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Trade and Job Loss in U.S. Manufacturing, 1979–1994

Lori G. Kletzer

10.1 Introduction

Since the late 1970s, millions of workers have lost their jobs following plant closures, plant relocations, or large-scale reductions in operations. Job insecurity remains at the forefront of public discourse, a stubborn reminder that even a prolonged economic expansion and a steadily falling national unemployment rate cannot erase perceptions created by widespread experiences of permanent job loss. Today, globalization and technological change are often cited as key factors in changes in employment stability.

This paper examines the relationship between increasing foreign competition and job displacement in U.S. manufacturing during the period 1975–94.[1] This was a period of increased trade flows, large swings in the value of the dollar, and falling trade barriers in developing countries.[2] This period was also characterized by widespread permanent job loss, particularly in manufacturing.[3]

Labor reallocation is a likely implication of a move to freer trade, and there is a sizable empirical literature that examines the link between in-

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1. As commonly understood, job displacement is an involuntary (from the worker's perspective) termination of employment based on the employer's operating decisions and not on a worker's individual performance.

2. For a discussion of the last of these three events, see Sachs and Warner (1995).

3. See Fallick (1996) and Kletzer (1998a) for reviews of the literature on the incidence and consequences of job displacement.

creasing trade and changes in industry net employment and wages. These net employment changes are a result of changes in the gross flows of new hires, recalls, quits, displacements, temporary layoffs, and retirements. My focus here on displacement is motivated by the perspective that the amount of social and private adjustment to freer trade depends in an important way on gross employment changes, and it is the job-loss component of employment change that most concerns workers, the general public, and policymakers. There is no doubt that the assertion "trade costs jobs" plays an important role in the domestic political economy of free trade.

This paper extends earlier research, first reported in Kletzer (1998b, 1998c), that found evidence that as imports become more competitive, domestic industry displacement rises.[4] The research is motivated by the expectation, based on theory and previous empirical work, that trade liberalization will lead to labor reallocation, with jobs moving away from import-competing industries and toward export industries. From that starting point, several questions are posed. Descriptively, how does the survey evidence on job displacement accord with standard measures of increasing foreign competition? Causally, is the incidence of job displacement across and within industries related to changes in foreign competition? Such changes may occur with developments such as the North American Free Trade Agreement (NAFTA) and the General Agreement on Tariffs and Trade (GATT). Finally, what does the pattern of labor reallocation look like, based on individual-level data? Do workers displaced from import-competing industries become reemployed in export industries or do they move to services (where average wages are lower)?

This paper is organized as follows. Section 10.2 reviews recent studies of the relationship between increasing foreign competition and changes in U.S. employment and wages, and the more recent studies of trade and job loss. Theoretical issues related to measures of industry trade sensitivity are discussed in section 10.3, followed by a discussion of the various data sources in section 10.4. Section 10.5 presents a descriptive analysis of the link between trade and job loss. The empirical model and estimation strategy are discussed in section 10.6. Results from the econometric analysis are presented in section 10.7. Individual-level data from the Displaced Worker Surveys are used in section 10.8 to examine the pattern of reemployment following job displacement. Section 10.9 offers concluding remarks.

10.2 A Brief Background from Previous Research

This examination of trade and job loss joins and complements recent work on trade, wages, and employment. This literature is motivated by

4. See also Haveman (1998) and Addison, Fox, and Ruhm (1995).

standard theories of international trade that predict trade liberalization will reduce lower-skill domestic employment and widen the wage gap between skilled and unskilled workers. The effects of trade on U.S. changing employment patterns and wage inequality is a subject of considerable debate. Over the years, the debate has ranged widely, and there are several reviews that help summarize this extensive and diverse literature. Dickens (1988), with a focus on trade and employment, assessed the literature up to the mid-1980s as reaching a common conclusion that import competition caused only a small fraction of employment losses. Most employment change was judged to result from changes in domestic demand, real wages, and productivity.[5] In their review of more recent studies, Belman and Lee (1995) reach a different assessment, that increased import competition affects negatively both employment and wages, with the employment effects several times larger than the wage effects.[6] Revenga (1992) is particularly notable. She shows that for a sample of manufacturing industries during the period 1977–87, changes in import prices have a sizable effect on employment and a smaller yet significant effect on wages. She concludes that most of the adjustment in an industry to an adverse trade shock occurs through employment. Revenga takes these results to suggest that workers are mobile across industries. This mobility implies that the effects of trade on the manufacturing sector are not limited to that sector, as workers seek new jobs in nonmanufacturing industries.

Richardson (1995, 51) sees trade as making a moderate contribution to increasing income inequality that warrants attention.[7] Cline (1997) offers a detailed, comprehensive, and critical survey of the trade and wage inequality literature. He concludes that about 20–25 percent of the rise in the skilled/unskilled wage gap over the past 20 years has been due to the combined forces of trade and immigration.

U.S. trade with developing countries is the most recent focus, in part due to 1980s trade liberalization in these countries. To date, there is an emerging consensus, both theoretical and empirical, that U.S.–developing country trade lowers the employment and wages of U.S. lower-skilled workers. Sachs and Shatz (1998) emphasize skill differences between the manufacturing and nontraded sectors, noting that a reduction in manufacturing employment, particularly import-competing manufacturing, will release relatively unskilled workers into the nontraded (service) sector, leading to a fall in the relative wage of unskilled workers.

5. Grossman (1986, 1987) is widely cited on this point.

6. See Borjas, Freeman, and Katz (1992); Freeman and Katz (1991); Murphy and Welch (1991); Revenga (1992); Sachs and Schatz (1994); and Davis, Haltiwanger, and Schuh (1996). Not all studies agree. A number of studies written in the late 1980s and early 1990s concluded that trade plays a small role; see Mann (1988), Krugman and Lawrence (1994), Lawrence and Slaughter (1993), and Lawrence (1994). Berman, Bound, and Griliches (1994) conclude that trade plays a small role in increasing the relative employment of skilled workers.

7. Leamer (1993, 1994) and Wood (1994) conclude more strongly about the role of increasing globalization in increasing income inequality in the United States.

Using a factor proportions model, Borjas, Freeman, and Katz (1997) find that the growth of U.S. imports of less-developed-country (LDC) manufacturing goods has increased the effective supply of less-skilled labor, lowering relative earnings of low-wage workers. They conclude that increased trade has a substantially smaller effect on relative wages than increased immigration.

None of these studies deny the role of increasing trade. The debate is over how large a role trade plays in changing employment patterns and relative wages, and whether trade or technological change is more important.[8]

10.3 Measuring Industry Trade Sensitivity

There are different ways in the trade and employment literature to measure changes in international trade. Some studies measure trade changes and increasing foreign competition as changes in import prices, and other studies use changes in import share. Kletzer (1998b) discusses in detail the various measures available and how the measures may (or may not) be related to changes in employment and job loss. Here, I summarize that discussion to provide a background for the empirical research that follows.

Import penetration ratios (or import shares) provide an intuitively appealing way to categorize industries facing significant foreign competition. More generally, industries with a large (or rising) share of output (or supply) internationally traded are often labelled trade-sensitive (or import/export-sensitive) on the basis of calculated import and export penetration ratios. If the flow of imports reduces domestic employment, industries with high import penetration ratios are where that result is most likely to be found.[9]

From a theoretical perspective, there is no simple causal link between the volume of trade and employment changes because the rise in import share could indicate a number of foreign or domestic developments. A few examples may be illustrative.[10] Take the case of perfect competition, increasing but different marginal costs of production for both domestic and foreign firms, with substitutability between domestic and foreign goods. Let foreign supply expand, perhaps from technological diffusion (or an export promotion scheme) that lowers foreign costs while domestic

8. See also Berman, Bound, and Machin (1997).

9. An import penetration ratio is calculated by dividing industry imports by the sum of industry output plus imports (the denominator is industry supply). An export penetration ratio is calculated by dividing industry exports by industry output. See Schoepfle (1982) for classifications over the period 1972–79 and Bednarzik (1993) for the period 1982–87. Davis, Haltiwanger, and Schuh (1996) find high rates of job destruction for plants in industries with very high import penetration ratios during the period 1972–88. Plants in the top quintile of industries ranked by import penetration ratios had average annual employment reductions of 2.8 percent.

10. See also the discussion in Richardson (1995).

costs remain unchanged. This reduces the foreign good price and imports rise. With constant demand, the rise in imports reduces price, domestic output, and domestic employment. With declining domestic output, import share also rises. How much the import share rises depends on the elasticity of domestic supply. As domestic supply becomes more elastic, a given increase in imports produces a bigger reduction in domestic quantity (and presumably employment) and a rising import share.

When trade is measured as quantity flows, it is important also to consider the role of domestic demand. In the perfectly competitive case, imports may also rise if domestic demand increases. Price moves accordingly, and if foreign supply is more elastic than domestic supply, import share will also rise because the increase in imports will exceed the increase in domestic output. Alternatively, if domestic supply is more elastic than foreign supply, the rise in imports will be accompanied by a decline in import share. Here, the use of quantities reveals an ambiguity: Rising imports and import share are associated with increased domestic employment and presumably less displacement, and rising imports may not be associated with rising import share. These two cases imply that, over time, industry import shares will differ as a result of differences in supply elasticities as well as differences in the competitiveness of domestic firms relative to foreign firms.

In a standard Heckscher-Ohlin model, industries face increasing import-price competition when import prices fall, thus the appeal of using a price measure to examine whether job loss occurs when imports become more competitive. The link between import-price competition and industry employment is fairly straightforward. If the price of an imported (substitutable) good falls, labor's marginal revenue product falls. This drop in the derived demand for labor reduces employment (on an upward-sloping labor-supply curve). Flexible wages dampen the fall in employment. If wages adjust fully to equate labor demand and labor supply (a competitive labor market), employment falls to desired levels through (employee-initiated) quits. How much wages and employment change will depend on supply and demand elasticities, but there will be no displacement. Only if prices fall enough that firms find it more profitable to shut down than to continue to operate will displacements occur (through plant closings).

In a market where wages differ from market clearing, the likely consequences of increasing import competition are a bit more complicated. In unionized labor markets, if current wages exceed opportunity wages, the presence of rents may leave room for wage concessions. These concessions may dampen employment loss. If wages diverge from market clearing for efficiency-wage reasons, firms may be reluctant to impose wage reductions if they anticipate negative productivity consequences. Alternatively, senior union members may prefer to maintain wages (and their jobs), with layoffs reducing the employment of junior workers.

There are at least two reasons to think that price, arguably the preferred measure, is not completely informative about the effect of changes in trade policy or foreign supply. The first is that during some of the time period studied here some industries had quota protection (apparel, footwear, radio and television). Import-price changes will not necessarily reflect these quantity restraints. More importantly, these quota restraints imply that market share (import share) is likely to be a determinant of foreign and domestic supply.

The second difficulty with price alone is more fundamental. Using a monopolistically competitive dominant/fringe model, Mann (1988) shows how market share is likely to be a determinant of both foreign and domestic supply. She notes that quantity is a key variable in monopolistic competition with heterogeneous outputs. Furthermore, in the context of a three-factor Cobb-Douglas production function with no restrictions on returns to scale and with capital fixed in the short run, she discusses how increasing returns to scale are an important determinant of price. In her empirical analysis, covering the period 1974–81 for a subset of import-sensitive industries, Mann finds that foreign competition, measured as both import prices and import share, plays a small role in determining employment relative to the role played by domestic demand and prices for most industries.

10.4 Data: Measuring International Trade and Job Displacement

10.4.1 Trade Indicators

Data on U.S. import and exports by four-digit Standard Industry Classification (SIC) category, for the period 1958–94, are available as part of the NBER Trade Database. The import and export data file, available online, also reports the 1958–94 value of domestic shipments from the NBER Productivity Database.[11]

Import-price data are available for many four-digit SIC manufacturing industries starting in 1983–84 and currently ending with 1992, with coverage of a small number of industries available from 1978. The price measure is a fixed-weight Laspeyres index with a 1985 base period.[12] Relative import prices are obtained by deflating by the producer price index (PPI) as a proxy for the aggregate price level.

The SIC-based industry trade data must be aggregated up to a three-

11. The 1958–94 file combines data from the earlier NBER Trade and Immigration data file (described in Abowd 1991) with the NBER Trade Database (see Feenstra 1996).

12. These indexes are described in more detail in U.S. Bureau of Labor Statistics (1992). They are based on a survey of actual transactions prices, and, to the degree possible, they reflect c.i.f. (cost, insurance, freight) prices. The NBER Trade data were used to aggregate up to three-digit CIC industry. When aggregation was needed, the SIC indexes were weighted by their relative shares in total imports.

digit Census Industrial Classification (CIC) industry level to combine trade information with information on job displacement. Aggregating up from four-digit SIC to three-digit CIC is somewhat "costly" for the import-price data. Coverage is not complete for all manufacturing industries, so that not all the four-digit SIC industries within a three-digit CIC industry have information available for constructing an aggregate three-digit CIC industry price index.

10.4.2 Job Loss

The Displaced Worker Surveys (DWS) provide information on displacement. Available surveys, administered biennially as supplements to the Current Population Survey (CPS), cover displacements occurring during the period 1979–95. In each survey, adults (of ages 20 years and older) in the regular monthly CPS were asked if they had lost a job in the preceding 5-year period due to "a plant closing, an employer going out of business, a layoff from which he/she was not recalled, or other similar reasons." If the answer was yes, a series of questions followed concerning the old job and period of joblessness.

A common understanding of job displacement is that it occurs without personal prejudice; terminations are related to the operating decisions of the employer and are independent of individual job performance. In the DWS, this definition can be implemented by drawing the sample of displaced from individuals who respond that their job loss was due to the reasons noted previously. Other causes of job loss, such as quits or firings, are not considered displacements.[13] This operational definition is not without ambiguity: The displacements are job displacements, in the sense that an individual displaced from a job and rehired into a different job with the same employer is considered displaced.

Some of the distinctions may be too narrow or arbitrary. The distinction between quits and displacements is muddied by the ability of employers to reduce employment by reducing or failing to raise wages. Wage changes may induce some workers to quit (and not be in the sample), while others opt to stay with the firm (and they get displaced and enter the sample).[14] This distinction means that the displaced-worker sample will underestimate the amount of job change "caused" by trade. In addition, if the workers who stay on with the firm until displacement are those who face the worst labor market outcomes of all those at risk of displacement, then the displaced sample will be potentially nonrandom and it will overstate the costs of job loss. Without data on quits, these issues cannot be addressed.

13. Individuals may also respond that their job loss was due to the end of a seasonal job or the failure of a self-employed business. These individuals are not considered displaced.

14. Jacobson, LaLonde, and Sullivan (1993) show that wages fall for displaced workers before they are displaced.

The sample here is limited to workers displaced from manufacturing industries who are ages 20 to 64 at the time of displacement. Because the information is retrospectively gathered, it has potential recall error. Problems of recall are compounded by the overlapping coverage of years of displacement by surveys, with some years covered in two or three surveys.[15] This bias is believed to be significant. As Topel (1990) and Farber (1993) show, it is likely that the surveys seriously underestimate job loss that occurred long before the survey date due to inaccuracies in recall as well as question design.[16] This makes it desirable to have nonoverlapping recall periods (that is, each year of displacement drawn from only one survey). For this analysis I restrict the sample to displacements occurring in the 2-year period prior to each survey. This makes recall periods shorter and eliminates overlapping year coverage. I drew a larger sample from the 1984 survey by also including workers displaced during 1979–80.

I calculated industry displacement rates by dividing the number of workers displaced from a three-digit CIC industry in a year by the number of workers employed in that industry in that year. The annual industry employment numbers were calculated from merged CPS Outgoing Rotation Group data files, and they are a proxy for industry workers at risk of displacement.

10.5 A Descriptive Look at Trade and Job Loss, 1979–94

10.5.1 Job Loss

Based on calculations from sample described, drawn from the DWS, 32 million workers reported experiencing at least one permanent job loss during the period 1979–94 (excluding agriculture). Manufacturing accounted for 35.5 percent of total job loss, with 10.2 million workers reporting a job loss from that sector. Averaging over the 16-year time period, manufacturing accounted for 18–19 percent of total nonagricultural employment, starting with 23.4 percent in 1979 and ending at 16.0 percent in 1994.

For the period as a whole, the top job-loss manufacturing industries, measured by total workers displaced, are shown in table 10.1. In part, these industries accounted for much of the job loss because they are large industries in terms of employment. By adjusting for employment, the displacement rate offers a proxy for the "risk of job loss." All these industries were near or below the average job-loss rate for manufacturing industries.

Figure 10.1 plots the total and manufacturing displacement rates during the period 1979–94. The rate of job loss from manufacturing is consider-

15. The 1984 DWS covered the period 1979–83; the 1986 survey, 1981–85; the 1988 survey, 1983–87; the 1990 survey, 1985–89; the 1992 survey, 1987–91; the 1994 survey, 1991–93; and the 1996 survey, 1993–95.

16. If more than one job was lost, information is gathered only for the job held longest. See Topel (1990) and Farber (1993).

Table 10.1 Number of Workers Displaced by Industry with Industry Displacement Rates

Industry (CIC)	Workers Displaced ($\times 10^3$)	Average Annual Displacement Rate
Electrical machinery, nec (342)	688.3	0.038
Motor vehicles (351)	618.9	0.051
Apparel (151)	617.7	0.052
Printing, publishing (excl. newspapers) (172)	522.1	0.038
Machinery (excl. electrical) (331)	509.2	0.044
Electronic computing equipment (322)	337.9	0.045
Fabricated structural metals (282)	313.3	0.056
All manufacturing industries	11,380	0.051

Note: nec = not elsewhere classified.

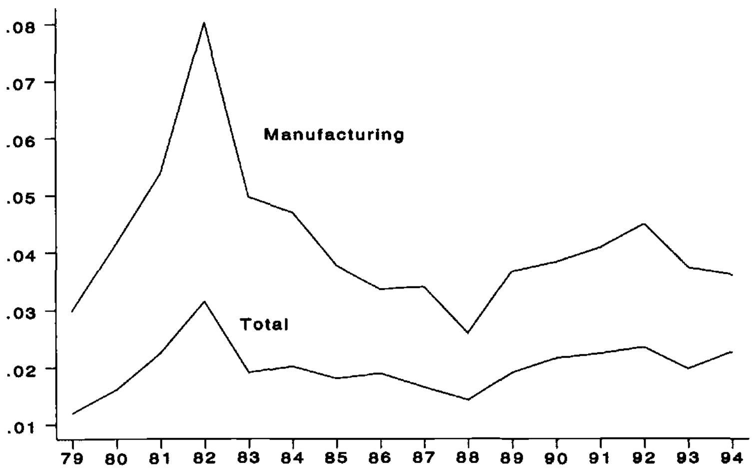

Fig. 10.1 Manufacturing and total displacement rates, by year
Source: Author's calculations from the 1984–96 Displaced Worker Surveys.

ably higher than for all industries. The manufacturing displacement rate rose to 8 percent in the early 1980s recession and then fell sharply until the late 1980s. It rose steadily through the prolonged early 1990s recession and then fell. Although the rate of job loss is down from its 1992 peak, it remains high given the extent of the 1990s expansion. The total displacement rate follows a similar, although dampened, pattern. The overall rate of job loss was high in 1994, given the strength of the economy (for more on the pattern of job loss over the 1980s and 1990s, see Farber 1997).[17]

17. My estimates of the rate of job loss are lower than Farber's due to differences in sample construction.

Table 10.2 Top Quartile, Mean Annual Displacement Rate, > .061

Industry	CIC	Mean Displacement Rate	Mean Import Share	Mean Change in Import Share
Leather products	222	.142046	.4079864*	.0238756*
Optical and health supplies	372	.1262741	.0801311	.003507
Radio, television	341	.1259439	.1957753*	.0081509*
Railroad locomotives	361	.1077487	.0925145	.0067265
Wood buildings and mobile homes	232	.0972105	.0434898	.0001035
Cycles and miscellaneous transport	370	.093942	.2542767*	−.0068314
Watches, clocks	381	.0913399	.5229867*	.0278894*
Footwear	221	.0906134	.4954904*	.0241364*
Structural clay products	252	.083527	.1209288	.0060668
Guided missiles	362	.0803838	.0256684	.0021725
Other primary metals	280	.0775787	.1853473*	.0038447
Ship and boat building	360	.0746358	.027272	.0012961
Leather tanning	220	.0739732	.2082242*	.00799*
Miscellaneous petroleum and coal	201	.0720061	.064999	−.0013748
Pottery and related products	261	.0717307	.3800826*	.0105394*
Primary aluminum	272	.0702517	.0828264	.0063072
Toys	390	.0677491	.3408123*	.0177078*

Source: Author's calculations from the Displaced Worker Surveys and U.S. Import and Export Data, 1958–94.

*Top quartile of respective distribution.

10.5.2 Trade and Job Loss by Industry

The previous discussion highlights the widespread job displacement of the last 16 years. Are high rates of job loss associated with import competition? Are import-competing industries characterized by high rates of job loss? As a preliminary, I stay within the tradition of using import shares to classify industries as "import competing." The mean annual import share across the industries in the sample was 0.117 during the period 1975–94, ranging from 0.002 to 0.523. The mean annual displacement rate across the industries in the sample was 0.052, ranging from 0.0078 to 0.142. If industries are ranked by mean annual displacement rates, the top quartile is listed in table 10.2, along with their mean displacement rate, mean import share, and mean change in import share. Overall, the industry list is consistent with the perception that import-competing industries have experienced high rates of job loss. The list has the "usual suspects:" footwear, leather products, pottery, radio and television, watches and clocks, and toys. For the most part, these high-job-loss-rate industries are either high import share (traditionally import-competing) or have experienced a large (positive) change in import share (increasing import competition), or both.

Table 10.3 contains additional summary univariate classifications of trade and job loss. Panel A reports the mean annual displacement rate for each quartile of the industry mean import-share distribution. The highest import-share industries have, on average, the highest job-loss rate, but from below the top quartile, job-loss rates are relatively uniform. Within each quartile, the distribution of job-loss rates is fairly similar. Panel B reports mean job-loss rates by industry mean change in import share. In this panel, lob-loss rates are higher for industries with above-average changes in import share.

At this level of industry aggregation, industries are both importers and exporters, and panel C reports the mean annual displacement rate for each quartile of the industry mean annual change in net export share, calculated as (Exports − Imports)/Shipments. Here, we might expect declining job loss with a positive change in net exports, so that from the top quartile to the bottom, job-loss rates would rise. This is the pattern in panel C, although the decline in job loss as net exports rise is not smooth, and the range of job-loss rates within each quartile is fairly similar. Last, panel D reports a mean import share for the full job-loss industry distribution.

Table 10.3 Trade and Job Loss by Industry

	Bottom Quartile	Second Quartile	Third Quartile	Top Quartile
A. By mean import share	<.043	.044 to .087	.088 to .1537	>.154
Mean annual displacement rate	.046	.045	.045	.065
[Min, Max]	[.024, .097]	[.021, .126]	[.016, .108]	[.008, .142]
B. By mean change in import share	<.0007	.0007 to .003	.003 to .0075	>.0075
Mean annual displacement rate	.045	.042	.055	.059
[Min, Max]	[.021, .097]	[.021, .080]	[.024, .126]	[.008, .142]
C. By mean change in net exports/ shipments	<−.0029	−.003 to −.0008	−.0008 to .00059	>.00059
Mean annual displacement rate	.059	.044	.053	.044
[Min, Max]	[.008, .142]	[.015, .080]	[.022, .126]	[.021, .094]
D. By mean annual displacement rate	<.031	.031 to .044	.045 to .061	>.061
Mean import share	.087	.081	.084	.207
[Min, Max]	[.002, .209]	[.01, .179]	[.007, .264]	[.025, .522]

Source: Author's calculations from the Displaced Worker Surveys and U.S. Imports and Exports, 1958–94.

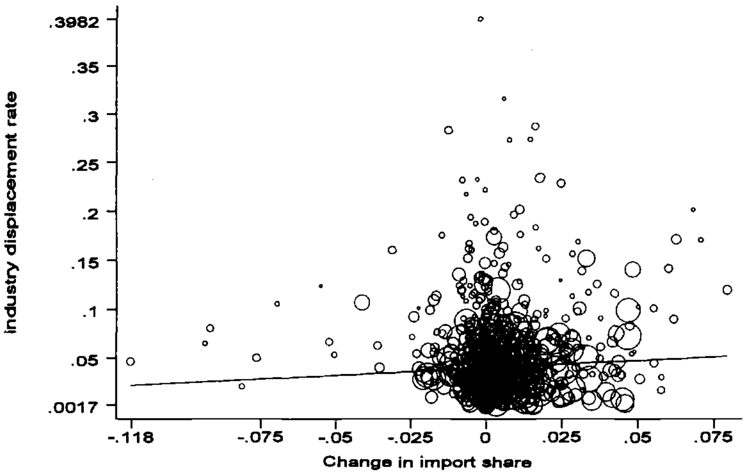

Fig. 10.2 Industry displacement rates and changes in import share, 1979–94
Source: See table 10.4.

Similar to table 10.2, import share is highest among the high-job-loss-rate industries, and the top half of the job-loss rate distribution has a distinctly higher import share than the lower half of the distribution. For the four measures used in table 10.3, appendix tables 10A.1 to 10A.4 report a full industry listing by quartile.

One suggestion from these univariate classifications is that the combination of "trade with job loss" arises from continued, sustained import competition. That is, high rates of job loss are found for industries with high import share and large (positive) changes in import share. For the most part, increasing import competition (positive changes in import share), from a lower level of import share, is associated with below-average job loss (e.g., photographic equipment, scientific and controlling instruments, and pulp and paper).

To examine the full industry-by-year range of observations, figures 10.2 and 10.3 are scatter plots of annual industry displacement rates and percent changes, from the previous year, in import penetration ratios (fig. 10.2), or real import prices (fig. 10.3). In each scatter plot, the circles are scaled to reflect industry employment size. Each plot contains a regression line for the simple regression of the displacement rate on the chosen trade indicator (and a constant term).

Figure 10.2 contains the scatter plot for displacement rates and import share for the period 1979–94. There are a number of industry-year observations where import share changes very little and displacement is high. At the same time, there are enough industries where positive (negative) changes in import share are associated with high (low) displacement rates,

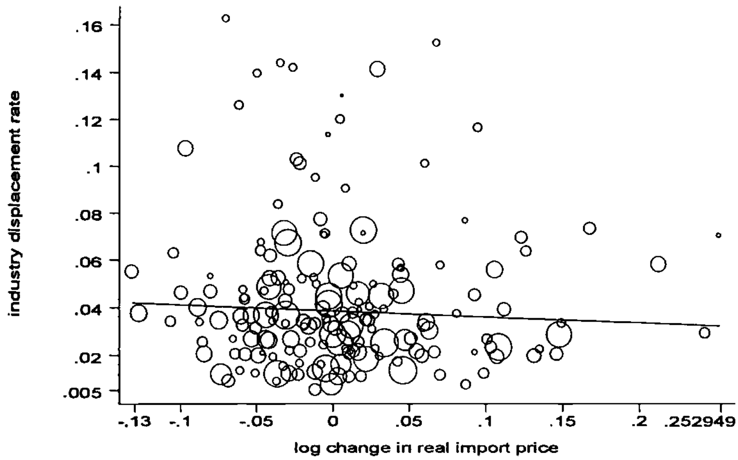

Fig. 10.3 Industry displacement rates and changes in import prices, 1983–92
Source: See table 10.4.

so that the regression line has positive slope (with *t*-statistic of 1.907 for the estimated slope coefficient).[18] A few traditionally trade-sensitive industries, such as footwear, leather products, apparel, and steel, are important in determining the slope of the regression line.

In figure 10.3, it is important to note that the price coverage is less comprehensive than the trade-flow coverage (only 20 three-digit CIC industries are included), and the period of coverage is 1983–92. This scatter plot seems to reveal little evidence of a negative correlation between import prices and job-loss rates. There are a few industry-year observations where an increase in import prices (a reduction in import competition) is associated with lower displacement rates. The regression line has a negative slope, with a *t*-statistic of –0.813.[19] There are also a number of industry observations with high displacement rates and little change in relative import prices.

A few observations stand out from these descriptive figures and tables. There is a set of industries facing sustained import competition, those

18. The estimated regression, using industry employment weights, with standard errors in parentheses, is

$$\text{Displacement rate} = \underset{(0.0011)}{0.0401} + \underset{(0.0805)}{0.1534}\,(\%\,\Delta\ \text{Import penetration ratio}).$$

19. The estimated regression, using industry employment weights, with standard errors in parentheses, is

$$\text{Displacement rate} = \underset{(0.0019)}{0.0387} - \underset{(0.0312)}{0.0254}\,(\text{log Difference real import price}).$$

with both high levels of import share and positive changes in import share where the rate of job loss is high. The scatter plots provide additional evidence, revealing industries where decreases in import prices are associated with high rates of job loss. These industries are consistent with the perception that "trade costs jobs," although inferences about causality should not be made based on the descriptive evidence. At the same time, the scatter plots reveal a considerable amount of variation in job displacement across industries. There are numerous industry-year observations where job loss is high in the absence of changes in foreign competition. Thus trade itself can explain only a small share of the variation in job displacement.

10.6 Empirical Model: Increasing Foreign Competition, Changes in Industry Employment, and Industry Job Loss

This section presents a simple empirical framework for examining the relationship between international trade and job displacement that follows Kletzer (1998b). It starts with a discussion of trade and employment change that follows Revenga (1992). A model of labor turnover is used to relate employment change to displacement.

To simplify the analysis, assume wages adjust to equate labor supply and labor demand. Using first differences, the demand for labor in industry i in year t (N_{it}) can be written as

$$(1) \qquad d\ln N_{it} = \beta_1 d\ln W_{it} + \beta_2 d\ln X^1_{it} + \beta_3 d\ln X^2_{it} + v_{1it},$$

where W_{it} is the industry wage, X^1_{it} is a vector of trade-related factors (discussed in more detail later) that shift labor demand for industry i in year t, X^2_{it} is a vector of non-trade-related factors, and v_{1it} is the error term. Also in first differences, labor supply can be written as

$$(2) \qquad d\ln N_{it} = \alpha_1 d\ln W_{it} + \alpha_2 d\ln H_{it} + v_{2it},$$

where H_{it} is a vector of factors that shift labor supply and v_{2it} is an error term. Labor market clearing implies

$$(3) \qquad d\ln N_{it} = \gamma_1\beta_2 d\ln X^1_{it} + \gamma_2\alpha_2 d\ln H_{it} + \gamma_3\beta_3 d\ln X^2_{it} + \varepsilon_{it},$$

$$(4) \qquad d\ln W_{it} = \lambda_1\beta_2 d\ln X^1_{it} + \lambda_2\alpha_2 d\ln H_{it} + \lambda_3\beta_3 d\ln X^2_{it} + u_{it}.$$

Equation (3) is a basic reduced-form equation for net changes in employment. A simple model of turnover can be used to modify and narrow the focus to just one of the gross flows, job displacement. Firms implement net employment reductions through the use of displacements and unreplaced attritions. Attritions are separations due to quits, discharges (for cause), retirements, and deaths. Attritions that are not replaced by employers are called unreplaced attritions. For an industry, net employment change in year t can be written as

(5) $$DIS + UA = -\Delta N,$$

where DIS is displacements, and UA is unreplaced attritions (other non-displacement separations minus accessions).[20] This net change in employment can be expressed as a proportion of total employment,

(6) $$\frac{DIS}{N_{t-1}} = \text{Displacement rate} = \frac{-(N_t - N_{t-1})}{N_{t-1}} - \frac{UA}{N_{t-1}}.$$

Relying on the approximation of the rate of change of employment $(N_t - N_{t-1})/N_{t-1}$ to the change in log employment $\ln N_t - \ln N_{t-1}$, for small changes, equation (6) is approximately equal to

(7) $$\text{Displacement rate}_t = d\ln N_t - \text{UA rate},$$

where UA rate $= UA/N_{t-1}$.

Equations (3) and (7) can be combined to yield a reduced-form equation for industry i displacement:

(8) $$\text{Displacement rate}_{it} = \gamma_1\beta_2 d\ln X^1_{it} + \gamma_2\alpha_2 d\ln H_{it} + \gamma_3\beta_3 d\ln X^2_{it} + \gamma_4 \text{UA rate}_{it} + (\varepsilon_{it} + \eta_{it}),$$

where η_{it} reflects unobservable factors related to displacement.

In the context of a turnover model, it is inappropriate to include quits, discharges, and accessions (summed here as the UA rate) as independent variables in a displacement relationship. Quits are very likely to be influenced by conditions within the industry.[21] Firms and industries are likely to differ in their use of the various components of turnover to implement desired changes in employment.

The elements of the vector X^1 need to be specified. There are two alternatives. The first, using relative import prices, yields

(9) $$\text{Displacement rate}_{it} = \delta_1 d\ln P^m_{it} + \delta_2 d\ln X^2_{it} + \Gamma_i + e^1_{it},$$

where P^m_{it} is the domestic price (in dollars) of the import good (relative to the aggregate price level). Elements of H are subsumed in X^2 and the UA rate is now subsumed in the industry fixed effect Γ_i; δ_1 and δ_2 are coefficients to be estimated, and e^1_{it} is the error term.

20. "Accessions" are new hires and rehires. The term "unreplaced attritions" appears in Brechling (1978).

21. Brechling (1978) presents a model of turnover with endogenous quits. In that model, quits rise and fall with industry employment growth and the state of the overall economy. In depressed industries, workers are much less likely to quit; therefore, normal attrition cannot be counted on to reduce employment.

At this point, it is important to note what is measured by industry relative import price. In the previous discussion, it was noted that falling relative import prices increase the competitiveness of final-good imports. From this there may follow a reduction in labor demand and desired employment and increased job loss. A reduction in import price, however, can also mean lower prices of imported intermediate inputs. The import-price data used here do not allow a distinction between the two types of imports. By including just one industry import price, the estimated parameter on import price combines the two different effects.

An alternative specification uses import share and exports. The previous discussion suggests that import share be used along with measures of domestic demand. Total sales can be decomposed into its component parts: the domestic market (Domestic = Sales − Exports + Imports); exports; and import share. A first-order approximation gives

$$(10) \qquad d\ln \text{Sales} = w_1 d\ln(\text{Domestic}) + w_2 d\ln(\text{Exports}) - w_3 d(\text{Import share}),$$

where w_1 = (Sales − Exports)/Sales, w_2 = Exports/Sales, and w_3 = Domestic/Sales. The weights adjust changes in the three components for the difference in the absolute magnitude of sales generated by the domestic side as compared to the trade side.[22] The following equation relates changes in sales to displacement:

$$(11) \quad \text{Displacement rate} = \delta_3 w_1 d\ln(\text{Domestic}) + \delta_4 w_2 d\ln(\text{Exports}) + \delta_5 w_3 d(\text{Import share}) + \delta_6 d\ln X_{it}^2 + \Pi_i + e_{it}^2,$$

where the δ are coefficients to be estimated, Π_i is the industry fixed effect, and e_{it}^2 is the error term.

Equation (11) specifies an industry's exposure to imports simply as import share (or import penetration ratio). This specification does not distinguish between imports of final goods and imports of intermediate inputs. Final-goods imports have traditionally been called "import competition." The discussion in section 10.3 on measures of trade sensitivity focused on final-goods imports. A rise in the use of imported intermediate inputs has a more ambiguous effect on displacement. If the intermediate inputs were formerly produced domestically,[23] job loss may be associated with the increased use. At the same time, if imported intermediate inputs are less costly than domestically produced intermediates (perhaps due to a fall in

22. This decomposition of sales is explained in detail by Freeman and Katz (1991).

23. The decision to switch intermediate input production from domestic to foreign is often called outsourcing.

import prices), industry labor demand may increase, resulting in higher desired employment and fewer displacements.

As specifications of the effect of trade on job loss, equations (9) and (11) are clearly partial equilibrium at the industry level. They do not address indirect effects on job displacement that may result from local industry interactions that produce spillover effects on a given industry's employment and job loss.[24]

10.7 Multivariate Analysis of the Evidence on Trade and Job Loss

Before turning to the estimation results for job loss, it is useful to consider the "trade" version of equation (3), where the log change in employment is the dependent variable. Table 10.4 reports coefficient estimates for a specification using changes in import prices (panel A) and changes in import shares, exports, and domestic demand (panel B), with the log change in blue-collar employment as the dependent variable. The changes are annual, and the specification includes industry fixed effects. Consistent with expectations, industry employment is positively correlated with industry relative import prices. In panel B, employment falls as import share rises, and it rises as exports and domestic demand rise.

10.7.1 Cross-Industry Estimates

Turning to the regression framework, tables 10.5 and 10.6 report cross-sectional estimates of a very simple specification relating annual industry displacement rates to two industry trade indicators.[25] Table 10.5 reports estimates from a cross-sectional time-series version of equation (11), where the explanatory variables are changes in domestic demand, exports, and import share. Table 10.6 reports estimates of equation (9), where the main explanatory variable is the change in relative import prices. In both tables, the dependent variable is the difference between an industry's annual displacement rate and its mean displacement rate during the time period. Subtracting out the mean industry displacement rate eliminates some industry-specific differences in displacement. Turning first to table 10.5, increases in domestic demand and exports are associated with declining job loss. Rising import share is positively related to job loss, and the hypothesis that the export and import coefficients are the same in magnitude cannot be rejected. Over the time period, there was a significant downward trend in the rate of job loss.

Technological change is one of the important elements missing from the discussion so far. The literature points clearly in the direction of techno-

24. On this point, see Goldberg and Tracy (chap. 8 in this volume).

25. The reported standard errors are corrected for heteroskedasticity and the clustering of observations by industry.

Table 10.4 **Changes in Industry Blue-Collar Employment, Changes in Relative Import Prices, and Changes in Import Shares Panel, Fixed Effect Estimates**

A	(1)
Time period	1983–92
Log change relative import price index	.1005 (.0673)
Change in manufacturing industrial production index	.0039 (.0011)
Industry fixed effects	Yes
Constant	−.0296 (.0053)
R^2 (within)	.091
R^2 (between)	.071
R^2 (overall)	.073
N	214
Number of industries	27

B	(1)	(2)	(3)
Time period	1979–94	1975–94	1970–94
Weighted log change in domestic demand	.2851 (.0298)	.3202 (.0249)	.3402 (.0275)
Weighted log change in exports	.7002 (.1439)	.5901 (.1171)	.4927 (.1247)
Weighted change in import share	−.3221 (.0929)	−.3149 (.0863)	−.3919 (.1014)
Industry fixed effects	Yes	Yes	Yes
Constant	−.0277 (.0030)	−.0293 (.0026)	−.0264 (.0030)
R^2 (within)	.135	.159	.126
R^2 (between)	.396	.527	.462
R^2 (overall)	.147	.170	.134
N	1,100	1,372	1,612
Number of industries	70	70	70

Source: Author's calculations from data drawn from the NBER Trade Database, Bureau of Labor Statistics, U.S. Import and Export Price Indexes, and the Displaced Worker Surveys.
Notes: Standard errors are in parentheses. Panel A includes one lag in the import price index.

logical change as a key explanation to declining unskilled employment in manufacturing and increasing wage inequality (see Krugman and Lawrence 1994; Lawrence and Slaughter 1993; Berman, Bound, and Griliches 1994; Berman, Bound, and Machin 1997). The challenges of proxying technological change are clear, and in this case there is the additional issue of potential endogeneity. Industries facing increasing foreign competition may be driven toward technological change as a response.[26] As a first step,

26. See Lawrence (chap. 6 in this volume).

Table 10.5 Industry Displacement Rates and Changes in Import Share: Cross-sectional Estimation

	All Workers					Blue-Collar Workers			White-Collar Workers		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time period	1979–94	1979–94	1979–94	1979–94	1983–92	1979–94	1979–94	1983–92	1979–94	1979–94	1983–92
Weighted ln change domestic demand	−.0697	−.0719	−.0704	−.0714	−.0006	−.0875	−.0935	−.0011	.0628	.0564	.0868
	(.0247)	(.0254)	(.0240)	(.0252)	(.0541)	(.0208)	(.0232)	(.0424)	(.0567)	(.0547)	(.0961)
Weighted ln change in exports	−.3060	−.3114	−.3068	−.3168	−.2803	−.3130	−.3134	−.3303	−.4801	−.4806	−.2803
	(.0724)	(.0716)	(.0722)	(.0713)	(.1025)	(.0676)	(.0702)	(.0901)	(.1546)	(.1529)	(.1846)
Weighted change in import share	.1037	.0999	.0943		.1840	.0508	.0527	.1519	.0549	.0699	−.0940
	(.0587)	(.0636)	(.0631)		(.0910)	(.0850)	(.0866)	(.0500)	(.1040)	(.0992)	(.1404)
Change in intermediate goods imports				.2916							
				(.3331)							
Change in manufacturing industrial production index	−.0005	−.0005	−.0005	−.0004	−.0003	−.0004	−.0005	−.0008	−.0006	−.00072	−.0002
	(.0003)	(.0003)	(.0003)	(.0003)	(.0008)	(.0003)	(.0004)	(.0007)	(.0008)	(.0009)	(.0013)
Time trend	−.0010	−.0010	−.0009	−.0010	−.0010	−.0008	−.0009	−.0019	−.00012	−.0001	−.0020
	(.0004)	(.0004)	(.0003)	(.0004)	(.0012)	(.0004)	(.0004)	(.0009)	(.0007)	(.0008)	(.0024)
Change in unionization (1983–95, annualized)		−.0041	−.0046	−.0041	.0012		.0006	.0022		−.0006	−.0041
		(.0028)	(.0029)	(.0029)	(.0062)		(.0009)	(.0038)		(.0013)	(.0103)
Change in TFP		.0084		.0053	−.0091		.0231	−.0407		.0616	−.0812
		(.0274)		(.0276)	(.0691)		(.0258)	(.0745)		(.0742)	(.1457)
Change in computer use (1984–93, annualized)			−.1172								
			(.1193)								
ln(Capital stock/Shipments)		−.0034	−.0033	−.0033	.0015		−.0015	−.00002		.0021	−.0006
		(.0026)	(.0027)	(.0024)	(.0016)		(.0014)	(.0022)		(.0017)	(.0066)
Constant	.0198	.0136	.0155	.0132	.0120	.0134	.0131	.0226	.0010	.0026	.0167
	(.0033)	(.0041)	(.0042)	(.0045)	(.0157)	(.0029)	(.0027)	(.0105)	(.0070)	(.0074)	(.0289)
R^2	.086	.090	.091	.088	.124	.083	.084	.154	.025	.026	.049
N	934	934	934	934	215	846	846	194	674	674	167
Number of industries	70	70	70	70	26	70	70	25	70	70	26

Source: Author's calculations from the Displaced Worker Surveys, 1984–96, U.S. Import and Export data, 1958–94, and the NBER Productivity Database.
Notes: Standard errors are in parentheses. Samples used in columns (5), (8), and (11) match the industries and time period used in table 10.6.

Table 10.6 **Industry Displacement Rates and Changes in Import Prices, 1983–92: Cross-sectional Estimation**

	All Workers			Blue-Collar Workers		White-Collar Workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln Change relative import price index	−.0403	−.0460	−.0406	−.0496	.0527	−.0702	−.0716
	(.0322)	(.0306)	(.0307)	(.0384)	(.0400)	(.0553)	(.0583)
Change in index of manufacturing industrial production	.0004	.0008	.0005	−.0005	−.0009	−.0006	−.0007
	(.0008)	(.0007)	(.0007)	(.0008)	(.0008)	(.0014)	(.0013)
Time trend	−.0017	−.0016	−.0016	−.0031	−.0032	−.0030	−.0030
	(.0011)	(.0011)	(.0012)	(.0012)	(.0012)	(.0022)	(.0023)
Change in unionization (1983–95, annualized)			.0013	.0043	.0063	−.0092	−.0094
			(.0074)	(.0027)	(.0029)	(.0096)	(.0097)
ln(Capital stock/Shipments)		.0002	.0005	−.0016	−.0024	−.0012	−.0019
		(.0027)	(.0032)	(.0018)	(.0021)	(.0075)	(.0075)
Change in TFP		−.1040		−.1308		−.0380	
		(.0545)		(.0662)		(.1454)	
Change in computer use (1984–93, annualized)			−.3028		.0459		.1861
			(.2351)		(.1171)		(.4532)
Constant	.0174	.0177	.0254	.0335	.0350	.0255	.0214
	(.0140)	(.0143)	(.0130)	(.0127)	(.0141)	(.0238)	(.0230)
R^2	.074	.089	.093	.132	.114	.046	.047
N	168	168	168	148	148	129	129
Number of industries	26	26	26	24	24	26	26

Source: Author's calculations from Displaced Worker Surveys, 1984–96, and U.S. Import and Export Data, 1958–94.

Notes: Standard errors are in parentheses. Specification includes one lag in the import price index.

columns (2) and (3) of table 10.5, use two distinct proxies for technological change, ignoring endogeneity, with insignificant results. Column (2) uses the year-to-year change in total factor productivity (TFP), calculated from the NBER Productivity Database. Changes in TFP appear to be positively correlated with job-loss rates, although the coefficient estimate is imprecise. In column (3), technological change is proxied by a variable that measures worker-reported changes in computer use within the three-digit CIC industry during the period 1984–93.[27] Increases in the use of computers are negatively correlated with industry displacement, but the coefficient is imprecisely estimated.

Controls for changes in industry union density and capital intensity are also included in columns (2)–(5). Because the trend in unionization in manufacturing was sharply downward during this time period (and therefore collinear with the time trend), changes in density are measured as the annualized long-period change in density during the period 1983–95. Although not measured precisely, industries with smaller declines in unionization had smaller job-loss rates. Through collective bargaining, workers may have been able to restrict displacement (through wage or other concessions). Lower job-loss rates are associated with the more capital-intensive industries, although the correlation is not statistically significant.

In practice, it is difficult to separate the effect of "import competition" on job loss from the effect of imported inputs on job loss, because industry import penetration is highly correlated with the use of imported inputs, or outsourcing. In an abbreviated fashion, column (4) considers the effect outsourcing. Does the use of imported intermediate goods reduce the demand for labor and contribute to job loss? In column (4), imports are measured as the annualized difference in imputed imports of intermediate goods between 1979 and 1990.[28] The estimated coefficient on the import measure is positive as expected, but not statistically significant.

Columns (6)–(11) present results separately for blue-collar and white-collar workers.[29] The results are basically the same across groups, with a few exceptions. Rising import share is associated with higher rates of job loss for both occupational groups, but the estimated coefficients are statistically insignificant for both. The significant downward time trend in job-loss rates is found only for blue-collar workers. Technological change, as

27. Computer use is available from CPS data for 1984 and 1993. The variable used here is the annualized change in computer use for workers in a three-digit industry between 1984 and 1993. The data are described in Autor, Katz, and Krueger (1997). I am grateful to David Autor for providing the computer use data.

28. The data are described in Feenstra and Hanson (1997). I am grateful to Gordon Hanson for providing the imported intermediate-goods data.

29. Service workers are combined with white-collar workers, so the divisions are approximately production and nonproduction.

proxied by changes in TFP, is associated with increasing job loss, although the estimates are imprecise.

For further comparison with the import-price regressions reported in table 10.6, columns (5), (8), and (11) of table 10.5 report estimates for the time period 1983–92 and for the subset of industries for which the import-price data are available. For this shorter time period, the coefficient on domestic demand falls appreciably in magnitude and is statistically insignificant. Job loss is positively related to import share and negatively related to exports. For the shorter time period, the proxies for technological change, changes in unionization, and capital intensity are all statistically insignificant.

Table 10.6 uses changes in relative import-price indices as the main explanatory variable. As expected, the correlation between changes in import price and job loss is negative. For all workers and for blue-collar workers, the estimates are imprecise, while for white-collar workers, the estimated coefficients are statistically significant. The sensitivity of displacement rates to the business cycle is captured by the change in the index of manufacturing industrial production, with the negative, but imprecisely estimated, coefficient showing the countercyclical nature of displacement. The main difference between the results in tables 10.5 and 10.6 is the sign of estimated correlation between technological change and job loss. Using import price during 1983–92, the correlation between changes in TFP and job-loss rates is negative, whereas the correlation is positive in the trade-quantity regression over the longer time period. The difference is not the specification of increasing foreign competition; it is the time period. Columns (5), (8), and (11) in table 10.5, using trade quantities, report a negative correlation between changes in TFP and job loss for the 1983–92 period. This estimated effect is consistent with the Rybczynski theorem, where factors flow into sectors experiencing technological advance. In an expanding sector, job-loss rates are expected to fall.

Overall, the estimates are consistent with some of the expectations about increasing foreign competition and job loss. Across industries, there is some evidence that the risk of job loss increases as imports rise and/or import prices fall. At the same time, this simple cross-industry specification explains little of the variation in job loss rates.

10.7.2 Within-Industry Estimates

Without more satisfactory proxies for technological change, and given the likely heterogeneity across industries in the use of layoffs, hiring, discharges, and quits to change employment levels, it may be desirable to estimate the relationships in an industry fixed effects framework. With industry fixed effects, the estimation focuses on changes over time in job loss and trade within an industry. That is, when a given industry faces increasing foreign competition, what happens to job loss?

Table 10.7 reports panel fixed effect estimates of a very simple specifica-

Table 10.7 Industry Displacement Rates, Changes in Relative Import Prices, and Changes in Import Shares Panel, Fixed Effect Estimates

A	(1)	(2)
Sample	Full	High import
Time period	1983–92	1983–92
ln Change relative import price index	−.0868 (.0461)	.0831 (.1091)
Change in manufacturing industrial production index	.0011 (.0009)	−.00007 (.0014)
ln(Capital stock/ Shipments)	−.0155 (.0217)	−.0236 (.0277)
Time trend	−.0017 (.0012)	−.0019 (.0021)
Change in TFP	−.1364 (.0714)	−.1725 (.0917)
Constant	.0514 (.0181)	.0581 (.0257)
Industry fixed effects	Yes	Yes
R^2 (within)	.134	.113
R^2 (between)	.181	.351
R^2 (overall)	.096	.274
N	132	76
Number of industries	17	13

B	(1)	(2)	(3)	(4)	(5)
Sample	Full	Full	Full	Balanced	Panel A
Time period	1979–94	1979–85	1986–94	1979–94	1983–92
Weighted ln change in domestic demand	−.0733 (.0191)	−.0571 (.0256)	−.0675 (.0298)	−.0576 (.0344)	−.0050 (.0475)
Weighted ln change in exports	−.3436 (.0605)	−.2364 (.0810)	−.2655 (.0945)	−.5614 (.0919)	−.4290 (.1118)
Weighted change in import share	.0703 (.0627)	.1266 (.0883)	.0126 (.0855)	.2037 (.1399)	−.0797 (.1022)
Change in manufacturing industrial production index	−.0005 (.0003)	−.0011 (.0004)	.0002 (.0006)	−.0010 (.0005)	.0008 (.0009)
ln(Capital stock/ Shipments)	−.0041 (.0078)	.0091 (.0143)	.0131 (.0159)	−.0218 (.0113)	−.0576 (.0203)

(continued)

Table 10.7 (continued)

B	(1)	(2)	(3)	(4)	(5)
Change in TFP	.0329	−.0449	.0853	.0928	−.0477
	(.0341)	(.0482)	(.0473)	(.0604)	(.0818)
Time trend	−.0009	.0012	.0007	−.0014	−.0021
	(.0003)	(.0010)	(.0005)	(.0004)	(.0011)
Constant	.0600	.0644	.0491	.0535	.0215
	(.0061)	(.0121)	(.0128)	(.0009)	(.0174)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
R^2 (within)	.088	.137	.048	.141	.225
R^2 (between)	.025	.0009	.139	.017	.004
R^2 (overall)	.056	.0525	.0007	.046	.032
N	966	438	528	433	168
Number of industries	72	70	71	27	17

Source: Author's calculations from data drawn from the NBER Trade Database, Bureau of Labor Statistics, U.S. Import and Export Price Indexes, the Displaced Worker Surveys, and the NBER Productivity Database.

Notes: Full sample denotes the largest feasible data set with information on the relevant variables. Standard errors are in parentheses. Specification in panel A includes one lag in the import price index.

tion relating annual industry displacement rates to the two sets of industry trade indicators. Panel A reports estimates from a specification using changes in relative import-price indices. Column (1) uses the sample of 17 industries for which data are available during the period 1983–92. Column (2) is restricted to a group of high-import industries, those industries within the top quartile of mean import share during the period 1975–94. The estimated coefficients in columns (1) and (2) reveal that as relative import prices fall and imports become more competitive, displacement rises (the estimated effect of changes in relative import prices includes one lagged term). The effect of a change in relative import price is not different for the high-import-share industries. The business-cycle component of displacement is proxied by the index of manufacturing industrial production. Counterintuitively, the sign of the estimated correlation is positive (as it is in table 10.6), although the estimate is imprecise. Similar to table 10.6, technological change is associated with lower rates of job loss. Although generally consistent with expectations, this simple specification does not explain much of the within-industry variation in displacement.

Panel B of table 10.7 reports estimates from a specification of trade flows and domestic demand. Columns (2) and (3) break up the time period into subperiods 1979–85 and 1986–92. Displacement rates are lower with increases in domestic demand and exports. Increases in import share are positively correlated with industry job loss, with a considerably stronger effect found for the first half of the 1980s than for the second half. The fit

Table 10.8 **Changes in Industry ln Displacement and Changes in Relative Import Prices Panel, Fixed Effect Estimates**

	(1)
Time period	1983–92
ln Change relative import price index	−1.5625 (0.7457)
Change in manufacturing industrial production index	−0.0105 (0.0107)
Industry fixed effects	Yes
Constant	8.9664 (0.0510)
R^2 (within)	0.041
R^2 (between)	0.026
R^2 (overall)	0.011
N	209
Number of industries	28

Source: Author's calculations from data drawn from the NBER Trade Database, Bureau of Labor Statistics, U.S. Import and Export Price Indexes, and the Displaced Worker Surveys.
Notes: Standard errors are in parentheses. Specification includes one lag in the import price index.

of the regression is somewhat better for the first half of the decade. Column (4) uses a balanced panel of industries, with the results little changed.

As a check, table 10.8 reports coefficient estimates for a specification using the natural log of industry displacement as the dependent variable. This specification matches Haveman (1998), and it uses changes in relative import prices as the primary independent variable. The estimated coefficient is negative, as expected, and statistically significant. A 1 percent fall in import price raises industry displacement by 1.56 percent. This estimate is close to Haveman's elasticity estimate of 1.69.

The measured response of job loss to changes in import prices and import share is probably understated. Revenga (1992) notes that if the import price variable, in equation (3), is correlated with any of the components of the disturbance term, ordinary least squares (OLS) parameter estimates will be biased and inconsistent. She notes several factors that may induce correlation between the import-price measure and the error terms, such as unmeasured worldwide shocks to materials costs or unobserved and unmeasured taste or demand shifts in the United States that influence import prices due to the size of the U.S. market.[30] Similar arguments can be made for the endogeneity of the import-share variable. A comparison of Revenga's OLS and instrumental variables (IV) estimates suggests

30. Closer to the model discussed in Mann (1988), import prices may be set specifically for the U.S. market, and this price setting will produce a correlation between import price and the disturbance terms.

rather strongly the likelihood of omitted variables (or simultaneity) that influence industry employment, wages, and import price, as OLS estimates of import-price elasticities appear significantly downward biased.[31] The use of displacement here may weaken this correlation empirically, but conceptually it is still likely to exist.

10.8 Reemployment Following Job Loss: Where Do Displaced Workers Become Reemployed?

Does increasing foreign competition lead to a reallocation of labor? The linkages of changing trade patterns to changing employment patterns have been examined in a number of papers, including Borjas, Freeman, and Katz (1992, 1997), and Sachs and Shatz (1994, 1998). These studies confirm that the rise of net imports from developing countries is unskilled intensive relative to the rest of manufacturing and the rest of the economy. Sachs and Shatz (1998, 30) show "that a cutback in manufacturing employment (particularly import-competing manufacturing employment) will release relatively unskilled workers into the service sector, with the effect being larger should those employees come from the import-competing sector of manufacturing." These studies reveal a potentially important aspect of the link between trade and wages, that the reemployment of displaced import-competing manufacturing workers in the (lower-wage) service sector provides one avenue for downward pressure on wages with increasing trade. These papers consider the economywide aspects of labor reallocation, and the implications for increasing earnings inequality. The individual-level implications of labor reallocation are equally important, certainly for displaced workers, and for understanding the costs of trade-related displacement. In this section, I use the information available in the DWS to directly examine the pattern of reemployment following job loss and the possible link between reemployment sector and earnings losses.

The individual-level consequences of job displacement are well studied and well known. The state of knowledge in two areas will be briefly restated here (interested readers should consult Kletzer 1998a for more details). There is a sizable literature on the question of whether workers displaced from import-competing industries face different (or worse) post-displacement outcomes that workers displaced from (manufacturing) industries less influenced by trade.[32] In Kletzer (1998b), I reported that workers displaced from high-import-share industries have different char-

31. Revenga's primary instrument is a source-weighted industry exchange rate, defined as a geometric average of the nominal exchange rates of countries accounting for more than 2 percent of industry imports.

32. The Bureau of International Labor Affairs (ILAB) of the U.S. Department of Labor sponsored a number of empirical studies of trade-affected workers in the 1970s and early 1980s. See Aho and Orr (1981) and studies and citations in Dewald (1978).

acteristics than workers displaced from other manufacturing industries: they are younger, less educated, less tenured, and more likely to be female. Average predisplacement real weekly earnings are significantly lower in high-import-share industries. Workers displaced from high-import-share industries are significantly less likely to be reemployed following displacement and most of the difference is due to the fact that women are disproportionately employed in import-competing industries and women are less likely to be reemployed following displacement from any industry. Trade-displaced workers may have more difficult labor market adjustments, but the source of the difficulty is their otherwise disadvantaged characteristics, not the characteristics of their displacement industry.[33]

Second, displaced-worker studies have also revealed that industry (or more broadly sector) may be an important dimension across which skills are transferable. The postdisplacement earnings of individuals who change industry are lower than the earnings of otherwise comparable individuals who stay in the same industry (see citations in Kletzer 1998a). It is important to note that larger earnings losses for workers who change industry may not necessarily reflect lost specific human capital. Industry wage effects due to efficiency wages, union rents, incentive pay schemes, or internal labor markets may partially account for the earnings losses.

10.8.1 Where Are Displaced Workers Reemployed?

With these studies as a backdrop, table 10.9 reports a matrix of transitions, from predisplacement industrial sector to postdisplacement industrial sector, using a sample of reemployed displaced workers drawn from the DWS. The sample contains workers displaced during the years 1979–94, with each of the 16 years drawn from only one survey. The transitions are only available for those workers reemployed at their survey date. "Old Sector" refers to time of displacement and those sectors are listed in the first column; "New Sector" refers to reemployment and those sectors are listed across the top of the matrix. Each cell contains four entries: the first is the percentage of reemployed old-sector workers who are reemployed in the new sector, and the second is the mean difference in log weekly earnings, predisplacement to postdisplacement, for those workers. The third and fourth entries are cell counts. For example, the first cell reports that 5.3 percent of reemployed mining workers were reemployed in agriculture, and their mean weekly earnings loss was approximately 79 percent.

Focusing attention on manufacturing-nonmanufacturing comparisons, several points stand out. Sizable proportions of the sample stay within the same industrial sector. The highest return proportions are professional services (62.6 percent), construction (48.9 percent), and wholesale and retail trade (46.9 percent). Within manufacturing, 32 percent of reemployed

33. See Neumann (1978) and Kruse (1988, 1991) for more on this point.

Table 10.9 Postdisplacement Employment by Sector, 1979–94

	New Sector										
Old sector	Agriculture	Mining	Construction	Manufacturing, Nondurables	Manufacturing, Durables	Transportation	Trade	Professional Services	Other Services	Government	Total
Mining	5.3	26.84	10.44	2.08	10.71	9.85	12.19	10.65	9.16	2.76	2.2
	−0.791	−0.027	−0.552	−0.885	−0.339	−0.349	−0.527	−0.586	−0.762	−0.558	−0.382
	17.2	124.9	44.5	9.6	49.0	30.5	56.5	38.0	28.6	6.9	406.2
	(9)	(82)	(34)	(6)	(26)	(25)	(34)	(27)	(21)	(7)	(271)
Construction	1.92	0.44	48.93	3.25	7.91	5.47	12.48	11.22	6.32	2.06	10.1
	−0.088	−0.081	−0.037	0.77	−0.215	−0.097	−0.325	−0.238	−0.246	−0.064	−0.128
	30.7	7.0	878.2	52.9	157.7	104.6	224.9	229.0	126.8	41.5	1,853.8
	(14)	(4)	(458)	(36)	(82)	(59)	(128)	(128)	(69)	(27)	(1,005)
Manufacturing, nondurables	1.37	0.30	3.81	32.0	14.27	5.05	15.73	15.48	9.98	2.00	11.9
	0.132	−0.098	0.020	−0.015	0.007	0.009	−0.190	−0.146	−0.279	−0.180	−0.087
	26.5	5.6	84.0	761.1	318.7	111.5	359.1	347.8	215.4	51.2	2,281.3
	(16)	(5)	(50)	(424)	(159)	(61)	(215)	(203)	(114)	(30)	(1,277)
Manufacturing, durables	1.15	0.54	6.44	7.55	39.16	5.17	14.08	12.45	11.28	2.14	22.5
	−0.604	−0.002	−0.205	−0.048	−0.072	−0.124	−0.376	−0.289	−0.393	0.028	−0.183
	31.4	27.6	262.4	341.3	1,749.4	210.3	598.3	530.2	428.7	94.9	4,275.0
	(16)	(13)	(147)	(190)	(929)	(107)	(348)	(275)	(218)	(56)	(2,299)
Transportation	1.72	0.57	5.73	3.55	6.36	42.04	14.92	11.95	10.68	2.49	6.89
	−0.498	0.106	−0.192	−0.248	−0.194	−0.083	−0.242	−0.248	−0.294	−0.203	−0.174
	16.8	9.0	64.4	42.9	76.3	538.9	185.4	150.2	127.4	35.6	1,247.4
	(6)	(5)	(43)	(23)	(42)	(291)	(100)	(82)	(62)	(17)	(671)
Trade	1.04	0.17	4.52	4.84	7.15	4.84	46.93	17.17	11.40	1.95	20.17
	−0.066	0.154	−0.156	0.019	0.053	−0.047	−0.052	−0.022	−0.073	0.089	−0.038
	26.4	7.0	168.1	182.5	277.1	178.8	1,691.8	673.3	383.0	80.3	3,668.7
	(15)	(8)	(87)	(97)	(144)	(103)	(940)	(350)	(202)	(47)	(1,993)
Professional services	0.63	0.42	2.92	3.61	4.37	3.14	10.58	62.63	8.77	2.91	14.55
	−0.559	−0.040	−0.335	0.009	0.085	−0.112	−0.191	−0.036	−0.355	0.188	−0.078
	6.2	9.1	78.9	105.3	121.7	78.5	289.0	1,677.9	236.9	88.6	2,692.5
	(5)	(8)	(39)	(53)	(65)	(44)	(151)	(876)	(119)	(55)	(1,415)

Other services	1.39	0.53	4.78	3.76	7.46	6.55	19.11	19.87	35.09	1.45	10.45
	−0.179	0.287	0.012	0.174	0.124	0.062	−0.120	−0.112	−0.068	0.147	−0.043
	16.1	12.5	88.1	71.0	146.4	138.5	363.2	350.4	594.6	30.4	1,811.9
	(7)	(7)	(47)	(41)	(75)	(71)	(198)	(195)	(321)	(18)	(980)
Government	1.42	0.00	2.35	5.42	2.93	8.12	11.09	34.83	7.73	26.11	1.21
	−0.062	—	0.144	−0.020	−0.053	−0.162	−0.404	−0.101	−0.199	0.119	0.079
	3.9	0	4.0	14.0	6.1	21.5	23.7	85.8	15.0	56.4	230.7
	(3)	(0)	(4)	(8)	(6)	(10)	(14)	(53)	(10)	(37)	(145)
Total	1.32	0.98	9.32	8.10	14.88	7.65	20.74	21.92	12.64	2.45	100.0
	−0.316	0.0036	−0.104	−0.017	−0.049	0.073	−0.168	−0.108	−0.220	0.030	−0.111
	175.6	203.0	1,673.0	1,581.2	2,902.8	1,413.4	3,792.3	4,083.0	2,156.8	486.3	18,467.8
	(91)	(132)	(909)	(878)	(1,528)	(771)	(2,128)	(2,189)	(1,136)	(294)	(10,056)
Top job loss	0.51	0.22	5.28	10.01	37.74	5.32	15.69	12.55	10.11	2.55	4.2
	−0.156	0.134	−0.106	−0.148	−0.098	−0.198	−0.291	−0.385	−0.518	0.637	−0.186
	2.1	2.1	37.9	85.5	323.7	35.8	124.8	95.7	69.9	24.7	802.6
	(1)	(1)	(23)	(52)	(172)	(18)	(74)	(50)	(33)	(14)	(438)
Top job loss and top trade	0.0	0.47	3.03	14.62	35.26	7.51	17.33	10.81	8.06	2.72	2.0
	—	0.134	−0.029	−0.138	−0.051	−0.054	−0.264	−0.215	−0.608	1.09	−0.131
	0	2.1	11.8	58.4	138.9	20.3	70.5	44.1	33.5	12.3	392.4
	(0)	(1)	(8)	(38)	(83)	(8)	(44)	(25)	(18)	(8)	(233)
Top trade	0.57	0.34	2.11	19.53	31.38	4.58	14.62	14.27	10.82	1.78	8.2
	−3.52	−0.081	0.067	−0.038	−0.036	−0.238	−0.221	−0.111	−0.171	0.369	−0.091
	2.1	6.4	29.2	327.1	505.2	61.0	228.0	232.2	172.0	31.4	1,595.1
	(2)	(3)	(20)	(182)	(265)	(29)	(126)	(123)	(92)	(20)	(862)

Source: Author's calculations from Displaced Worker Surveys, 1984–96, and U.S. Import and Export data file, 1958–94.

Notes: First entry in cell is the percentage of reemployed old-sector workers who are employed in the new sector. Second entry in cell is the mean difference in log weekly earnings. Third entry in cell is weighted cell count in thousands. Fourth entry in cell is unweighted cell count (in parentheses).

Top job loss includes industries in the top quartile of industry mean job-loss-rate distribution; Top job loss and top trade includes industries in top job-loss-rate quartile and either top mean-import-share quartile or top mean-change-in-import-share quartile; top trade group includes industries in both top-import-share quartile and top-change-in-import-share quartile.

nondurable goods workers remain in the sector, and 39 percent of durable goods workers remain in the sector. Overall, there is movement out of manufacturing. Approximately 34 percent of reemployed workers were displaced from manufacturing; the percentage of workers reemployed in manufacturing was 23 percent. Trade and services represent approximately 54 percent of postdisplacement employment, up from 44 percent of predisplacement employment. Thus, many displaced workers are reemployed in the (growing) nontradable sector. The variation in earnings change is considerable. The average earnings change for the overall sample was −11.1 percent (a loss), and −8.7 percent for nondurable goods workers and −18.3 percent for durable goods workers. Among manufacturing workers, the largest earnings losses are experienced by workers reemployed in trade and services (ranging from 15 to 40 percent). It is interesting to note that workers displaced from the relatively lower-wage trade and services sector experience earnings gains if reemployed in manufacturing (and the reemployment percentages are small, ranging from 3 to 7 percent).

What happens to trade-displaced workers? It is difficult to isolate a set of workers displaced by trade. Instead of "trade-displaced," table 10.9 offers three definitions of import-competing. The first, listed in the table as "Top job loss," are workers displaced from the top quartile of mean job-loss-rate industries, those industries listed in table 10.2. For the most part, these industries are import-competing. How do these workers fare? Thirteen of the 17 top job-loss-rate industries are durable goods industries, so perhaps it is not surprising that the reemployment pattern of the top job-loss group looks like the durable goods group overall.[34] More than one-third of the group is reemployed in a durable goods industry, and these workers have the smaller earnings losses (9.8 percent). Very large earnings losses are experienced by workers who are reemployed in trade and services, ranging from 29 to 52 percent. The mean earnings change for this group is −18.6 percent, the median is −10.2 percent. For comparison, the mean earnings change for workers not in this group is −10.7 percent and the median is −4.7 percent.

The second group, called "Top job loss and top trade," includes workers displaced from industries that are in the top quartile of the mean job-loss-rate distribution and in either the top quartile of the mean import-share distribution or the top quartile of the mean change in import-share distribution. This tighter definition of import-competing job loss industry includes footwear; watches, clocks; leather products; toys; pottery and related products; radio and television; leather tanning; other primary metals; and cycles and miscellaneous transport. This group looks very similar

34. The nondurable goods industries are footwear, leather products (excluding footwear), leather tanning, and miscellaneous petroleum and coal products.

to the "Top job loss" group, with slightly smaller mean (13 percent) and median (7 percent) earnings losses. Again, large earnings losses are experienced by those workers reemployed in trade and services.

The last trade-displaced group is called "Top trade" and it includes workers from industries that are in the top quartile in both mean import share and mean change in import share, but without regard to job-loss rate. These industries (with their mean job-loss rates) are footwear (0.090); watches, clocks (0.091); leather products (0.142); miscellaneous manufacturing (0.053); apparel (0.052); office and accounting machines (0.0078); toys (0.067); photographic equipment (0.029); electronic computing equipment (0.045); pottery and related products (0.071); electrical machinery (0.039); radio and television (0.125); and leather tanning (0.074). Not all of the import-competing industries have high job-loss rates, in particular those industries with sustained strong demand such as office and accounting machines, computers, and photographic equipment. This group has the smallest average earnings losses of the three identified groups and losses that are slightly lower than the overall average (the mean change is −9.1 percent and the median change is −4.5 percent). Notably, this last group, while still predominantly durable goods industries, has smaller earnings losses across reemployment sectors. Those workers who return to manufacturing have smaller earnings losses than the average returning manufacturing worker and workers who become reemployed in services have smaller earnings losses than the average worker displaced from manufacturing and reemployed in services.

Table 10.9 confirms some priors: Workers displaced from manufacturing and reemployed in trade and services experience large earnings losses. Workers displaced from import-competing manufacturing, mostly durable goods, have the largest average earnings losses of any industrial group (with the exception of mining) and their losses are particularly large if reemployed in trade and services. An important qualifier to the last point is that earnings outcomes for workers displaced from import-competing and high-job-loss manufacturing industries appear to be different from (worse than) the outcomes of workers displaced from industries defined by import competition alone.

What cannot be learned from this kind of descriptive analysis is why earnings losses are large. The losses are partly due to lost firm- and industry-specific skills, but they are also due to losses of union rents, efficiency wages, and other industry-specific components of pay. These questions are beyond the scope of this paper.

10.8.2 Are Workers Reemployed in Exporting Industries?

Table 10.9 provides one straightforward answer to this question: no. The largest share of workers displaced from import-competing industries are reemployed in trade and services, largely nontradable sectors. The ques-

Table 10.10 **Top Reemployment Industries for Displaced Workers, with Export and Import Shares**

Industry	Number Reemployed (× 10³)	Manufacturing Reemployed (%)	Export Share	Import Share
Machinery (excl. electrical)	367.6	7.0	0.139	0.128
Electrical machinery	354.6	6.7	0.138	0.180
Motor vehicles	274.7	5.2	0.094	0.237
Furniture and fixtures	190.4	3.6	0.017	0.080
Fabricated structural metals	177.1	3.4	0.031	0.012
Manufacturing average			0.075	0.117

tion can be rephrased and narrowed as follows: Within manufacturing, are workers reemployed in exporting industries? Durable goods industries dominate the top quartile of export share industries (15 of the 18 are durable goods industries). As noted previously, durable goods industries also dominate the group of highly import competing industries. As larger (by employment) industries, durable goods industries account for larger shares of both displacement (22.9 percent) and reemployment (14.9 percent) than nondurable goods industries (12.6 percent and 8.1 percent). Within durable goods, the top reemployment industries are shown in table 10.10.

Large employers tend to dominate this list, rather than exporting industries, although electrical and nonelectrical machinery industries have both characteristics. If we consider the set of industries that are in the top quartile in both export share and changes in export share during the 1975–94 period, these industries accounted for 14.8 percent of manufacturing reemployment and 3.4 percent of all reemployment. The industries, with their mean import and export shares, are shown in table 10.11.

For workers and policymakers, an important characteristic of manufacturing exporting industries is that they tend to be high wage, in the sense of paying wages that are above average for manufacturing (and considerably above average for all industries). In table 10.11, high-wage industries are those with sizable positive wage differentials, in the range of 0.083 to 0.207, as measured by Katz and Summers (1989).[35] Workers reemployed in these industries experience smaller earnings losses than workers reemployed elsewhere. For nondurable goods–displaced workers, reemployment in these industries resulted in average earnings changes of +13.8 percent, compared to −9.4 percent for workers reemployed elsewhere. For

35. Katz and Summers (1989) control for the usual worker characteristics and estimate wage differentials for two-digit CIC industries, using the full year 1984 Current Population Survey (1989, 218–19, table 2). These numbers are the proportionate difference in wages between the average workers in a given two-digit industry and the average worker in all industries.

Table 10.11 Industries with High Mean Export Share and High Mean Import Share, 1975–94

Industry	Export Share	Import Share	High Wage
Ordnance	.131	.059	Yes
Scientific and controlling instruments	.209	.126	Yes
Aircraft and parts	.266	.091	Yes
Office and accounting machines	.180	.210	Yes
Leather tanning and finishing	.143	.208	
Electronic computing equipment	.246	.239	Yes
Electrical machinery	.138	.180	
Cycles and miscellaneous transport equipment	.163	.254	Yes
Engines and turbines	.217	.149	Yes

durable goods–displaced workers, average earnings losses were −4.8 percent if reemployed in these industries, compared to losses of −19.9 percent if reemployed elsewhere.

10.9 Conclusion

This paper has investigated the relationship between changes in foreign competition and job displacement for a sample of manufacturing industries during the period 1979–94. The results are broadly consistent with the perception that imports displace some domestic jobs. This broad consistency appears to be a result of a strong positive relationship between increasing foreign competition and job displacement for industries long identified as import competing; these are industries such as footwear, leather products, radio and television, watches and clocks, and toys. At the same time, there are a number of import-competing industries with below-average rates of job loss, such as office and accounting machines and photographic equipment. Over this time period, there was also considerable job loss from industries facing little or no change in import competition (e.g., guided missiles and space vehicles, wood buildings and mobile homes, and optical and health services supplies). With this variation, the overall relationship between increasing foreign competition and permanent job loss appears much less systematic. What is unknown is whether the trade/job loss relationship might be stronger within more narrowly defined industries. The displacement data do not allow further industry detail.[36]

Across industries, increasing foreign competition accounts for a small share of job displacement. There are high rates of job loss for industries

36. For related studies using establishment- and plant-level data, see Davis, Haltiwanger, and Schuh (1996) and Bernard and Jensen (1995).

with very little trade. This conclusion would be highlighted if the analysis sample included trade and service industries, where rates of job loss are high while the services produced are mostly nontradables. In the absence of satisfactory high-frequency proxies for technological change, the role of technological change remains in debate.

There is an important limitation to this analysis. Displacement is just one of the flows that contribute to net changes in employment. It is likely that firms use all the components of turnover (quits and new and replacement hiring, as well as displacement) to move actual employment toward its desired level as foreign competition changes. It may be difficult for the data to isolate one flow in the absence of the others.

Sizable earnings losses follow job displacement. Workers displaced from import-competing manufacturing, mostly durable goods, have the largest average earnings losses of any industrial group (with the exception of mining) and their losses are particularly large if reemployed in trade and services. Even if the causal model remains unclear, workers have good reason to worry about job and income insecurity in the face of increasing foreign competition.

Appendix

Table 10A.1 **Industries Ranked by Mean Import Share, 1975–94, with Mean Displacement Rate, 1979–94**

Industry	CIC	Mean Import Share	Mean Displacement Rate
Lowest Quartile, Mean Import Share < .043			
Newspaper publishing and printing	171	.0023761	.0250716
Paperboard containers	162	.0064723	.0244208
Paints, varnishes	190	.007349	.0445853
Bakery products	111	.0085282	.0270649
Grain mill products	110	.0099001	.0327966
Logging	230	.0117149	.0597909
Fabricated structural metal	282	.0117886	.0558123
Dairy products	101	.0149561	.0444522
Printing, publishing (excl. newspapers)	172	.0153291	.0379967
Cement, concrete, gypsum	251	.0167538	.034515
Soaps and cosmetics	182	.0182893	.0347624
Guided missles, space vehicles	362	.0256684	.0803838
Ship and boat building	360	.027272	.0746358
Iron and steel foundries	271	.0318033	.0514859
Metal forgings and stampings	291	.0363809	.0268301
Meat products	100	.0379604	.032494
Wood buildings and mobile homes	232	.0434898	.0972105
Second Quartile, Mean Import Share .044–.087			
Plastics, synthetics	180	.0473768	.0271835
Canned and preserved fruits and vegetables	102	.0476178	.0326721
Miscellaneous food	121	.0509952	.0395866
Miscellaneous fabricated metals	300	.0560881	.0316113
Floor coverings	141	.0570617	.0491985
Ordnance	292	.0586891	.0594666
Drugs	181	.0639753	.021542
Miscellaneous petroleum and coal products	201	.064999	.0720061
Yarn, thread, and fabric mills	142	.0666864	.0424119
Beverages	120	.0674657	.0215012
Miscellaneous wood products	241	.0753061	.0360452
Miscellaneous nonmetallic mineral and stone	262	.0789392	.0521278
Miscellaneous fabricated textiles	152	.0795402	.036756
Optical and health supplies	372	.0801311	.1262741
Furniture and fixtures	242	.0804759	.0242372
Glass and glass products	250	.0814068	.04817
Primary aluminum	272	.0828264	.0702517
Petroleum refining	200	.0879131	.0259471
Third Quartile, Mean Import Share .088–.1537			
Aircraft and parts	352	.0909808	.0292094
Railroad locomotives	361	.0925145	.1077487
Industrial and miscellaneous chemicals	192	.0961335	.0314104
Screw machine products	290	.1100422	.0292981

(continued)

Table 10A.1 (continued)

Industry	CIC	Mean Import Share	Mean Displacement Rate
Sugar and confectionery	112	.1104992	.0391602
Cutlery, handtools	281	.1158531	.0281042
Household appliances	340	.115925	.0471302
Structural clay products	252	.1209288	.083527
Miscellaneous textile mill	150	.1228917	.0424784
Sawmills and millwork	231	.1233245	.0387356
Other rubber products	211	.1257362	.0512525
Scientific and controlling instruments	371	.1265785	.0157536
Knitting mills	132	.128416	.0204538
Machinery (excl. electric)	331	.1285396	.0439213
Construction and material moving machines	312	.1327857	.0567377
Farm machinery	311	.1369748	.0614961
Engines and turbines	310	.1492626	.0393126
Metalworking machines	320	.1522968	.0356374
Blast furnaces	270	.1537628	.061097
Top Quartile, Mean Import Share >.154			
Pulp, paper, and paperboard	160	.1569003	.0227719
Tires and inner tubes	210	.1600136	.0439544
Photographic equipment	380	.1682403	.0294131
Electrical machinery	342	.1799477	.0388985
Other primary metals	280	.1853473	.0755787
Radio, television	341	.1957753	.1259439
Leather tanning	220	.2082242	.0739732
Office and accounting machines	321	.2099128	.0078594
Apparel	151	.2258708	.0523536
Motor vehicles	351	.2371851	.0507589
Electronic computing	322	.2396241	.0455519
Cycles and miscellaneous transport	370	.2542767	.093942
Miscellaneous manufacturing	391	.264089	.0536586
Toys	390	.3408123	.0677491
Pottery and related products	261	.3800826	.0717307
Leather products (excl. footwear)	222	.4079864	.142046
Footwear	221	.4954904	.0906134
Watches, clocks	381	.5229867	.0913399

Table 10A.2 **Industries Ranked by Mean Displacement Rate, 1979–94, with Mean Import Share, 1975–94**

Industry	CIC	Mean Displacement Rate	Mean Import Share
Lowest Quartile, Mean Displacement Rate, <.031			
Office and accounting machines	321	.0078594	.2099128
Scientific and controlling instruments	371	.0157536	.1265785
Knitting mills	132	.0204538	.128416
Beverages	120	.0215012	.0674657
Drugs	181	.021542	.0639753
Pulp, paper, and paperboard	160	.0227719	.1569003
Furniture and fixtures	242	.0242372	.0804759
Paperboard containers	162	.0244208	.0064723
Newspaper publishing and printing	171	.0250716	.0023761
Petroleum refining	200	.0259471	.0879131
Metal forgings and stampings	291	.0268301	.0363809
Bakery products	111	.0270649	.0085282
Plastics, synthetics	180	.0271835	.0473768
Cutlery, handtools	281	.0281042	.1158531
Aircraft and parts	352	.0292094	.0909808
Screw machine products	290	.0292981	.1100422
Photographic equipment	380	.0294131	.1682403
Industrial and miscellaneous chemicals	192	.0314104	.0961335
Miscellaneous fabricated metals	300	.0316113	.0560881
Second Quartile, Mean Displacement Rate, .031–.0439			
Meat products	100	.032494	.0379604
Canned and preserved fruits and vegetables	102	.0326721	.0476178
Grain mill products	110	.0327966	.0099001
Cement, concrete, gypsum	251	.034515	.0167538
Soaps and cosmetics	182	.0347624	.0182893
Metalworking machines	320	.0356374	.1522968
Miscellaneous wood products	241	.0360452	.0753061
Miscellaneous fabricated textiles	152	.036756	.0795402
Printing, publishing (excl. newspapers)	172	.0379967	.0153291
Sawmills and millwork	231	.0387356	.1233245
Electrical machinery	342	.0388985	.1799477
Sugar and confectionery	112	.0391602	.1104992
Engines and turbines	310	.0393126	.1492626
Miscellaneous food	121	.0395866	.0509952
Yarn, thread, and fabric mills	142	.0424119	.0666864
Miscellaneous textile mill	150	.0424784	.1228917
Machinery (excl. electric)	331	.0439213	.1285396
Third Quartile, Mean Displacement Rate, .045–.061			
Tires and inner tubes	210	.0439544	.1600136
Dairy products	101	.0444522	.0149561
Paints, varnishes	190	.0445853	.007349
Electronic computing	322	.0455519	.2396241
Household appliances	340	.0471302	.115925
Glass and glass products	250	.04817	.0814068

(continued)

Table 10A.2 (continued)

Industry	CIC	Mean Displacement Rate	Mean Import Share
Floor coverings	141	.0491985	.0570617
Motor vehicles	351	.0507589	.2371851
Other rubber products	211	.0512525	.1257362
Iron and steel foundries	271	.0514859	.0318033
Miscellaneous nonmetallic mineral and stone	262	.0521278	.0789392
Apparel	151	.0523536	.2258708
Miscellaneous manufacturing	391	.0536586	.264089
Fabricated structural metal	282	.0558123	.0117886
Construction and material moving machines	312	.0567377	.1327857
Ordnance	292	.0594666	.0586891
Logging	230	.0597909	.0117149
Blast furnaces	270	.061097	.1537628
Farm machinery	311	.0614961	.1369748
Top Quartile, Mean Displacement Rate, >.061			
Toys	390	.0677491	.3408123
Primary aluminum	272	.0702517	.0828264
Pottery and related products	261	.0717307	.3800826
Miscellaneous petroleum and coal products	201	.0720061	.064999
Leather tanning	220	.0739732	.2082242
Ship and boat building	360	.0746358	.027272
Other primary metals	280	.0755787	.1853473
Guided missles, space vehicles	362	.0803838	.0256684
Structural clay products	252	.083527	.1209288
Footwear	221	.0906134	.4954904
Watches, clocks	381	.0913399	.5229867
Cycles and miscellaneous transport	370	.093942	.2542767
Wood buildings and mobile homes	232	.0972105	.0434898
Railroad locomotives	361	.1077487	.0925145
Radio, television	341	.1259439	.1957753
Optical and health supplies	372	.1262741	.080131
Leather products (excl. footwear)	222	.142046	.4079864

Table 10A.3 **Industries Ranked by Mean Change in Import Share, 1975–94, with Mean Displacement Rate, 1979–94**

Industry	CIC	Mean Change in Import Share	Mean Displacement Rate
Lowest Quartile, Mean Change in Import Share <.0007			
Cycles and miscellaneous transport	370	−.0068314	.093412
Sugar and confectionery	112	−.0053447	.0391602
Petroleum refining	200	−.0033942	.0259471
Miscellaneous petroleum and coal products	201	−.0013748	.0720061
Miscellaneous textile mill	150	−.0012623	.0424784
Meat products	100	−.0002888	.032494
Dairy products	101	−.0000962	.0444522
Newspaper publishing and printing	171	−.0000713	.0250716
Cement, concrete, gypsum	251	−.0000165	.034515
Wood buildings and mobile homes	232	.0001035	.0972105
Logging	230	.0002047	.0597909
Bakery products	111	.0004583	.0270649
Printing, publishing (excl. newspapers)	172	.0004609	.0379967
Beverages	120	.0004957	.0215012
Fabricated structural metal	282	.0004979	.0558123
Paperboard containers	162	.0005126	.0244208
Grain mill products	110	.0006532	.0327966
Paints, varnishes	190	.0007758	.0445853
Second Quartile, Mean Change in Import Share .0007–.003			
Pulp, paper, and paperboard	160	.0008016	.0227719
Miscellaneous food	121	.0008925	.0395866
Ship and boat building	360	.0012961	.0746358
Metal forgings and stampings	291	.0013335	.0268301
Canned and preserved fruits and vegetables	102	.0013905	.0326721
Sawmills and millwork	231	.0014915	.0387356
Iron and steel foundries	271	.001629	.0514859
Soaps and cosmetics	182	.0016824	.0347624
Floor coverings	141	.001952	.0491985
Guided missiles, space vehicles	362	.0021725	.0803838
Screw machine products	290	.0025258	.0292981
Miscellaneous wood products	241	.0025542	.0360452
Drugs	181	.0025735	.021542
Miscellaneous fabricated metals	300	.0026224	.0316113
Farm machinery	311	.00266	.0614961
Industrial and miscellaneous chemicals	192	.0033692	.0314104
Miscellaneous nonmetallic mineral and stone	262	.003402	.0521278
Third Quartile, Mean Change in Import Share .003–.0075			
Optical and health supplies	372	.003507	.1262741
Blast furnaces	270	.0037119	.061097
Plastics, synthetics	180	.0037193	.0271835
Other primary metals	280	.0038447	.0755787
Glass and glass products	250	.003995	.04817
Furniture and fixtures	242	.0050339	.0242372
Household appliances	340	.0052597	.0471302

(continued)

Table 10A.3 (continued)

Industry	CIC	Mean Change in Import Share	Mean Displacement Rate
Motor vehicles	351	.0054276	.0507589
Ordnance	292	.0055606	.0594666
Cutlery, handtools	281	.0058958	.0281042
Yarn, thread, and fabric mills	142	.0059667	.0424119
Miscellaneous fabricated textiles	152	.006024	.036756
Structural clay products	252	.0060668	.083527
Primary aluminum	272	.0063072	.0702517
Machinery (excl. electric)	331	.0063173	.0439213
Aircraft and parts	352	.0065456	.0292094
Railroad locomotives	361	.0067265	.1077487
Engines and turbines	310	.0071777	.0393126
Tires and inner tubes	210	.0075621	.0439544
Top Quartile, Mean Change in Import Share >.0075			
Leather tanning	220	.00799	.0739732
Radio, television	341	.0081509	.1259439
Knitting mills	132	.0084907	.0204538
Scientific and controlling instruments	371	.0086181	.0157536
Metalworking machines	320	.0089322	.0356374
Other rubber products	211	.0092831	.0512525
Photographic equipment	380	.0095574	.0294131
Construction and material moving machines	312	.0096119	.0567377
Pottery and related products	261	.0105394	.0717307
Electrical machinery	342	.0118051	.0388985
Miscellaneous manufacturing	391	.0121933	.0536586
Apparel	151	.0152491	.0523536
Toys	390	.0177078	.0677491
Office and accounting machines	321	.0191396	.0078594
Electronic computing	322	.0192546	.0455519
Leather products (excl. footwear)	222	.0238756	.142046
Footwear	221	.0241364	.0906134
Watches, clocks	381	.0278894	.0913399

Table 10A.4 **Industries Ranked by Mean Change in Net Exports (as a share of output), 1975–94, with Mean Displacement Rate, 1979–94**

Industry	CIC	Mean Change in Net Export Share	Mean Displacement Rate
Lowest Quartile, Mean Change in Net Export Share, <.0029			
Footwear	221	−.0173007	.0906134
Watches, clocks	381	−.0160877	.0913399
Leather products (excl. footwear)	222	−.015963	.142046
Miscellaneous manufacturing	391	−.0111059	.0536586
Apparel	151	−.0107097	.0523536
Office and accounting machines	321	−.0104705	.0078594
Toys	390	−.0091293	.0677491
Photographic equipment	380	−.0085043	.0294131
Electronic computing	322	−.0079246	.0455519
Structural clay products	252	−.0063408	.083527
Knitting mills	132	−.0057957	.0204538
Miscellaneous fabricated textiles	152	−.0056321	.036756
Other rubber products	211	−.0056314	.0512525
Railroad locomotives	361	−.0055018	.1077487
Pottery and related products	261	−.0044469	.0717307
Metalworking machines	320	−.0038791	.0356374
Construction and material moving machines	312	−.0035712	.0567377
Blast furnaces	270	−.0034804	.061097
Furniture and fixtures	242	−.0029966	.0242372
Second Quartile, Mean Change in Net Export Share, −.003 to −.0008			
Yarn, thread, and fabric mills	142	−.0029837	.0424119
Metal forgings and stampings	291	−.0028382	.0268301
Machinery (excl. electric)	331	−.00264	.0439213
Tires and inner tubes	210	−.0025678	.0439544
Motor vehicles	351	−.002472	.0507589
Primary aluminum	272	−.0024263	.0702517
Drugs	181	−.0023017	.021542
Cutlery, handtools	281	−.0021052	.0281042
Electrical machinery	342	−.0019275	.0388985
Scientific and controlling instruments	371	−.0018343	.0157536
Iron and steel foundries	271	−.0018204	.0514859
Logging	230	−.0017241	.0597909
Household appliances	340	−.0016676	.0471302
Miscellaneous wood products	241	−.001543	.0360452
Glass and glass products	250	−.00122	.04817
Miscellaneous nonmetallic mineral and stone	262	−.000999	.0521278
Sawmills and millwork	231	−.0009384	.0387356
Guided missiles, space vehicles	362	−.0008502	.0803838
Third Quartile, Mean Change in Net Export Share, −.0008 to .00059			
Miscellaneous food	121	−.0007332	.0395866
Miscellaneous fabricated metals	300	−.0006225	.0316113
Fabricated structural metal	282	−.0005097	.0558123
Optical and health supplies	372	−.0003269	.1262741
Grain mill products	110	−.0002926	.0327966

(*continued*)

Table 10A.4 (continued)

Industry	CIC	Mean Change in Net Export Share	Mean Displacement Rate
Ship and boat building	360	−.0002632	.0746358
Floor coverings	141	−.0002121	.0491985
Canned and preserved fruits and vegetables	102	−.0001781	.0326721
Wood buildings and mobile homes	232	−.0000265	.0972105
Bakery products	111	8.26e-07	.0270649
Ordnance	292	.0000759	.0594666
Newspaper publishing and printing	171	.0001095	.0250716
Printing, publishing (excl. newspapers)	172	.000126	.0379967
Cement, concrete, gypsum	251	.0001543	.034515
Farm machinery	311	.0003342	.0614961
Paperboard containers	162	.0003597	.0244208
Pulp, paper, and paperboard	160	.0004148	.0227719
Radio, television	341	.0005997	.1259439
Top Quartile, Mean Change in Net Export Share, >.00059			
Aircraft and parts	352	.000614	.0292094
Dairy products	101	.0006212	.0444522
Industrial and miscellaneous chemicals	192	.0006395	.0314104
Paints, varnishes	190	.0006576	.0445853
Beverages	120	.0006595	.0215012
Screw machine products	290	.0006609	.0292981
Leather tanning	220	.000763	.0739732
Soaps and cosmetics	182	.0008036	.0347624
Plastics, synthetics	180	.0009911	.0271835
Miscellaneous petroleum and coal products	201	.0013933	.0720061
Meat products	100	.0028748	.032494
Engines and turbines	310	.0044416	.0393126
Petroleum refining	200	.0048386	.0259471
Other primary metals	280	.0052128	.0755787
Miscellaneous textile mill	150	.0058516	.0424784
Sugar and confectionery	112	.0089662	.0391602
Cycles and miscellaneous transport	370	.0155033	.093942

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Comment Lisa M. Lynch

If one wants to understand some of the recent sources of resistance to further trade liberalization, then examining the gross flows data on employment rather than net employment numbers is critical. While the impact of trade on gross job loss is only part of the story of the overall impact of trade on employment, it is where much of the "emotion" that Ross Perot and Pat Buchanan tapped into lies. Lori Kletzer's paper does much to enhance our understanding of this issue.

There are several key findings in this paper. In Kletzer's descriptive analysis, she concludes that high rates of job loss are found for industries with high import shares and large positive changes in their import shares. However, increasing import competition from a lower level of import share is

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associated with below-average job loss. These are interesting facts that could benefit from future work to place these findings within an enhanced theoretical model of trade and employment.

In the multivariate analysis of job displacement rates in manufacturing presented in table 10.5, Kletzer finds that quantity measures of trade (especially log change in exports) seem to have a large effect on job displacement rates, while technology (as measured by total factor productivity or computer use) has no effect. But, as shown in table 10.6, when she uses price measures of trade (the change in relative import prices) she finds no effect of trade on displacement and a large effect of technology. In table 10.7, she examines within-industry displacement rates and finds that using import prices has no statistically significant effect on job loss. But when she uses quantity measures of trade, she finds that increases in exports lowers displacement rates significantly. So, depending on whether you look at trade quantities or prices you find different results and the reader is left to ponder what the "real" effects of trade and technology on job displacement rates actually are.

In perhaps the most interesting part of the paper, Kletzer looks at what happens to workers when they lose a job in terms of income loss. If there was not a big income loss, then we probably would not worry that much about the gross-flows analysis. Kletzer finds that displaced workers who come from import-competing and high-job-loss manufacturing jobs do much worse than those displaced workers from industries defined by import competition alone. In other words, it is not trade in your sector that hurts you, per se, just a lot of trade.

Leaders of organized labor might use these findings to conclude that this is a good reason to have quotas. But before they embrace all of the work presented in this paper, I have a few suggestions for the author and others doing research in this area. First, in the Displaced Workers Survey one of the interesting findings is that the reason for job loss has been changing over time. Examining reasons for job loss separately and how they are related to trade and technology would be valuable. Second, since much of the debate on trade's impact on the labor market has to do with changes in the relative demand for skilled labor, why not look at workers by educational attainment as well as blue-collar/white-collar occupational status? Third, the empirical analysis would probably be improved by using generalized method of movements (GMM) analysis to control for endogeneity bias. Fourth, it would be useful to distinguish between import competition from newly industrialized countries (NICs) versus industrialized nations, as some of the other papers in this volume have done.

More generally, I think that future work on the relative importance of technology and trade for job displacement rates would benefit from using data sets such as the U.S. Census Bureau's Longitudinal Record Database (LRD) on manufacturing establishments. By using the longitudinal dimension of the LRD, Kletzer's framework for measuring trade's impact

Table 10C.1 **Employees at Various Educational Levels by Changes in Male Inequality, 1979–90 (percent)**

	Math Level				
Country	Very High, 4/5	Medium, 3	Low, 2	Minimal, 1	Change in Inequality
United States	27.1	32.5	24.5	15.9	+0.28
Germany	27.6	45.2	22.9	4.3	−0.06
Canada	27.6	36.0	25.0	11.4	+0.13
Netherlands	24.8	48.0	21.2	6.0	0.00
Sweden	38.1	39.8	17.4	4.7	0.00

Source: OECD, *Literacy, Economy and Society: Results from the International Adult Literacy Survey, 1995* (revised data) and Freeman and Katz (1995).

on gross employment flows, and the periodic technology surveys done by the Census Bureau, we may improve our understanding of the relative importance of trade and technology for job loss in the United States.

In conclusion, let me raise a broader issue that has been addressed in part by other papers in this volume. I am left uneasy when I look at much of the literature on the relative effect of trade versus technology on the U.S. labor market and see that many European countries have experienced trade and technological changes similar to those in the United States without a corresponding increase in inequality. One explanation of the variance in the degree of inequality across countries in spite of similar technological and trade shocks is that the relative supply of skilled workers in some of these countries has been better able to keep up with the changes in the relative demand for skilled workers than in the United States. As Nickell and Bell (1996) discuss, countries that have an education and training system that produces a much more compressed distribution of human capital are also more likely to have experienced less increase in income inequality over the last 20 years. For example, as shown in table 10C.1, the variation in mathematics ability for workers is much smaller in countries like Germany, Sweden, and the Netherlands than in the United States or Canada. In particular, there are almost 4 times as many workers in the United States with minimal mathematics skills as compared with Sweden.

If we look in more detail at the ability levels of workers by age, there is even more disturbing data. As shown in figure 10C.1, there are almost 10 times as many young workers with zero or minimal math skills (i.e., unable to add two numbers together) in the United States as there are in Germany. Similar patterns hold for other European countries.

This suggests that there are other institutions or factors at play that ameliorate the effect trade and technology have on the distribution of wages. I would like to argue that education and training systems are an important part of these institutional differences. Europe seems to have

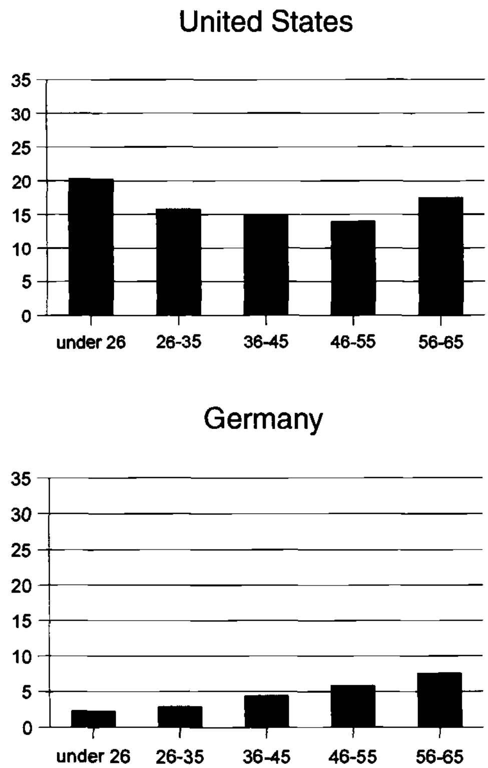

Fig. 10C.1 Percentage of employed workers with minimal math skills in the United States and Germany
Source: OECD Adult Literacy Survey.

done a better job in getting a higher percentage of the workforce skilled than the United States. In addition, while there has been a convergence in educational attainment among the major industrialized economies over the last 20 years, these data from the OECD adult literacy survey suggest that the "quality-adjusted output" of the educational and training systems of these countries seems to vary more than the years of completed schooling would suggest. Whatever one may think about the relative importance of trade and technology for labor market inequality, there seems to be much to be done in the United States to improve the skill levels of workers.

References

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