28
1987–97	2.29 ^a (0.33)	-6.66 ^a (0.94)	1.07 (1.00)	7.62 ^a (1.90)	8.30 ^c (4.56)	0.55	21.34
More-educated union workers							
1977–87	0.43 ^a (0.09)	-0.6 ^a (0.15)	0.95 ^c (0.48)	0.67 ^a (0.22)	-3.2 ^a (0.78)	0.43	12.89
1987–97	0.50 ^a (0.07)	-1.53 ^a (0.20)	1.31 ^a (0.22)	1.60 ^b (0.67)	-2.15 ^b (0.84)	0.62	27.67
More-educated nonunion workers							
1977–87	3.04 ^a (0.38)	-1.65 ^b 0.65	2.73 (2.06)	2.69 ^a (0.94)	5.04 (3.35)	0.66	33.99
1987–97	1.52 ^a (0.33)	-4.25 ^a (0.94)	5.84 ^a (1.03)	14.40 ^a (3.12)	3.35 (3.92)	0.57	23.28
Traded goods and services^e							
Basically educated union workers							
1977–87	0.57 ^b (0.27)	-3.64 ^a (0.69)	4.1 ^b (2.02)	1.62 (1.48)	-29.51 ^a (5.09)	0.27	8.02
1987–97	0.04 (0.07)	-0.04 (0.21)	-2.28 (0.61)	2.31 ^a (0.86)	-6.66 ^b (2.70)	0.21	5.85
Basically educated nonunion workers							
1977–87	0.44 (0.41)	-0.28 (1.06)	13.22 ^a (3.11)	14.24 ^a (2.29)	26.56 ^a (7.86)	0.34	11.13

(table continues next page)

Table 5.4 Employment changes by education level and union status regressed on changes in domestic spending, imports, exports, and labor coefficients, 1977–87 and 1987–97 (continued)

Union status	Domestic spending	Imports	Exports	Labor coefficient	Constant	R ²	F-statistic
Basically educated nonunion workers							
1987–97	0.89 ^a (0.32)	-2.69 ^a (0.96)	0.99 (2.73)	-4.09 (3.89)	-2.22 (12.18)	0.11	2.96
More-educated union workers							
1977–87	0.17 ^b (0.07)	-0.09 (0.17)	2.53 ^a (0.57)	1.17 ^a (0.30)	-2.92 ^a (1.11)	0.32	10.11
1987–97	-0.12 (0.11)	0.25 (0.31)	1.8 ^b (0.87)	1.16 (0.73)	-0.08 (3.28)	0.12	3.25
More-educated nonunion workers							
1977–87	2.8 ^a (0.45)	-2.88 ^a 1.15	10.25 ^a (3.87)	9.29 ^a (2.00)	19.14 ^b (7.15)	0.44	0.59
1987–97	1.87 ^a (0.53)	-5.71 ^a (1.60)	7.37 (4.34)	-0.5 (3.66)	41.87 ^b (16.44)	0.16	4.51

a. Coefficients significantly different from zero at the 1 percent level.

b. Coefficients significantly different from zero at the 5 percent level.

c. Coefficients significantly different from zero at the 10 percent level.

d. The number of observations of manufactured goods for all years was 74.

e. The number of observations for traded goods and services in 1977–87 was 92, and for 1987–97 was 97.

Note: Numbers in parentheses are standard errors.

Source: See appendix A.

increases are neutral in their impact on union versus nonunion workers, unionist displacement shares correspond to unionist employment shares.

In this case of neutrality, one expects the estimated regression coefficient for the negative impact on the number of union workers of (say) a \$1 billion increase in imports of manufactured goods to be less than the negative impact on the number of nonunion workers associated with this import increase, simply because the number of union workers in the typical manufacturing industry, for example, is less than the number of nonunion workers. Under these circumstances, the ratio of union to nonunion workers negatively affected in employment terms should be approximately equal to the ratio of union to nonunion workers employed in the industries covered.

Table 5.5 Comparison of initial ratios of union to nonunion employment and ratios of changes in union to nonunion employment associated with trade changes and education level, 1977–87 and 1987–97

Education level and period	Employment ratio at beginning of period	Ratio of changes associated with:	
		Changes in imports	Changes in exports
All levels of education			
Manufacturing			
1977–87	0.61	1.54^a	1.05
1987–97	0.33	0.30	-0.34^a
Traded goods and services			
1977–87	0.47	1.14^c	0.25
1987–97	0.23	-0.02^a	-0.06
12 or fewer years of education			
Manufacturing			
1977–87	0.75	2.56^a	0.95
1987–97	0.43	0.24^c	-3.38^a
Traded goods and services			
1977–87	0.58	12.89^a	0.31
1987–97	0.30	0.02^b	-2.32^a
13 or more years of education			
Manufacturing			
1977–87	0.30	0.36	0.35
1987–97	0.18	0.36^a	0.22
Traded goods and services			
1977–87	0.25	0.03^b	0.24
1987–97	0.16	-0.04^a	0.30

a. Difference between ratio of employment changes of union to nonunion workers significantly different from ratio of total employment of union to nonunion workers at the 1 percent level.

b. Difference between ratio of employment changes of union to nonunion workers significantly different from ratio of total employment of union to nonunion workers at the 5 percent level.

c. Difference between ratio of employment changes of union to nonunion workers significantly different from ratio of total employment of union to nonunion workers at the 10 percent level.

Note: Ratios of union to nonunion import changes indicating that union workers fared relatively worse in a statistically significant sense than nonunion workers are displayed in bold type, whereas those indicating that union workers fared relatively better in a statistically significant sense than nonunion workers are displayed in bold italics.

Source: Author's calculations.

A ratio of the numbers of union to nonunion workers (where both groups are negatively affected by increased imports) that is statistically significantly larger than the average ratio of union to nonunion employment suggests that unionist displacement is extraordinarily and disproportionately high.⁶ It would be consistent with such hypotheses as that increased management opposition to unions induced by decreased profit opportunities brought about by increased import competition resulted in a disproportionately adverse employment-adjustment impact for union workers. In contrast, a positive ratio of union to nonunion displacement impact that is less than the ratio of union to nonunion employment indicates that union workers are relatively less adversely affected than nonunion workers by increased imports.

On the export side, a ratio of the increase in employment of union to the increase in nonunion workers associated with a \$1 billion increase in exports smaller (or larger) than the ratio of the number of union to nonunion workers employed in the covered industries indicates that union workers did not fare as well as nonunion workers (or fared better than nonunion workers) in relative terms from the positive employment impact of increased exports.

In the third stage of the regression analysis, even if the relationships of these ratios indicate that union workers are more adversely affected in employment terms than nonunion workers by increases in imports or exports, one needs to determine if this differential trade effect represents a major or minor component of the unionization decline in the industries covered in the analysis. Tables 5.6 and 5.7 (on p. 58 and p. 61) provide the information relevant to this question by using the estimated regression coefficients on the changes in domestic expenditures, imports, exports, labor coefficients, and the constant term together with the actual industry changes in these variables to allocate the total changes in the number of union and nonunion workers among the four independent variables and a constant term. The constant term picks up the employment effects brought about by variables not included in the regression equations, such as a general antiunion shift in behavior toward unions by management and antiunion governmental actions, as were discussed in chapter 1.

To begin with, consider the manner in which the estimated regression coefficients in tables 5.3 and 5.4 (on p. 46 and p. 47) should be interpreted and some of the main differences in their signs and magnitudes across industry groups, time periods, and union versus nonunion status. The set of coefficients listed in the first row of table 5.3 covers all unionized

6. As is discussed below, when the changes in either union or nonunion employment are unexpectedly positive when imports increase so that their ratio is negative, the matter of which group fares relatively better obviously depends simply on which of the two groups has the positive sign. The same point applies when the change in employment from increased exports is negative for either union or nonunion employment.

workers in the 74 manufacturing industries in the data set during the period 1977–87. As is shown in the imports and exports columns, for example, they indicate that a \$1 billion increase in imports (all other variables remaining unchanged) is, on average, associated with a decrease in industry employment of 6.84 thousand union workers, or, expressed in numbers of workers per \$1 billion, 6,840 union workers, and a \$1 billion rise in exports with an increase of 3.14 thousand union workers per industry, i.e., 3,140 union workers. A \$1 billion rise in domestic spending is associated with an industry rise in union employment of 1,700 workers, whereas the average industry change during the period in the labor input coefficient (i.e., the number of workers used to produce \$1 billion worth of output) is associated with a decline in union employment of 80 workers.

Other influences picked up by the constant term in the regression equation are associated with an average employment decrease in each industry from 1977 to 1987 of 30,440 workers. It should be emphasized that these numbers do not represent actual changes in the number of jobs, but are best viewed as short-run adjustment-pressure effects, holding the other variables constant.

The expected negative relationship between changes in imports and changes in employment and positive relationships between changes in domestic expenditures, exports, and labor coefficients and changes in employment generally hold for union and union workers during both periods and sets of industries in table 5.3. The only deviation from this sign pattern occurs for the export-change coefficient of union workers as a group during the 1987–97 period in both the manufacturing sector and the traded goods and services industry group. The export signs are negative, and the coefficient is statistically significant in the manufacturing sector.

Table 5.4 (on p. 47) in which union workers are divided into those who are basically educated (12 or fewer years of education) and those who are more-educated (13 or more years of schooling), indicates that the basically educated group of union workers is the source of the statistically significant negative export coefficient on all union workers in this time period. The export coefficient on more-educated union workers for the 1987–97 time period is significantly positive in both manufacturing and the traded goods and services group. Table 5.4 also shows an unexpectedly negative sign for the regression coefficient on the labor coefficient-change variable for basically educated workers in the 1977–87 period. An important feature of the constant term in the various equations for both time periods is that it is negative for unionized workers but positive for nonunion employees.

About three-quarters of all the regression coefficients in table 5.3 differ from zero in a statistically significant manner. But there is a considerably higher proportion of significant variables in the manufacturing sector alone (80 percent) compared with the traded goods and services group (65 percent). This occurs because excluding the 74 manufacturing industries

from the data set used for the regressions and regressing the independent variables only on changes in the numbers of union and nonunion workers employed in those nonmanufacturing industries with both imports and exports (18 in the 1977–87 period and 23 in the 1987–97 period) generally yields insignificant coefficients (a number of which have the wrong signs) for the import-change and export-change variables.⁷

The regression coefficients for the other two independent variables (changes in domestic spending and in labor coefficients) also have unexpected signs in the nonmanufacturing regressions, especially for union workers. Because these outcomes could be consequences either of poor data for many of the nonmanufacturing industries or of diverse omitted variables affecting these industries, we shall emphasize the regression results covering manufacturing for which the quality of data seems much better and the forces affecting the coefficients are more uniform across sectors.

As was stressed above, a key issue being investigated in the regression analysis is whether increases in imports and exports affected the employment of union workers and nonunion workers in a comparable manner. This can be ascertained for workers engaged in manufacturing activities during the 1977–87 period, for example, by comparing the relative magnitudes of the import and export coefficients for union and nonunion workers engaged in manufacturing (reported in the first and third rows of regression coefficients in table 5.3) with the relative number of union and nonunion workers employed in manufacturing at the outset of the period. The coefficient for the import-change variable for union workers in the 1977–87 period implies, as was pointed out above, that a \$1 billion increase in industry imports for the 74 manufacturing industries is, on average, associated with a decrease in employment of 6,840 union workers, whereas the import-change coefficient for nonunion workers in manufacturing during this period indicates an average industry decrease in nonunion employment of only 4,450 jobs.

Because there were more nonunion than union workers in manufacturing in 1977, these estimates suggest that relative to nonunionized manufacturing workers, unionized workers were disproportionately affected in an adverse manner by import growth. The ratio of the industry decrease in 6,840 union jobs to the industry decrease in 4,450 nonunion jobs per \$1 billion rise in imports in manufacturing during the 1977–87 period is 1.54. In contrast, the ratio of total employment in manufacturing of all union workers to total employment of all nonunion workers in this sector in 1977 is only 0.61.⁸ Moreover, the ratio of change

7. These regressions are not reported in the tables but are available from the author.

8. This is the case because, as reported in table 2.1, the proportion of unionized workers in manufacturing in 1977 was 38.0 percent and thus the 1977 proportion of nonunionized workers in manufacturing was 62.0 percent. Consequently, the ratio of union to nonunion workers was 38.0/62.0, or 0.61.

in union to nonunion employment per \$1 billion of imports in manufacturing between 1977 and 1987 differs from the ratio of total employment of union to nonunion workers in 1977 at the 1 percent level of statistical significance.⁹

The ratio of the export-change coefficients for union and nonunion workers in manufacturing during this period is +3,140 union workers per \$1 billion divided by +2,990 nonunion workers per \$1 billion (see table 5.3), or 1.05. Because of this export-side ratio is positive, it indicates that a \$1 billion rise in exports created relatively more jobs for union workers than would be expected from their relative importance in manufacturing at the period's outset. However, the difference between the 1.05 union–nonunion export ratio and the 0.61 union–nonunion employment ratio in manufacturing is not statistically significant at a level of 10 percent or less.

To facilitate such comparisons, table 5.5 (on p. 49) indicates the ratios of the employment of union to nonunion workers in manufacturing alone and in the combined traded goods and services product group at the beginning of each period for workers at all levels of education as well as for basically educated and more educated workers. It also reports the ratios of the regression coefficients of the changes in union to the changes in nonunion employment associated with a \$1 billion increase in imports as well as for exports.

Table 5.5 also indicates whether the ratios of the changes in union to nonunion employment differ at conventional levels of statistical significance from the corresponding ratios of the employment of union to nonunion members. To facilitate the interpretations to be given to the comparisons, union to nonunion import-change ratios indicating that union workers fared relatively worse in a statistically significant sense than nonunion workers are displayed in bold print, whereas those indicating that union workers fared relatively better in a statistically significant sense than nonunion workers are displayed in bold italics.

9. This significance level is measured by first calculating the differences between the changes in the number of union workers across manufacturing industries between the 1977–87 (let this be $nun7787$) and the changes in the number of nonunion workers across manufacturing industries between 1977–87 (let this be $nno7787$), where the latter numbers are each multiplied by the ratio of the total number of union to total number of nonunion workers in manufacturing in 1977 (let this constant term be $tnun77/tnno77$). Expressed as an equation, the differences calculated across manufacturing industries are $nno7787 - (nno7787 * tnun77 / tnno77)$. These differences are then regressed on the usual right-hand-side variables in the regression equation, namely, changes in domestic spending, imports, exports, and labor coefficients across manufacturing industries during the 1977–87 period. Finally, the level at which the import coefficient (or any of the other coefficients) is statistically different from zero is then determined. A similar procedure for determining statistical significance with regard to the ratios of changes of union to nonunion workers associated with import changes is followed for other groups of workers and sets of industries as well as for exports.

Consider first the relationships between the employment ratios and the two trade ratios during the 1977–87 decade, beginning with the basically educated (12 or fewer years of education) group of workers (shown in the middle rows of table 5.5), along with the more-educated workers (13 or more years of education, in the bottom rows), and finally both groups combined (in the top rows). The most important conclusion to be drawn on the import side from table 5.5 in this period is that basically educated union workers fared worse in a statistically significant sense compared with basically educated nonunion workers, both in the manufacturing and in the combined traded goods and services industry groups. The ratio of the number of basically educated to more-educated workers employed in manufacturing in 1977 is 0.75, whereas the statistically significant ratio of the decrease in the number basically educated workers to more-educated workers per \$1 billion increase in imports during the 1977–87 period is 2.56. For traded goods and services as a product group, the same ratios are 0.58 and 12.89, respectively.

For more-educated union workers alone, the relationships during the 1977–87 period are rather different than for the basically educated group. More-educated union workers were affected in employment terms in about the same relative manner as more-educated nonunion workers in the manufacturing sector and in a better (and statistically significant) manner in the traded goods and services sector. Specifically, for this education category, the ratio of union to nonunion employment change for manufacturing imports is about the same (0.36) as the ratio of union to nonunion total employment (0.30); but the ratio of union to nonunion employment change for imports of traded goods and services is considerably smaller (0.03) when compared with a 1977 total employment ratio of 0.25.

Because the number of basically educated workers is considerably larger than the number of more-educated workers, the relationships for all workers (union plus nonunion) as a group are the same as for the basically educated group. The 1977–87 ratio of the negative employment-adjustment impact on manufacturing of a \$1 billion increase in imports on union compared with nonunion workers is 1.54 and differs in a statistically significant manner, whereas in that sector the ratio of the total employment of union to nonunion workers in 1977 for all levels of education is only 0.61. In the traded goods and services product group, the respective ratios are 1.14 and 0.47.

On the export side for the 1977–87 period, no significant relationships exists with regard to how well union workers fared compared with nonunion workers in employment-creation terms. The ratio of all union to all nonunion jobs associated with a \$1 billion increase in exports in the manufacturing sector is 1.05, compared with a 1977 total employment ratio for these workers of 0.61.

Although this indicates a more favorable employment treatment of all union relative to all nonunion workers, the difference between these

ratios is not statistically significant. For both basically educated and more-educated employees in manufacturing, the employment-increase ratios for union relative to nonunion workers are also greater than the total employment ratio, but again the differences are not statistically significant. For the traded goods and services group during the 1977–87 period, the union to nonunion employment-change ratios are all higher than the total employment ratios (indicating that union workers fared relatively worse than nonunion workers); but again, the ratios do not differ in a statistically significant sense.

Next, consider the relationships between these ratios for the three worker-groups during the 1987–97 period. They are quite different from the 1977–87 period on both the import and export sides. With regard to import increases, the most striking relationship is that basically educated union workers fared relatively better in employment displacement terms than basically educated nonunion workers. In contrast to the first period, the 1987–97 ratios of employment decreases of union and nonunion workers associated with increased imports are smaller (rather than larger) in a statistically significant sense for basically educated workers than the employment ratio of basically educated union to nonunion workers in 1987 in both manufacturing and traded goods and services, namely, 0.24 to 0.43 and 0.02 to 0.30, respectively. Furthermore, whereas in the 1977–87 period more-educated union workers in manufacturing fared relatively about the same as more-educated nonunion workers, in the 1987–97 period more-educated union workers in the manufacturing sector fared relatively worse in statistically significant terms than more-educated nonunion workers.

The negative signs on the union to nonunion employment-change ratios associated with increased imports in the traded goods and services industry group both for all workers as a group and for more educated workers are the consequence of positive (rather than the expected negative) regression coefficients on the union worker variable for these two groups of workers (see tables 5.3 and 5.5). These positive coefficients are not statistically different from zero, however. But when the employment-change ratios are compared with the total employment ratios for these groups of workers, they do differ in a statistically significant sense. They indicate a more favorable treatment in the goods and services sector during the 1987–97 period for all union workers as a group compared with all nonunion workers and for more-educated union workers compared with their nonunion counterparts.

On the export side, the union to nonunion employment-change ratios for 1987–97 not only have a negative (rather than the expected positive) sign in four of the six cases but differ statistically from their 1987 overall employment ratios of union to nonunion workers at the 1 percent level in three of these cases. This is the consequence of the negative relationship between changes in exports and changes in the employment of basically

educated union workers (but not basically educated nonunion or more educated union and nonunion ones) that exists in the regression results for the 1987–97 period (see table 5.4).¹¹ For example, a \$1 billion increase in exports is associated with the loss of 3,600 jobs for basically educated union workers in the manufacturing sector.¹²

The most likely reason for this relationship would seem to be that the increases in exports are correlated with some economic factor not explicitly included in the regression equation that has the effect of decreasing the employment of basically educated workers. One plausible factor is foreign direct investment, which we know is positively correlated with exports (see Lipsey, forthcoming), and which in recent years has been associated with the transfer of less-skill-intensive production activities from the United States to lower-wage countries.¹³ The existence of the wage premium earned by union workers (see table 2.4), coupled with greater competitive pressures in export markets than domestic markets, may account for increased foreign direct investment by firms directed at producing less-skill-intensive components abroad in certain industries and thus for the negative relationship between export changes and

11. The negative signs of the union to nonunion employment-change ratios for all workers in manufacturing alone and in all traded goods and services are, for example, due to the influence of the negative 1987–97 relationship between increases in exports and the change in the number of basically educated workers employed in these product groups, because increases in exports and changes in the employment of more-educated workers are positively related (see table 5.4).

12. A scatter diagram of the partial regression coefficients of increases in exports and changes in the employment of basically educated union labor across manufacturing industries indicates that the industries responsible for the negative export coefficient are the manufacturing industries 61–81 in the list of industries in appendix B. These industries include such products as machinery and computing equipment; electrical machinery, equipment, and supplies; transportation equipment; professional photographic equipment and watches; and amusement and sporting equipment. Regressing the independent variables for the other manufacturing industries, namely, industries 8–60, yields a significantly positive coefficient for the export-change coefficient. Moreover, whereas the constant term is significantly negative in the 8–60 group of industries (as is the case for all manufacturing industries as a group), the constant term is positive, although not significant, for manufacturing industries 61–81.

13. Export increases seem to be positively associated with increases in foreign direct investment for a number of reasons. When a firm outsources less-skill-intensive production activities to foreign countries, the outsourcing activities often take place on a skill-intensive production component that is produced domestically and then exported. Moreover, if the final product is sold in third countries, it is often less expensive to ship other skill-intensive components to the outsourcing country for final assembly rather than shipping the unskilled labor-intensive component back to the home country to be assembled with the other components and then exported to the third countries. Even when the unskilled labor-intensive part is exported to the home country, the savings in labor costs may enable the firm to increase its exports of the final product as it becomes more competitive internationally.

employment changes of basically educated union workers in the 1987–97 decade.¹⁴

As was discussed in chapter 4, the fact that foreign outsourcing often involves exports of skilled labor-intensive components on which unskilled labor-intensive tasks are undertaken also contributes directly to this negative relationship between export increases and the employment of basically educated union workers. Of course, simply poor measurement of these variables may also account for this result. We clearly need to make testing efforts—both with a more complex econometric model that includes measures of the fundamental economic forces affecting trade and employment and with a more detailed database—before we can be confident about the validity of our findings on this matter.

Total Employment Effects

Whereas tables 5.3 and 5.4 indicate the estimated employment effects per \$1 billion change in domestic spending, imports, and exports and per unit change in labor coefficients, tables 5.6 and 5.7 report the changes in total employment associated with the actual changes in these variables—that is, the employment changes obtained by multiplying the regression coefficients in tables 5.3 and 5.5 by the respective observed changes across industries in the right-hand-side variables.¹⁵ This provides information concerning the relative importance in total employment terms for union and nonunion workers of the different right-hand-side variables and the constant term.

For example, table 5.6 indicates that the increase in domestic spending on manufactured goods during the 1977–87 period was associated with an adjustment impact on union workers of all education levels who are employed in manufacturing of +828,000 workers. The change in union employment associated with the increase in imports during this period was –1,374,000 jobs, whereas the change in the employment of union workers in this sector related to the increase in exports was +172,000 workers. The decline in the number of workers required per \$1 billion of industry output resulted in a change in union workers of –17,000. The employment-impact importance of factors other than changes in domestic

14. The existence of a positive (though not statistically significant) regression coefficient for basically educated nonunion workers (see table 5.4) suggests that employers may have used the threat of transferring production activities abroad as a means of inducing basically educated union workers to drop their union affiliation.

15. Because of rounding, the sum of the employment changes in tables 5.6 and 5.7 for workers of different educational levels and in different product groups may not exactly equal the product of the industry means of number of workers multiplied by the number of industries that are reported in tables 5.1 and 5.2.

Table 5.6 Estimated employment changes by union status associated with changes in domestic spending, imports, exports, and labor coefficients, 1977–87 and 1987–97 (thousands of workers)

Union status	Domestic spending	Imports	Exports	Labor coefficient	Other factors	Total change
Manufactured goods						
Union workers						
1977–87	828	-1,374	172	-17	-2,252	-2,643
1987–97	2,218	-2,094	-424	-202	-653	-1,155
Nonunion workers						
1977–87	2,736	-895	164	-661	509	1,853
1987–97	7,319	-7,053	1,243	-838	1,120	1,781
Traded goods and services						
Union workers						
1977–87	492	-707	403	-229	-3,047	-3,047
1987–97	-194	137	-118	-197	-782	-782
Nonunion workers						
1977–87	2,156	-622	1,600	-2,449	3,721	3,721
1987–97	6,264	-5,949	2,043	273	4,175	4,175

Source: Author's calculations.

spending, imports, exports, and the labor coefficients that are picked up by the constant term in the regression is indicated by the change of -2,252,000 union workers associated with this term.

The sum of all these changes, namely, -2,643,000 union workers, is equal to the change in union membership in manufacturing during the 1977–87 period. The employment-impact effects for nonunion workers in manufacturing during this period associated with the four independent variables are +2,736,000 nonunion workers from domestic spending, -895,000 from imports, +164,000 from exports, and -661,000 from the change in labor coefficients. In contrast to union workers, the effect of omitted variables on the employment of nonunion workers is positive, namely, +509,000 nonunion workers. The sum of the employment adjustment impact on nonunion workers of the independent variables and the omitted variables is +1,853,000.

Of special interest with regard to these estimates of short-run adjustment impact is the relative importance of any differential treatment of union versus nonunion workers associated with changes in trade in accounting for the overall decline in unionization. As was pointed out in the previous section (see table 5.5), there is statistically significant evidence that the employment adjustment effects of increased imports in the manufacturing sector during the 1977–87 period did negatively

affected basically educated union workers in a manner that was greater than their relative importance in the manufacturing labor force. Specifically, the ratio of the employment impact of $-1,374,000$ union jobs compared with $-895,000$ nonunion jobs, namely, 1.54, associated with increased imports during this period (see table 5.6) is much greater than the ratio of union to nonunion workers in the manufacturing sector at the outset of the period, namely, 0.61.

The magnitude of the disproportionately adverse impact of increased imports on union workers can be estimated as the difference between the $-1,374,000$ and what this number would be if the sum of the negative employment impact of increased imports on union plus nonunion employment during the period ($-1,374,000$ plus $-895,000$, or $-2,269,000$ workers) is allocated in proportion to the 0.61 ratio of union to nonunion workers employed in manufacturing in 1977. If this estimating procedure is followed, the negative impact of increased imports on union employment versus nonunion workers amounts to $-860,000$ union workers instead of $-1,374,000$ union workers.¹⁶ Thus, the measure of the disproportionately adverse impact of increased imports on union workers amounts to $-514,000$ union workers ($-1,374,000$ minus $-860,000$). Although this is a substantial number of workers, the discriminatory employment impact of increases in imports of manufactured goods on union compared with nonunion workers is equal to less than one-quarter of the negative impact on union members of influences not captured by the independent variables in the regression equation but, instead, indicated by the constant term of $-2,252,000$ union workers.¹⁷ This implies that factors other than the extent of import increases across industries played the dominant role in accounting for the decline in union employment during the period.

If similar calculations are undertaken for the 1977–87 change in union membership in manufacturing for basically educated workers by themselves (see table 5.7), the discriminatory impact of increased imports in the manufacturing sector on the employment of union compared with

16. Let x and y equal the hypothetical employment effects of increased imports on union and nonunion workers, respectively, in manufacturing if the total decrease in the employment of union and nonunion workers associated with increased imports in 1977–87 ($-1,374,000$ plus $-895,000 = -2,269,000$; see table 5.7) is distributed in the same ratio as the total number of union to nonunion workers employed in manufacturing in 1977, namely, 0.61 (see table 5.5). Thus, solving the two equations, $x/y = 0.61$ and $x + y = -2,269,000$, yields values for x and y of $-860,000$ and $-1,409,000$, respectively. The difference between the calculated value for basically educated union workers in table 5.7 ($-1,374,000$) and the hypothetical value for basically educated ones ($-860,000$) is $-514,000$.

17. Another indicator of the importance of the “other factors” not included among the independent variables in “explaining” the change in union membership in the 1977–87 period is that the combined impact of changes in all the independent variables, namely, changes in domestic expenditures, imports, exports and labor coefficients, account for only $-391,000$ of the total change in union membership of $-2,643,000$.

nonunion workers amounts to -498,000 workers, a number that again is equal to less than a quarter of the negative employment impact of omitted variables, namely, -2,132,000 basically educated union workers.¹⁸

As was also noted in discussing table 5.5 and in contrast to the 1977-87 period, there is statistically significant evidence in the 1987-97 period that increased imports affected the employment of basically educated union workers in a less (rather than more) negative manner than would be expected from their relative importance in overall employment terms. If the negative employment impact on basically educated union workers plus the negative impact on nonunion workers of increased imports in manufacturing during the 1987-97 period (see table 5.7) of -1,055,000 plus -4,324,000 or -5,379,000 workers had been distributed in proportion to the 0.43 employment ratio (see table 5.5) of basically educated union to basically educated nonunion workers in manufacturing for 1987, the negative employment impact of the increased imports on union workers would have been -1,617,000 rather than the -1,055,000 number reported in table 5.7.¹⁹ The difference between -1,055,000 and -1,617,000, namely +562,000 workers, is a measure of the relatively less adverse (i.e., more favorable) employment effect of increased imports on basically educated union compared with basically educated nonunion workers in the 1987-97 decade.

At the same time, I also find that export increases were associated with an unexpected, statistically significant decrease in the employment of basically educated union workers in manufacturing during the 1987-97 decade. As is reported in table 5.7, the estimated magnitude of this change is -665,000 basically educated workers in the manufacturing sector, whereas the estimated change in the number of basically educated

18. As is indicated in table 5.7, the negative employment impact of increased imports on basically educated union workers in manufacturing in 1977-87 is -1,232,000, and the negative impact on basically educated nonunion workers is -480,000, thus yielding a -1,712,000 change in all basically educated manufacturing workers associated with import increases during this period. The ratio of basically educated union workers to basically educated nonunion workers in 1977 is 0.75 (see table 5.5). Thus, the negative impact on basically educated unionized workers in manufacturing of increased imports would have been only -734,000 unionized workers if increased imports had affected basically educated unionized worker in a manner proportional to their relative importance in employment terms. The difference between the -1,232,000 and -734,000 figures, or -498,000 workers, is the estimate of the disproportionately adverse impact of increased imports on basically educated unionized workers.

19. Again, let x and y equal the hypothetical employment effects of increased imports on basically educated union and nonunion workers, respectively, if the total decrease in the employment of basically educated workers associated with increased imports in 1987-97 (-1,055,000 plus -4,324,000 = -5,379,000; see table 5.7) is distributed in the same ratio as the total number of basically educated union to nonunion workers employed in manufacturing in 1987, namely, 0.43 (see table 5.5). Solving the two equations, $x/y = 0.43$ and $x + y = -5,379,000$, yields values for x and y of -1,617,000 and -3,762,000, respectively. The difference between the calculated value for basically educated union workers in table 5.7 (-1,055,000) and the hypothetical value for basically educated ones (-1,617,000) is +562,000.

Table 5.7 Estimated employment changes by education level and union status associated with changes in domestic spending, imports, exports, and labor coefficients, 1977–87 and 1987–97 (thousands of workers)

Education level and union status	Domestic spending	Imports	Exports	Labor coefficient	Other factors	Total
Manufactured goods						
Basically educated union workers						
1977–87	569	-1,232	156	86	-2,132	-2,553
1987–97	1,193	-1,055	-665	-306	-410	-1,243
Basically educated nonunion workers						
1977–87	1,164	-480	163	-1,388	635	94
1987–97	4,455	-4,324	197	-867	615	76
More-educated union workers						
1977–87	209	-121	52	-10	-237	-107
1987–97	981	-997	242	22	-159	89
More-educated nonunion workers						
1977–87	1,483	-332	149	-43	372	1,629
1987–97	2,947	-2,758	1,078	202	248	1,716
Traded goods and services						
Basically educated union workers						
1977–87	376	-683	265	-347	-2,715	-3,104
1987–97	84	-29	-550	-351	-646	-1,492
Basically educated nonunion workers						
1977–87	285	-48	854	-3,057	2,449	483
1987–97	2,056	-1,932	237	-623	-215	-477
More-educated union workers						
1977–87	111	-16	163	10	-269	-1
1987–97	-286	179	431	-286	-8	30
More-educated nonunion workers						
1977–87	1,798	-491	662	77	1,761	3,807
1987–97	4,321	-4,104	1,770	-11	4,061	6,037

Source: Author's calculations.

nonunion workers is +197,000. Following the same procedure used in estimating hypothetical effects of imports yields a hypothetical value for the expected number of basically educated union workers on the export side of -141,000 and basically educated nonunion workers of -327,000, because the employment ratio of basically educated union to nonunion workers in 1987 was 0.43.

Thus, the disproportionately adverse employment treatment on the export side of basically educated union workers in the 1987–97 decade was –524,000 (–665,000 minus –141,000). This number does not quite offset the measure of the disproportionately more favorable treatment of basically educated union workers compared with nonunion workers on the import side, namely, +562,000. The net disproportionately favorable employment effect of imports plus exports on basically educated unionized workers of 38,000 (562,000 minus 524,000) is equal to only about 9 percent of the –410,000 impact of “other factors” on the employment of basically educated unionized workers during the 1987–97 decade.

As was mentioned above, still another contrast with the earlier period is the statistically significant evidence that more-educated union workers in manufacturing in the 1987–97 period fared disproportionately adversely in employment-change terms from increased imports than more-educated nonunion workers (see table 5.5). Using the methodology followed in estimating such a number on the import side for the 1977–87 period, the extent of the disproportionately adverse effect of increased imports on more-educated workers is equal to –424,000 more-educated union workers.²⁰

In addition to the information revealed about the relative importance of changes in imports and exports in accounting for any disproportionately adverse or less favorable impact on union workers, tables 5.6 and 5.7 also indicate the relative importance of the other independent variables on the changes in employment. For example, another relationship of interest is the association between changes in labor coefficients and changes in union versus nonunion employment.

One important finding with regard to this issue is that in the 1977–87 period, union workers fared much better compared with nonunion workers in terms of the employment-displacing effects of the decreases in labor coefficients. In manufacturing (see table 5.6), for example, the negative employment impact of the labor-coefficient decline in this period is only –17,000 jobs for union workers compared with –661,000 for nonunion workers, a ratio of 0.03—relative to an overall employment ratio of union to nonunion workers of 0.61 in 1977. Again, however, the 1987–97 period relationship is quite different. In this period, the employment displacement impact ratio was 0.31, compared with an employment ratio in 1987 of 0.33, thus indicating that the fall in labor coefficients affected union and nonunion workers in approximate proportion to their employment numbers in 1987.

20. In this case, the two equations are $x/y = 0.18$ and $x + y = -3,755,000$, so that $x = -573,000$ more-educated union workers and $y = -3,182,000$ more-educated nonunion workers. Therefore, the difference between the number of more-educated unionists in manufacturing reported for imports in table 5.7 for the 1987–97 period (–997,000) and number estimated above (–573,000) is –424,000.

In summary, the main conclusion to be drawn from this chapter is that factors other than simply changes in imports and exports mainly “explain” the extensive deunionization during the 1977–97 period. In the 1977–87 decade, the largest group of union workers in manufacturing, namely, those with 12 or fewer years of education, did face considerably larger employment-displacing import pressures relative to nonunion workers with the same educational background than would be expected from the relative importance of these two groups in the manufacturing labor force.

However, the opposite relationship held in the 1987–97 period. Yet export increases in this decade are also unexpectedly associated with an absolute decrease (rather than increase) in the employment of basically educated union workers. I speculate that the effect of other factors positively correlated with export increases, such as increased foreign direct investment and outsourcing, may account for this relationship and emphasize the need for more complex econometric models to investigate this issue. Still, deunionization among basically educated workers is mainly associated with factors not directly related to either import or export changes or the other independent variables in the regression equation but measured in the constant term in this equation.