Job Creation, Job Destruction, and International Competition: A Literature Review

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Abstract

This paper is a chapter in our forthcoming monograph, *Job Creation, Job Destruction, and International Competition* (W.E. Upjohn Institute, 2003), and expands on the ideas advanced in Klein, Schuh, and Triest (2003). The chapter provides an extensive review of the literature that studies the connection between international factors, such as real exchange rates and trade agreements, and the domestic labor market. Until recently, the literature has focused on the effects of international factors on net employment at aggregate levels or in selected import-competing industries. In the long run, aggregate net employment largely is unaffected by international factors, whereas these factors have important allocative effects in the short and long run, both between and within detailed industries. Thus, it is appropriate to study the components of net employment – gross job creation and destruction – when measuring the impact of international factors on labor markets. Examining gross job and worker turnover associated with changes in international factors raises questions about the accuracy of prior estimates of adjustment costs associated with international factors because gross flows are an order of magnitude larger than net employment flows.

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Introduction

This chapter surveys research that attempts to explain and quantify the effects of real exchange rates and international trade on employment. The survey provides a context for the research we present later in this book. Our research on the influence of international factors on gross job flows is directly related to, and an extension of, previous studies of employment dynamics. However, as discussed in this chapter, the preponderance of these studies focus on changes in net employment rather than on job creation and job destruction.

The survey comprises three parts. The first section describes the connection between international trade and labor markets, and it explains how standard trade theory has had a limited view of this connection until recently. The second section reviews the early empirical studies, which focused primarily on the relationship between international factors and net employment. Finally, the third section reviews recent research based on the flow approach to labor markets, which focuses on the relationship between international factors and the dynamic processes of gross job and worker flows.

It is in this last area where our research on international factors and gross job flows contributes to the literature. We introduce labor-flow dynamics into the analysis of international trade and, in so doing, help clarify the costs of adjustment associated with changes in international factors. This analysis also highlights the role of international factors as an important channel for allocative forces that drive labor-market dynamics. We evaluate the importance for labor-market dynamics of the real exchange rate and trade policy relative to other factors that have been more extensively studied.

Before proceeding, we note that a voluminous body of research considers the effects of international factors on real wages, skill-biased technological change, and income distribution. This research is closely related to the questions we pose and attempt to answer in this book, and it should be integrated with them in future research. However, research on wage-related issues is so vast and sufficiently distinct from our concern with dynamic employment responses that we do not take it up. Thus, a full review of the literature on trade and wages is beyond the scope of this book.[1]

1. International Factors and Labor Markets

1.1 Trade and Unemployment

In his Ely Lecture, "The Challenge of High Unemployment," Alan Blinder (1988) identified the field of international trade as one of two where theory had failed to sufficiently address the problem and consequences of unemployment. Blinder

[1] For surveys of this literature, see Feenstra and Hanson (forthcoming), and articles in the Summer 1995 issue of the *Journal of Economic Perspectives* (vol. 9, no. 3), including Freeman (1995), Richardson (1995), and Wood (1995).

wrote:

> *Conditions of full employment are necessary to validate standard propositions in trade theory. High unemployment calls many of these propositions into question. Both the positive predictions of trade theory and its normative prescriptions may be wrong.* (p. 11)

This assessment did *not* lead Blinder to support barriers to free trade, but he did conclude that it is necessary "to pursue a vigorous full-employment policy so that displaced workers will be quickly reemployed." (p. 11) In Blinder's view, there is a large gap between economists' overwhelming and unswerving advocacy of free trade to obtain long-run welfare gains on the one hand and the striking reality of vehement opposition to free trade by many individuals and firms on the other. In our view, the only way to bridge the gap is to consider explicitly the short-run welfare costs associated with job and worker reallocation, unemployment, and the destruction of human capital.

Economists' conclusions about the welfare gains from trade in the long run derive from the standard Heckscher-Olin-Samuelson (HOS) trade model, where factors of production are assumed to be homogeneous across sectors, and there are no impediments to the intersector mobility of factors. In the HOS model, a change in the terms of trade engenders reallocation of factors across sectors, but at no cost. Aggregate employment is constant across changes in underlying conditions in the static version of this model.

In the 1980s and early 1990s, this theoretical prediction seems to have guided empirical research, which focused on net employment effects in aggregate sectors and, to a lesser extent, detailed industries. In his survey of the literature, Baldwin (1995) reported that "The general findings of these inquiries is that the net employment effects of changes in exports and imports have not been significant in OECD countries." However, studies surveyed by Baldwin do find that "trade changes have produced significant adverse employment effects in particular industries..." (pp. 13-14). The next section corroborates this conclusion in more detail and with respect to real exchange rates. Despite large effects on industry-level employment, the underlying presumption of these studies is that the aggregate welfare gains far exceed the cost incurred by factors, especially workers, that shift industries or sectors. These studies largely ignore the adjustment costs associated with changes in employment patterns across sectors, as well as distributional effects, focusing instead on potential net aggregate welfare gains.

Responding to Blinder's challenge, Davidson, Martin, and Matusz (1999) reconsidered the predictions of the HOS model by adding unemployment that arises because trade-dislocated labor must search for a new job in another sector. They find that some of the traditional conclusions, including welfare implications, are modified or changed altogether and depend on whether laborers are employed or unemployed (searching for a job). Their central conclusion is that unemployment rises in large, relatively capital-abundant countries that increase their trade with small, relatively labor-abundant countries, and that the unemployed workers in the large countries suffer welfare losses. This unemployment-augmented HOS model bears similarities to the Ricardo-Viner (RV) trade model, where some factors of production are

completely immobile across sectors. Thus, the nature and process of factor adjustment to trade are of critical importance in assessing the impact of trade on factor markets.[2]

This important line of research underscores Blinder's fundamental critique of prior research on unemployment: "too much of our theoretical debate has taken place within the confining strictures of *homogeneous* labor." (emphasis added) In reality, factors of production are not all perfectly mobile across sectors. In fact, workers and jobs are heterogeneous within sectors and industries, even within firms and establishments, so the process of matching the right workers and jobs is complex. Because of this pervasive heterogeneity, reallocation of labor across sectors, industries, regions, firms and establishments is very costly and time consuming.

Although an important step in the right direction, the new efforts to account for unemployment in measuring the net effects of international trade are still incomplete. Increases in unemployment are proportional to reductions in net employment (plus changes in the labor force). However, changes in net employment significantly understate the magnitude of gross job destruction and creation occurring in the economy, as we explain in the remainder of this section.

1.2 Labor-Market Flows

A microeconomic-based flow approach to labor markets has become the dominant paradigm for modern macroeconomic theories of unemployment and labor-market dynamics.[3] This flow approach explains the behavior of employment and unemployment by introducing dynamic changes in the number and location of workers and jobs. In the flow approach, heterogeneous firms continuously offer a variety of job opportunities, and heterogeneous workers (each of whom has distinct skills) continuously offer their services. Thus, the labor market is characterized by continuous search — firms seeking the best workers, and workers seeking the best jobs.[4]

Figure 1 provides a schematic diagram of labor-market stocks and flows. The figure illustrates how workers and jobs flow among stocks, or states, of the labor market. Employment, and other labor stocks, typically have inflows and outflows from multiple sources and thus may change for different reasons at different times. In particular, the flows indicate that the labor market is in a constant state of flux and that it is necessary to study the flows to understand how the stocks change over time.

Consider first the labor market stocks. Total net employment (E) is the set of all matches (denoted by the saw-toothed intersection) between heterogeneous workers who supply labor (E^s) and the heterogeneous jobs offered by firms that demand labor (E^d). Note, importantly, that the *levels* of labor supply and demand are never equal because there are always unemployed workers (U) and unfilled, or vacant, jobs (V) arising from frictions associated with heterogeneity and the costs of matching. Unemployed workers do not fill vacancies instantaneously because it takes time for workers to find the vacancies, or the skills of unemployed workers do not match the

[2] See also the studies by Riordan and Staiger (1993), Sener (2001), and Hoon (2001a, 2001b).

[3] For surveys of this literature see Haltiwanger (1995), Davis, Haltiwanger, and Schuh (1996), Davis and Haltiwanger (1999), Mortensen and Pissarides (1999), and Hall (1999).

[4] For an overview of the search literature, see Mortensen and Pissarides (1999).

skill demands of the vacancies, or the geographic location of the workers is different from that of the vacancies.

The level of employment is jointly determined by the net result of two types of labor-market flows, worker flows and job flows. Workers flow among three states of the labor market: employment, unemployment, and not in the labor force (N). On the supply side of the labor market, employment increases when the flows into employment (ne and ue) rise, or the flows out of employment (en and eu) fall, or both. Some workers flow from job to job (ee) but do not affect employment. From the employers' perspective, jobs flow among firms that continuously create new jobs (C) and destroy old jobs (D). On the demand side of the labor market, employment increases when job creation (ce) rises and more vacant jobs are filled (ve), or when job destruction (ed) falls, and fewer existing jobs become vacant (ev).

It is important to understand that worker flows and job flows are not synonymous. For example, if unemployed workers merely replace newly retired workers (i.e., both en and ue flows rise), employment doesn't change. In particular, these worker flows occur without changes in the stock of jobs (labor demand) through greater job creation. Similarly, if a firm replaces newly destroyed jobs with newly created jobs, and its employed workers are simply reassigned jobs within the firm, then worker flows do not change.

In practice, however, the labor-market matching is much more complex, and all worker and job flows tend to occur simultaneously. Davis, Haltiwanger, and Schuh (1996, chapter 6) and Bleakley, Ferris, and Fuhrer (1999) showed that there are relatively steady correlations among certain types of flows, but the connections are not one for one. In general, the termination of existing matches via job flows (ed or ev) tends to generate worker flows (eu, en, and ee), which typically raises unemployment. Likewise, the establishment of new matches via job flows (ce and ve) also tends to generate worker flows (ue, ne, and ee), which typically lowers unemployment. But, even in these instances, the link between labor-market stocks is not one for one — employment and unemployment are not inextricably linked.[5]

Abstracting from economic growth, the flow approach says that even when employment reaches an equilibrium or steady state value, the labor market is not at rest. The reason is that gross job and worker flows are not zero when employment is in equilibrium. Individual workers and individual jobs are involved continuously in matching and rematching.

In fact, empirical estimates reported in the literature indicate that gross flows are much larger than net flows such as employment growth, which averages around 2 percent per year in the United States (similar to population growth). Job creation and destruction in manufacturing occur at annual rates of about 10 percent each (implying a job reallocation rate of about 20 percent), compared with net employment growth of only about -1 percent (Davis, Haltiwanger, and Schuh 1996). Monthly worker flows into and out of employment and unemployment also occur at annual rates an order of magnitude larger than employment growth (Blanchard and Diamond 1990; Bleakley, Ferris, and Fuhrer 1999). Monthly flows of workers directly from one employer to another (ee) are even higher than other worker flows (Fallick and Fleischman 2001).

[5] During the postwar period, the correlations between changes in employment and unemployment are -0.52 on a monthly basis and -0.83 on a quarterly basis.

Figure 1 helps explain why we focus on job flows in our investigation of the effects of international factors on employment. Changes in real exchange rates and trade liberalization directly affect the *demand* for labor; hence, they directly affect the pace of job creation and destruction. These factors also may affect worker flows but only indirectly, if at all. Given existing data, it is quite difficult empirically to identify worker flows resulting from job flows and worker flows occurring for other (supply-side) reasons. For example, job destruction caused by international factors may reduce employment if the workers whose job are destroyed move to unemployment (*eu*) or leave the labor force (*en*). However, it will not reduce employment if the worker simply moves to another job (*ee*) that was created at the same time, either by the same employer or by another. Furthermore, workers connected to internationally open firms may move in and out of the labor force (*ne* and *en*) or to and from unemployment (*eu* and *ue*) for reasons having nothing to do with international factors.

1.3 Labor-Market Adjustment Costs

Standard trade theory generally does not emphasize the costs associated with adjusting, or reallocating, factors of production.[6] There are two main reasons: the adjustment process is assumed to be transitory and short-lived, and the benefits of trade are thought to far outweigh the adjustment costs. However, the actual evidence in the literature on the nature and duration of adjustment and on the net benefits of trade liberalization is modest and incomplete, as we explain in this section.[7]

In the prevailing view, changes in international factors affect aggregate employment only transitorily because workers eventually are reallocated to other sectors or firms where they are most productive. This process may take some time, but the presumption is that appropriate macroeconomic policy will return the economy to full employment relatively quickly and costlessly. Because internationally generated labor reallocation raises the efficiency of the aggregate economy, aggregate welfare increases. Thus, at the aggregate level, it appears that flexible exchange rates and more open trade policies provide something for nothing — higher welfare with no overall employment change, at least in the long run.

A classic study by Magee (1972) provided detailed estimates of the welfare gains from eliminating all U.S. trade-related restrictions in 1971. Magee's efforts are impressive, but this endeavor is so daunting that the estimates must be considered extremely rough and incomplete.[8] Nevertheless, he included estimates of both welfare gains and the short-run labor-adjustment costs associated with the elimination of all trade-related restrictions.

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[6] This point, and the subsequent discussion, apply equally to all factors of production, such as labor and capital, but we emphasize labor here.

[7] See Matusz and Tarr 2000 for a complementary survey of this issue.

[8] Estimates of both the welfare gains and the adjustment costs likely are underestimated significantly. Welfare gains from economic growth, economies of scale, competition and antitrust, general equilibrium effects, and other miscelleneous factors are omitted. For example, see Melitz (2002) for the latest evidence on the beneficial impact of trade on productivity growth via reallocation. Likewise, adjustment costs from hiring and firing workers, search, and the destruction of human capital are omitted.

In estimating labor-adjustment costs, Magee took the traditional aggregate, homogeneous labor approach criticized by Blinder. Adjustment costs are calculated solely as the income loss due to unemployment arising from net employment loss in the industries affected by the relaxation of trade-related restrictions. Specifically, Magee calculated adjustment costs as "the implied change in [net] employment, multiply this by a wage rate and an assumed duration of unemployment, and spread this loss equally over the five-year period that I assume industries require to adjust to changes in trade barriers and reach a new long-run equilibrium." (p. 680) Note that this methodology makes two implicit assumptions that are critical to the results. It assumes that the dislocated workers are re-employed, rather than replaced in the labor force by new workers or re-entrants. More importantly, it assumes that the dislocated workers receive the same wage once they are re-employed (or that the entrants earn the same wage).

According to Magee's calculations, the welfare gains from eliminating all U.S. trade-related restrictions would have swamped the associated costs of adjustment. He estimated that annual welfare gains amounted to approximately 1 percent of Gross Domestic Product (GDP) in 1971, whereas estimated adjustment costs amounted to only 0.01 percent of GDP. This implies that the ratio of welfare gains to adjustment cost losses is approximately 100 to 1.[9]

Baldwin, Mutti, and Richardson (1980) drew similar conclusions. They provided estimates of U.S. welfare gains and adjustment costs associated with a 50 percent multilateral tariff reduction in the late 1970s (as opposed to Magee's 100 percent reduction). Their adjustment cost estimates offered several improvements on Magee's calculations, including controls for detailed demographic characteristics of unemployed workers, positive income effects from export promotion, and estimates of capital adjustment costs. They conclude: "In the aggregate, the calculated gains from trade liberalization *dwarf* the measured adjustment costs by a ratio of almost 20 to 1." (p. 405, emphasis added) Interestingly, it is not the inclusion of capital adjustment costs that produces a smaller gain-to-cost ratio than Magee's, because capital adjustment costs account for only about 12 percent of total adjustment costs.[10]

With welfare gains estimated to be at least 20 times greater than adjustment costs, and perhaps 100 times greater or more, it is not surprising that many economists have essentially ignored adjustment costs associated with changes in international factors. But, if the net gains to trade are so large, why is there such breadth and depth of opposition to reducing trade restrictions? One logical explanation is that adjustment costs are concentrated in a small number of workers and firms who have much to gain from being very vocal, while the benefits are highly diffuse and thus small — perhaps imperceptibly small — to most economic agents. However, another possibility is that adjustment costs are larger than previously estimated or believed. If so, ignoring adjustment costs becomes less tenable.[11]

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[9] Magee called his estimates "ball park" and "rough," so we use some rounding to boil down the implications to "rounder" numbers without distorting the main points. For example, the reported adjustment costs range from 0.85 to 0.96 percent of the total welfare gains, which we call "1 percent."

[10] Some analogous studies offer estimates for specific industries. Takacs and Winters (1991), which tries to account for some of natural labor turnover, obtained a gain-to-cost ratio of 59 to 1 for removal of "voluntary" import restraints in the footwear industry in the United Kingdom. De Melo and Tarr (1990) obtained a gain-to-cost ratio of 65 for removal of the quotas in U.S. textiles, steel, and automobile industries.

[11] Of course, free trade opponents have raised other important issues too, such as concerns about the

One reason adjustment costs might be larger is that labor reallocation may involve fixed costs of reallocation in addition to income loss during unemployment. Recent research has begun to recognize the existence and potential importance of per-worker adjustment costs for each trade-dislocated worker, as in Fung and Staiger (1996), Furusawa and Lai (1998), and Davidson and Matusz (2001). These fixed costs may include time and resource costs of retraining or relocating, among other things. However, these studies focus on net employment changes at the industry level rather than the much larger gross flows at the establishment level. If adjustment costs are proportional to gross job and worker flows, which are roughly an order of magnitude larger than net employment growth, then adjustment costs might turn out to be an order of magnitude larger than previously estimated. To our knowledge, the only other study that raises this issue is Kletzer's (2001) analysis of imports and worker flows.

If adjustment costs are roughly proportional to gross flows, then the net welfares gains from trade would be considerably smaller than previously believed. For example, the gain-to-loss ratios could drop to 10 to 1 in Magee's study and only 2 to 1 in the Baldwin, Mutti, and Richardson (1980) study. The calibrated model of Davidson and Matusz (2001) indicates that short-run adjustment costs could amount to 90 percent of the long-run gains from trade in some cases. Of course, any projections such as these are hypothetical and preliminary at this point, and they need empirical verification. It seems worth exploring these ideas, however, given the stakes involved. In any event, the magnitudes of the ratios suggested by gross-flow-based analysis seem to have the potential to better explain the breadth and intensity of opposition to free trade. At a minimum, they suggest that adjustment costs and the redistribution of gains from trade may merit more attention from economists than they have received.

In contrast to standard theory, the flow approach to labor markets inherently emphasizes the simultaneous occurrence of "winners and losers." Gross job and worker flows in response to changes in international factors imply that some individual firms and workers end up worse off while others end up better off. Economists typically assume that aggregate welfare gains from trade are large but that welfare costs typically associated with adjustment to changes in international competition are small. However, a complete and accurate assessment of the true net welfare gains from international openness depends critically on a complete and accurate assessment of the true welfare losses associated with these adjustment costs.

Unfortunately, there is very little evidence on the magnitude of the welfare losses associated with the labor-market effects of international openness. The vast majority of evidence, summarized in the next section, is based on net employment changes in aggregate sectors, such as manufacturing, or aggregate industries that may exhibit modest differentials in openness. But, the flow approach to labor markets informs us that net employment changes significantly understate the magnitude of gross flows in labor markets, even within detailed industries. Thus, a more complete and accurate estimate of the labor-adjustment costs associated with international factors *must* focus on the impact of these factors on gross worker and job flows. In particular, even when net employment is unchanged, international factors can induce significant costs of adjustment through job destruction and creation.

Many specific types of labor adjustment costs arise in connection with job and

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environment, inequality, and human rights.

worker flows induced by international factors. These costs can be summarized broadly in two types. One type is costs to the firm associated with the hiring, training, and firing of workers. The other is costs to fired or dislocated workers, which take several distinct forms: 1) spells of unemployment, 2) loss of firm-specific human capital, 3) costs associated with moving geographic location to find a new job, and 4) general retraining for a new job. The first two take the form of income loss; the latter two are out-of-pocket expenses.[12]

Very few studies quantify these labor-adjustment costs directly because detailed data are not readily available and because it is inherently difficult to quantify these costs. Instead, most efforts focus on inferring the costs indirectly from econometric models of labor-demand and adjustment-cost functions (see Hamermesh and Pfann 1996). Many of these studies use aggregate data, but some actually use firm-level data. However, the most precise and complete estimates come from studies of European economies, which probably have higher costs of adjustment to labor flows than does the U.S. economy.

Abowd and Kramarz (1997, p. 1) claimed to "present the first direct evidence on the fixed costs associated with hiring and separations [firing] of various types, the asymmetries in these costs, and the shape of the adjustment cost functions."[13] They used a unique database from France containing matched worker-firm data on a host of labor variables, including among the best available estimates of direct adjustment costs to firms. Abowd and Kramarz found that the cost of firing a worker (average for all reasons) amounts to 56 percent of the average annual labor cost to the firm of that worker. Put another way, the cost is more than one-half, or 6.7 months, of the worker's annual compensation. The cost of firing a worker for economic reasons is even greater, amounting to 126 percent or 15.1 months of annual compensation.[14] In contrast, the total cost of hiring and training a worker amounts to about 5 percent or 0.6 month of annual compensation. French firing costs are approximately linear with respect to the number of workers fired, and there is a fixed cost attributable to personnel departments. This adjustment cost structure likely leads to large, discrete labor adjustment at the microeconomic level.

Another source of direct evidence on labor turnover costs is Del Boca and Rota (1998), a study of 61 primarily small and medium-sized manufacturing companies in Italy. They estimated that hiring costs (including training) range between 2.0 and 2.6 months of labor costs, and firing costs range from less than one month to 20 months of labor costs, depending on the nature of the separation. These cost estimates are somewhat larger than the Abowd-Kramarz estimates for France. Unfortunately, we do not have analogous estimates for U.S. firms.

Empirical evidence on the second type of adjustment cost, the costs suffered by dislocated workers, also is limited largely by data availability. Nevertheless, surveys of this literature by Hammermesh (1989), Fallick (1996), and Kletzer (1998) all draw the same general conclusions. Workers dislocated from their jobs by international or other factors are likely to experience unusually long unemployment

[12] Of course, labor-adjustment costs are not unique to international factors. All forces that induce labor adjustment through job and worker flows generally will entail these kinds of costs.

[13] There are a few prior estimates, such as in Holt et al. (1960), Oi (1962), and Button (1990), but these are relatively simple and they come from a very small number of firms.

[14] Conventional wisdom would suggest that these firing costs are lower in the United States, but these numbers are remarkably large for any relatively free-market economy.

spells and declines in their post-displacement income. The actual unemployment spells and income losses of displaced workers depend heavily on individual worker characteristics, such as age, work experience, and industry. Some displaced workers can even earn higher incomes on their subsequent jobs. More typical, however, is one of the leading studies in this field, Jacobsen, LaLonde, and Sullivan (1993). They found that dislocated workers with high job tenure and significant firm-specific human capital experience average earnings losses of 25 percent of their pre-displacement income.

In addition to unemployment spells and earnings losses, dislocated workers can also face substantial welfare losses associated with other pecuniary and nonpecuniary costs of adjustment. Workers who must ultimately move to another geographic region to obtain employment may face pecuniary losses, such as moving costs or capital losses on homes, and nonpecuniary losses, such as family separations or broken social ties as well. To our knowledge, there are no concrete estimates of these types of adjustment costs, but they surely factor into a complete calculation of social welfare.

2. International Factors and Net Employment

Virtually all early studies of the relationship between international factors and labor markets focused on net employment, either at an aggregate level, such as manufacturing, or in industries that have relatively intense exposure to international competition.[15] Table 1 summarizes these studies, which we discuss in detail in this section. A central question of these studies is whether net employment declines in response to increased international competition. International competition includes the effects of (real) exchange rates, the volume of exports and imports, and trade policies such as tariffs or quotas.

Interest in the relationship between international trade and employment in U.S. manufacturing industries grew in the early 1980s as the trade balance registered record deficits, but trade deficits were far from the only determinant of manufacturing employment during this period. In the early 1980s, the U.S. economy suffered its deepest recession since the Great Depression of the 1930s. An important task facing researchers is to disentangle the effects of international factors from the effects of other contemporaneous events.

Isolating the effects of international competition is often more than just an academic exercise. For example, an industry that petitions the International Trade Commission (ITC) for actions to help alleviate international competition must show that import pressure is the most significant cause of its injury. In two separate studies, Gene Grossman studied the effects of import competition on employment. One of these studies focused on the U.S. steel industry, and the other considered nine U.S. manufacturing industries.

Grossman's (1986) study of the steel industry involved the estimation of

[15] This section discusses only studies of U.S. net employment because this literature is extensive. There are many analogous studies of foreign net employment and international factors as well. For example, see Dewatripont, Sapir, and Sekkat (1999) for an in-depth study of European employment and international trade. There is also a broader literature on globalization and international unemployment rates, such as Wagner (2000).

employment equations, in which the dependent variable was the average weekly hours of employment of production workers in the Blast Furnaces and Steel Mill industry (SIC number 3312). The regression uses monthly data over the period from 1973 to 1983. One of the regressors was the ratio of the dollar price of foreign steel, inclusive of any tariff costs, to an overall U.S. price index. The tariff-inclusive dollar price of foreign steel is the product of the foreign-currency price of steel, the relevant bilateral exchange rate, and a tariff rate drawn from the University of Michigan model of World Production and Trade. There were two large changes in the tariff rate over the sample period, a tariff surcharge during the Nixon administration and the Tokyo round of tariff reductions, which concluded in 1979.

Grossman found a statistically significant unitary elasticity of the relative cost of foreign steel on the hours of employment of production workers. But, when comparing the actual time path of workers' hours and a counterfactual in which the tariff-inclusive domestic-currency price of foreign steel is unchanged, he found that, for the most part, actual hours exceed the hours estimated to have prevailed had the price of foreign steel remained unchanged. The exception here, the case where simulated hours fall short of actual hours, is during the period of the rapid dollar appreciation at the end of his sample from mid 1982 through 1983. Thus, Grossman concluded that the source of the significance of the price of foreign steel on employment is changes in the exchange rate rather than changes in tariff rates or changes in the foreign-currency price of foreign steel. He also noted that the exchange rate represents the single biggest determinant of hours of employment by production workers *but for* the secular shift away from employment in SIC 3312; a time trend in these regressions indicated a significant reduction of hours of 9 percent per year.

In subsequent research, Grossman (1987) found less evidence of the effect of import prices in other manufacturing industries. This paper applied the methodology of his earlier work to a study of the effects of the price of imports on average hourly earnings and production-worker employment hours in nine manufacturing sectors. The nine sectors he studied were either three-digit or four-digit SIC industries that are commonly thought of as competing with imports, such as Leather Tanning (SIC 311), Ball and Roller Bearings (SIC 3562), and Radio and Television (SIC 365). The sample consists of monthly observations over the period of 1969 to 1979. He found that a significant reduction in import prices adversely affected employment in only one of these nine industries, Radio and Television. Significant effects of import prices on wages were found for only three industries: Leather Tanning, Ball and Roller Bearings, and Photography Equipment (SIC 386), and the elasticities were generally small.

Grossman's sample period ends in the midst of the great dollar appreciation of the 1980s. Branson and Love (1988) addressed a similar question as Grossman (1987), but their focus was on the effects on employment of the exchange rate during the entire period of the appreciation of the dollar during the first half of the 1980s. Their sample covers the period 1970 to the first quarter of 1986. While Grossman targeted import competition, Branson and Love, by using the real exchange rate and a wider sample of industries, implicitly focused on both import competition and export promotion. Branson and Love estimated separate regressions for each of the 20 two-digit SIC manufacturing industries using quarterly data. The key dependent variable in their study is a multilateral dollar real exchange rate. This is one way in which their work differs from that of Grossman, who used separate sector-by-sector foreign price

series. Branson and Love's work is also distinguished from Grossman's research since they run separate regressions for employment of production workers and employment of nonproduction workers.

Branson and Love found a significant negative coefficient on the exchange rate (that is, an appreciation reduces employment, and conversely) in 13 of the 20 industries they studied. Among the significant coefficients on the real exchange rate, the elasticities range from 0.13 to 0.65, with the larger values found in durable goods industries and among production workers. Especially strong effects are found in the Primary Metals, Fabricated Metal Products, and Non-electrical Machinery industries. These three industries, along with the Transportation Equipment industry, acccount for two-thirds of the one million jobs they estimated were lost as a result of the dollar appreciation as compared to a counterfactual case of no appreciation in the first half of the 1980s. As with the results presented by Grossman, they attributed a bigger change in employment to the change in the exchange rate than to other factors, such as the change in the price of energy, although they too found that the trend change in employment accounts for more of the reduction in employment than does the change in the real exchange rate.

The estimate by Branson and Love of the loss of one million manufacturing jobs in response to the dollar appreciation of the first half of the 1980s is consistent with the results presented by Revenga (1992). This similarity is striking because Revenga studied only a subset of relatively disaggregated manufacturing firms consisting of 38 three-digit and four-digit SIC manufacturing industries. This subset represented 72 percent of total manufacturing imports and 35 percent of total manufacturing employment in 1985. The period Revenga studies, 1977 to 1987, also differs from the longer sample of Branson and Love but, of course, both samples include the dollar appreciation episode of the first half of the 1980s. The key dependent variable in Revenga's regressions is industry-specific import prices. For each industry, Revenga constructed this variable by using the weighted average of bilateral dollar exchange rates where the weights represent the U.S. imports from the respective countries. She regressed this variable, as well as a number of controls, on quarterly data for both employment (measured either as the number of production workers or as the average number of person-hours per week) and the average hourly earnings of production workers. Among the pooled cross-section regressions that she ran, her most significant estimate is an employment elasticity of -0.23. Given Revenga's estimate of a fall in import prices of about 20 percent over the 6-year period from 1980 to 1985, and total manufacturing employment that annually averaged 19.4 million jobs over this period, the estimate of the annual average job loss is 0.15 million manufacturing jobs.[16] Thus, over this 6-year period, Revenga's estimates suggest a loss of 0.9 million manufacturing jobs, an estimate strikingly close to that of Branson and Love.[17]

Revenga's research also documented the wide variation in exposure to international competition across the industries she studied, a result that is particularly relevant for our research presented later in this book. Revenga reported that the ratio of imports to total output across the industries in her sample ranges from 0.04 (for

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16 $19.4 \times (-0.23) \times \frac{0.20}{6} = -0.15$

17 $(-0.15) \times 6 = -0.9$

Meat Products, SIC 2010) to 0.70 (for Apparel, SIC 2380). She divided her industries into three groups based on share of imports. Over the period 1980 to 1987, the fall in employment across these groups is quite diverse, with a reduction of 28 percent in the high import share group, 14 percent in the medium import share group, and 8 percent in the low import share group. Revenga also noted, however, that the standard deviation within each group is quite high, a point consistent with the statistics presented in the previous chapter and one that suggests the importance of considering gross job flows rather than net employment changes. The wide differences across import-share groups in the mean values of net employment change motivate Revenga's use of a regression specification that interacts import share with import price, a specification that is also suggested by the model we present in Chapter 5 and that we implement in our empirical analysis in Chapter 6. Revenga estimated elasticities of employment with respect to import prices equal to 0.16 for an industry with the mean level of import share (equal to 18 percent) and 0.29 for an industry with an import share one standard deviation above the mean (that is, import share equal to 29 percent). The estimated elasticities of wages with respect to the exchange rate are much lower, ranging from 0.06 to 0.09. Revenga suggested that these differences in the relative size of elasticities reflects a situation where workers are highly mobile across industries but not across skill groups.[18]

The studies mentioned above do not distinguish between import competition from developing and industrial nations. A noteworthy aspect of the expansion of trade between the United States and the rest of the world, however, is that imports from developing nations represented about a quarter of all U.S. imports in 1970 and 1980 and then rose to 32 percent of all imports in 1990 and 38 percent of all imports in 1996. An often-voiced concern is that trade with developing nations represents a greater threat to manufacturing employees in the United States (especially those with relatively low skill levels) than a comparable amount of trade with industrial countries.

Sachs and Schatz (1994) attempted to decompose the role played by trade with developing countries from that of trade with industrial countries in altering employment in the United States. They based their analysis on a data set consisting of the amount of bilateral trade of 51 three-digit U.S. manufacturing industries with each of 150 countries in the years 1978 and 1990. They calculated a counterfactual value of trade that would have occurred had the pattern of bilateral trade in 1990 been the same as the pattern of trade in 1978, assuming a constant relationship between industry shipments and industry final demand across those two years. These estimates are then used to calculate employment patterns in 1990 had the 1978 pattern of trade prevailed in that year. Sachs and Schatz concluded that employment levels in 1990 were 7.2 percent lower for production workers and 2.1 percent lower for non-production workers than would have been the case had the pattern of bilateral trade in that year been the same as the pattern of bilateral trade in 1978. They stated that almost all of the difference between the actual and the calculated counterfactual employment is due to a tilt in trade towards developing countries. But, as pointed out in the published comments on this paper by Deardorff (1994), the correlation between

[18] This result is consistent with a relatively flat industry labor-supply schedule and a relatively steep industry labor-demand schedule. In this case, changes in import prices, which shift the labor-demand schedule, will have proportionally larger effects on employment than on wages. The model we develop in Chapter 5, which forms the basis of the subsequent empirical analysis, assumes high worker mobility across industries.

trade and labor-market outcomes does not address questions of causality since both trade and employment could be responding to other factors that changed between 1978 and 1990, such astrade liberalization, the (exogenous) growth of labor-abundant foreign economies, and technical change.

This problem of joint causality cited by Deardorff is probably less pronounced for the aforementioned studies of the effect of dollar exchange rates on United States employment. It is more reasonable, when using annual data, to assume that changes in real dollar exchange rates are not driven by contemporaneous events originating in the U.S. labor market for narrowly defined industries.[19] Regression analysis allows one to control for factors such as monetary policy and fiscal policy that jointly affect aggregate labor-market developments and dollar exchange rates. It may be more difficult to control for joint causation between trade patterns and employment, especially over a period of a decade or more.

All of the studies on the effects of exchange rate changes on employment cited above look only at labor-market responses in the United States. Burgess and Knetter (1998) expanded the scope of analysis by considering the effects of the real exchange rate on manufacturing employment in the G-7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States). Separate regressions are run for 14 industries in each country (although data are not available for three of the potential 98 industry-country groups). The industry categories, based on an Organisation for Economic Cooperation and Development classification, correspond approximately to two-digit SIC industries and cover manufacturing as well as agriculture, mining, finance, construction, transport services, and wood products. The regressions use annual data over the period from1970 to 1988. The dependent variable is the growth rate of total employees of the particular industry. The exchange rate series used in the regressions are simple averages of the seven bilateral exchange rates for each of the seven countries with respect to the other members of the G-7.

Burgess and Knetter reported significant coefficients on the real exchange rate of the expected sign (that is, an appreciation reduces employment growth, and conversely) in more than one-quarter of the 95 regressions they estimated. The coefficient on the real exchange rate is of the opposite sign and significant in only 3 percent of the regressions. The country with the highest average estimated response of employment growth to the real exchange rate for the full set of industries is the United Kingdom, followed by the United States, followed by Germany and Japan. The estimated speed of adjustment is also faster in the United States and the United Kingdom than in Germany or Japan. Using the full panel, Burgess and Knetter found that the only country with a responsiveness of employment growth to the real exchange rate that is significantly different fromthe United States' is the United Kingdom.

The research cited above tends to find a significant effect of the real exchange rate on employment. This contrasts with the general tenor of the results of Goldberg and Campa (2001). Goldberg and Campa suggested that the source of the difference between their results and those of either Branson and Love, or of Revenga, lies in the way in which they account for differences in the scope and type of currency exposure across industries. They note that there are three channels through which the exchange

[19] It is worth noting, in this regard, that the correlation between nominal dollar exchange rates and the respective real dollar exchange rates typically exceeds 0.90.

rate affects labor demand: import penetration, export orientation, and the use of imported inputs. The first two of these channels would be associated with a situation where an appreciation lowers labor demand and, consequently, reduces employment. This is the direction of causation that the previously mentioned studies considered, but the third channel, the use of imported inputs, tilts the exchange rate response in the other direction, since an appreciation lowers the cost of production and, given an appropriate cross-elasticity of demand for labor and other inputs, increases labor demand and employment.

Goldberg and Campa captured the different channels through which the exchange rate influences labor demand and employment by using, in their regressions, the product of the exchange rate and a measure of the level of industry exports and, separately, the product of the exchange rate and a measure of the use of imported intermediate goods by an industry. The high correlation across industries of import penetration and imported intermediate use precludes them from including the product of the exchange rate and a measure of import penetration as well. They used both a multilateral real exchange rate, which is common across all industries, and a real exchange rate that reflects the trade patterns of particular industries. They reported that the results with either series are similar and, therefore, only presented results using industry-specific exchange rates. The exchange rates are decomposed into their permanent (nonstationary) and transitory (stationary) components, using the technique of Beveridge and Nelson (1981). The dependent variables studied include number of jobs, total hours worked, industry wages, overtime hours, and overtime wages. The regressions on number of jobs, total hours, and industry wages use only the permanent component of the exchange rate, while the regressions on overtime hours and overtime wages use only the transitory component. The observations represent annual data at the two-digit SIC level over the period 1972 to 1995. All the variables in the regressions are first differences but for lagged levels of the dependent variables. They run both time series panels using data from all industries, panels in which they split the sample into low-markup and high-markup industries, and separate regressions for individual manufacturing industries.[20]

The results presented by Goldberg and Campa suggest the importance of splitting the sample by markup, since there are no instances of significant effects of the exchange rate on any of their dependent variables for high-markup industries. But, for the low-markup subsample, there is evidence of a significant effect of both the exchange rate interacted with exports and the exchange rate interacted with imported intermediate goods on the number of jobs and overtime employment. In addition, the coefficient on the product of the exchange rate and exports is significant in the full-sample overtime hours regression. The industry wage regressions include significant coefficients both on exchange rate terms for the subsample of low-markup industries and on the product of the exchange rate and exports for the full sample. The overtime wage regression includes a significant coefficient on the product of the exchange rate and exports for the low-markup sample only.

This distinction in the pattern of significance, between high- and low-markup

[20] The industries characterized as low markup by Goldberg and Campa include the 11 industries Food and Kindred Products (SIC 20), Textile Mill Products (SIC 22), Apparel and Mill Products (SIC 23), Lumber and Wood Products (SIC 24), Furniture and Fixtures (SIC 25), Paper and Allied Products (SIC 26), Petroleum and Coal Products (SIC 29), Leather and Leather Products (SIC 31), Primary Metal Products (SIC 33), Fabricated Metal Products (SIC 34), and Transportation Equipment (SIC 37).

industries, is also evident in the estimated employment and wage elasticities derived from separate regressions on data for two-digit industries. For example, the five largest estimated elasticities (evaluated using average shares of exports and imported inputs) for number of jobs with respect to the exchange rate are all in industries that are classified as low markup. These industries include Leather and Leather Products (elasticity = –0.20), Petroleum and Coal Products (elasticity = –0.12), Primary Metal Products (elasticity = –0.09), Furniture and Fixtures (elasticity = –0.08), and Fabricated Metal Products (elasticity = –0.07). These estimated elasticites are all significant at the 5 percent level and represent the only significant estimated elasticities for total hours with respect to the exchange rate among the 20 industries. Likewise, these five industries, along with Textile Mill Products, represent the full set of industries with a significant elasticity of total hours with respect to the exchange rate. In fact, arranging industries by the size of the estimated elasticities of total hours yields the same order as in the case of the ranking by the elasticity of number of jobs. But, for each industry, the estimated elasticity is larger for total hours than for number of jobs, with significant estimates ranging from –0.28 (for Leather and Leather Products) to –0.07 (for Textile Mill Products).

Goldberg and Campa found relatively few industries in which there is a significant effect of the real exchange rate on total employment as compared to the results of others, such as Revenga. Even among industries in which Goldberg and Campa found significant results, the estimated elasticities (evaluated at the mean level of the interaction terms) are all less than Revenga's estimate of an elasticity of –0.23 for her pooled sample. There could be quite a few reasons for these differences, including differences in both sample periods and industries studied.[21] Also, there are differences in estimation, notably the decomposition of the exchange rate by Goldberg and Campa. As will be seen, the results we present in Chapter 6 are more supportive of a role for the exchange rate in affecting total employment than is the case with the results presented by Goldberg and Campa.

In another paper, Goldberg and Tracy (2000) analyzed the effect of real exchange rate movements on employment and wages in the United States using data disaggregated by two-digit industry as well as by state. As in Goldberg and Campa, the key regressors are industry-specific import and export real exchange rates constructed by weighting (separately for imports and exports) the bilateral real exchange rates of U.S. trading partners in each two-digit industry for each year, and controls for variations in the importance of exports and imported inputs across industries and states. Goldberg and Tracy found that appreciations of the dollar relative to the currencies of export partners are associated with reductions in employment, while appreciations of the dollar relative to the currencies of imported input providers are associated with increased employment. Their results suggest, however, that there is considerable heterogeneity in these effects across industries and states. They found that employment is unambiguously responsive to exchange rate movements in only 13 of the 20 industries examined.

[21] Goldberg and Campa noted that Revenga's sample of industries, which, in 1980, represented 72 percent of manufacturing imports but only 35 percent of manufacturing employment, was chosen to focus on the effects of import competition in the United States and, therefore, is not representative of manufacturing as a whole.

3. International Factors and Gross Flows

The studies cited in the preceding section focus on changes in aggregate net employment, either at the sector or at the industry level. However, aggregate net employment masks the extensive volume of gross job and worker flows underlying labor markets. Consequently, a new literature has emerged recently with a small but growing number of studies of the effects of international factors on labor-market flows. In this section, we review this nascent literature on international factors and gross labor-market flows in two parts. The first part focuses on studies of job flows; the second part focuses on studies of worker flows.

3.1 Job Flows

Studies of job flows look for the effects of international factors on job creation and destruction, *ce* and *ed* in Figure 1. (Unfortunately, data on *cv* and *vd* are not available.) This approach assumes a direct connection between international factors and the total demand for labor at particular production establishments.[22] Establishments will create and destroy jobs (i.e., expand or contract the level of employment) in response to changes in international conditions.

The first analysis of job flows and international factors is Davis, Haltiwanger, and Schuh (1996, chapter 3). They reported average rates of U.S. manufacturing job flows for 1973 to 1986 by quintiles of four-digit SIC industries sorted according to their exposure to international trade (their table 3.5). Exposure is defined in terms of import penetration, the ratio of imports to imports plus domestic output, and in terms of export share, the ratio of exports to domestic output. They found:

> *Strikingly, the table shows no systematic relationship between the magnitude of gross job flows and exposure to international trade. The only aspect of table 3.5 suggesting that international trade reduces job security is the large rate of gross job destruction among industries with a very high import penetration ratio.... On balance, the evidence is highly unfavorable to the view that international trade exposure systematically reduces job security.* (pp. 48-49)

This apparent lack of a connection between international trade and job flows largely is attributable to the long-run nature of their analysis. They compared the 14-year *averages* of job flows and trade exposure, but one would not necessarily expect to find a connection between average job flows and average trade exposure. Factors determining average trade exposure include resource endowments, geography, transportation costs, exchange rate policies, and free trade political philosophies. In contrast, factors determining average job flows include costs of hiring and firing

[22] Labor demand may be affected directly, in establishments that engage in international trade, or indirectly, in establishments that do not engage in international trade but compete with establishments that do.

workers, barriers to entry and exit from markets, the pace of technological change, product and process innovation, and government labor-market policies. There is no well-established theoretical or empirical reason for a connection between these two sets of underlying factors that determine long-run averages.

On the other hand, there are good reasons to expect a correlation between job flows and *changes* in international factors at higher frequencies. Changes in the exchange rate and changes in trade restrictions (tariffs, quotas, etc.) are likely to induce factor reallocation across firms and industries, unless the changes are very small or very transitory. Thus, we would expect the year-to-year movements in job flows and trade exposure to be closely correlated, and a time series analysis thus more likely to reveal such correlation.

Gourinchas (1998) offered the first time series analysis of international factors and gross job flows. He used VAR models to estimate the effects of real exchange rates on job creation and destruction during the period of 1972 to 1988 using quarterly job flows data from Davis, Haltiwanger, and Schuh at the four-digit SIC industry level. Industries are classified as traded, nontraded, or other using export share and import penetration ratios.[23] He restricted his sample to 103 of a possible 450 industries, focusing on the 68 industries that are the most involved in international trade (his "traded" group) or the 35 industries least involved in international trade (his "nontraded" group). An industry-specific real exchange rate is calculated for each of the 103 industries used in the regressions. These industry-specific exchange rates are the weighted average of real bilateral dollar exchange rates, with weights reflecting the proportion of trade with a particular country undertaken by that industry over the entire sample period. He used the deviation from trend of the logarithm of the industry-specific real exchange rates in the regressions.

Gourinchas reported that real exchange rates move job creation and destruction in the *same* direction in traded industries but have little or no effect on job flows in nontraded industries. A 10 percent appreciation (increase above trend) raises job destruction by 0.44 percent and raises job creation by 0.17 percent in traded industries over three quarters, thereby reducing net employment by 0.27 percent and raising job reallocation by 0.61 percent. A 10 percent depreciation produces simultaneous declines in job destruction and creation of the same magnitudes, thereby reducing job reallocation by 0.61 percent. Thus, real exchange rates have allocative effects on jobs whereby appreciations stimulate job reallocation and depreciations inhibit job reallocation, the latter producing a so-called "chill" in reallocative activity. This result contrasts with the typical conclusion from most previous studies of U.S. job flows, which find that aggregate shocks tend to be dominant. That is, job creation and destruction tend to respond in opposite directions to standard macroeconomic shocks, with destruction rising relatively more than job creation falls. Consequently, Gourinchas' work is among the first to demonstrate the presence of a contemporaneous allocative effect.[24]

In a closely related study, Gourinchas (1999) found that the real exchange rate affects gross job flows even more in France than in the United States, but he did not find evidence of contemporaneous allocative effects. He estimated an analogous VAR system using annual French manufacturing data on net and gross employment for

[23] See p. 162–163 of his article for details.

[24] Another is Davis and Haltiwanger (2001), which provides similar evidence for oil price shocks.

two-digit industries from 1984 to 1992. Once again, Gourinchas identified a selected sample of industries classified as tradable according to their export shares and import penetration ratios. He found that a 10 percent increase in the real exchange rate in tradable industries reduces job creation by 7.1 percent and increases job destruction by 2.4 percent, thus reducing net employment by 9.5 percent.

These results for France differ from his U.S. results in three ways. First, the job-flow responses are an order of magnitude larger in France, reflecting both greater openness and more sensitivity to international factors. Second, job creation and destruction move in opposite directions in France, rather than in the same direction, a response more consistent with the bulk of U.S. job flow studies. Third, job creation is more responsive than the job destruction, rather than vice versa as in the U.S. data.

Both Gourinchas studies offer dynamic heterogeneous-agent models to explain the empirical results. The model in Gourinchas (1998) extended the matching framework of Mortensen and Pissarides (1994) to include a tradable and nontradable production sector with a relative price that represents the real exchange rate. Fluctuations in the real exchange rate lower the job-matching rate, which induces a simultaneous increase in both job creation and destruction (and therefore job reallocation) with a greater short-run response of destruction. This dynamic pattern fits the U.S. data but not the French data, so the model in Gourinchas (1999) introduces heterogeneous vintage capital, similar in spirit to the work of Caballero and Hammour (1996). Match-specific capital and inefficient contracting prevent wages from adjusting sufficiently to unanticipated real exchange rate movements. Job destruction thus rises immediately, and job creation falls somewhat before eventually rising as unemployed workers are rematched.

The results in this monograph build on our earlier work (Klein, Schuh, and Triest 2003), which extended and modified Gourinchas' results for the United States. We used essentially the same data except that we include all four-digit industries and explicitly account for the fact that openness varies across industries and time. We also developed a multi-sector model of firms with heterogeneous exposure to international trade. The model allowed us to derive estimating equations for job creation and destruction that control for a host of industry-specific variables not included by Gourinchas, in addition to aggregate variables similar to those included in his VARs. Perhaps most importantly, we showed that the *growth* rate, rather than the level, of the real exchange rate determines job flows. Furthermore, we decomposed the exchange rate into trend and cyclical components.

Our results show that for all U.S. industries, and controlling for industry-level openness, changes in the growth of the real exchange rate influence job destruction but not job creation. A 10 percent appreciation (increase in growth) raises job destruction by 0.33 percent and lowers net employment by a similar amount over three quarters (job creation falls 0.02 percent, but the response is insignificant). These results, which are consistent with the bulk of previous job flows studies, suggest that Gourinchas' finding of an allocative effect for real exchange rates appears to be an artifact of his sample limitations and the absence of our industry-level controls.

However, by decomposing real exchange rates into trend and cyclical components, we showed that both aggregate and allocative forces are at work through exchange rates. The responses of job flows in the industry with median openness are markedly different for moderate appreciations of the trend and cyclical components of

the real exchange rate.[25] A moderate appreciation of the trend real exchange rate has purely *allocative* effects—job creation and destruction both increase by about 0.4 percent, so job reallocation rises about 0.7 percent, but net employment essentially is unchanged. This result is similar to the results reported by Gourinchas. In contrast, a moderate appreciation of the cyclical component of the real exchange rate has primarily *aggregate* effects—job destruction rises about 0.7 percent and net employment declines by the same magnitude because the effect on job creation is essentially zero. The aggregate effects dominate the allocative effects when the model is estimated using the actual real exchange rate. All job flow responses are roughly three times larger for the industry at the 90th percentile of the openness distribution.

Davidson and Matusz (2001) also used the Davis, Haltiwanger, and Schuh job flows data to conduct empirical tests of the ideas advanced in their earlier work with Martin on trade and search generated unemployment.[26] They argued that firms must pay compensating wage differentials associated with job and worker turnover rates. Those firms with low job destruction rates and high job creation rates will have lower wages and thus have a comparative advantage in foreign trade, which Davidson and Matusz define as net trade (exports minus imports) normalized by the domestic market (production plus imports). They reported evidence of a statistically significant negative correlation between average net trade and average job destruction and a somewhat weaker and less significant positive correlation between average net trade and average job creation, at both the two-digit and the four-digit industry level.[27] In a related study, Magee, Davidson, and Matusz (2001) inferred that the distribution of factor income is related to job turnover rates by providing evidence that campaign contributions to political action committees match up well with votes by politicians on trade-related legislation.

Finally, a recent study of four European manufacturing sectors reports little or no connection between international trade and proxies of labor-market flows. Bentivogli and Pagano (1999) used data from Eurostat's Labor Force Survey to construct measures they call job creation, job destruction, and job reallocation. Job destruction is defined as newly unemployed workers (relative to employment), job creation is defined as net employment growth, and job reallocation is defined as the sum of these two. Clearly, these measures are not the same as the DHS plant-level measures of job flows, and they mix job and worker flow concepts. For example, newly unemployed workers (flows *eu* and *nu* in Figure 1) include not only workers whose jobs were destroyed but also workers who became unemployed for other reasons. Bentivogli and Pagano estimated regression models of the flow proxies and uniformly found that lagged exports to and imports from newly industrialized economies in Asia are completely insignificant in their regressions, while worker characteristics are very significant. They conclude that recent increases in trade with Asian countries are not responsible for adverse labor-market developments in

[25] A moderate appreciation is defined as two consecutive years of one standard deviation increases: about 10 percent in the cyclical rate and about 3 1/2 percent in the trend rate.

[26] This paper also used data on worker flows—job acquisitions (related to job creation) and job separations (related to job destruction)—published by the Bureau of Labor Statistics until 1981. Because the methodology and results are similar to those using the job flows data, we focus on these.

[27] The regressions are very similar in spirit to the evidence in Davis, Haltiwanger, and Schuh (1996), but with two important differences: 1) the correlations are tabulated at the detailed industry level rather than by quintiles of industries, and 2) the focus is on industries' net trade, rather than industries' import and export intensities.

Germany, France, Italy, and the United Kingdom.

3.2 Worker Flows

Studies of worker flows look at the impact of international factors on workers who report being displaced from employment: in Figure 1, these worker flows include *ee*, *eu*, and *en*. This approach assumes a direct connection between international factors and the demand for individual workers at particular production establishments, which may or may not engage in international trade. Workers will flow from employment in a job at a particular establishment to some other state of the labor market in response to changes in international conditions that affect that establishment.[28] These studies use data on workers who report being laid off (displaced) from particular employers.

The worker-flow approach has the advantage of identifying the impact of international factors on gross labor flows at a more fundamental level—within establishments—than job flows. However, the worker-flow approach also has two disadvantages. First, it is more difficult to connect the international factors to specific worker flows because workers flow out of employment for many reasons other than job destruction due to international factors. Unfortunately, there is insufficient information about workers' employers in the worker-flow data to be able to control for this problem. Second, the worker-flow data depend heavily on workers' ability to recollect historical circumstances and on their understanding of firms' employment decisions. Both of these difficulties may induce measurement error in the worker-flow data that limits the ability to identify accurately the link between international factors and worker flows.

Two studies by Kletzer (1998a, 2000) considered the effects of international factors on employment and found evidence that import competition contributes to job loss or displacement. She used data from the Bureau of Labor Statistics' Displaced Worker Surveys (DWS), a supplement to the Current Population Surveys (CPS). The DWS ask a panel of participants: "Have you lost a job in the previous 5-year period due to plant closings, your employer going out of business, a layoff without recall, or other similar reasons?" Workers answering "yes" are a subset of the all possible job separations, which also include quits and other types of firings.[29] Using econometric models, Kletzer tested whether import competition is a significant contributor to worker displacement and also whether export sales tend to reduce worker displacements.

In both articles, Kletzer regressed the job displacement rate of three-digit Commerce Industrial Classification (CIC) industries on, among other variables, the price of imported goods for that three-digit CIC industry. Her sample consisted of 70 industries from 1979 to the early 1990s. The evidence in Kletzer (2000) is that export

[28] Note that the level of employment (job flow) at the establishment may or may not change along with the worker flow, depending on whether the establishment retains the job and replaces the worker, destroys the job without creating a new one, or destroys the job and creates a new one.

[29] Kletzer also notes that an individual displaced from a job and rehired into a different job with the same employer is considered displaced. Also, worker displacement may understate actual job loss since it does not capture quits in anticipation of layoffs, quits motivated by wage dissatisfaction or deteriorating working conditions, or changes in the rate of shutdown by firms.

sales significantly lower displacement rates, but the results do not strongly support the hypothesis that import prices are a significant determinant of displacement rates. Some industries with extensive import competition exhibit extensive job displacement, but extensive job displacement also occurs in other industries with little or no import competition. In Kletzer (1998a), using a more restricted sample, the effect of import prices on displacement rates is somewhat more significant, although a measure of import share cannot be shown to significantly affect displacement rates, even within this sample. The effect of exports and, especially, domestic demand on displacement rates, is shown to be much stronger. Overall, the Kletzer results highlight the limitations of the worker-flow approach.

The analysis of Goldberg, Tracy, and Aaronson (1999) is similar to that of Kletzer but broader in terms of measured job displacement. They used data from the CPS during the period of 1977 to 1997, matching the response of civilian men (aged 18 to 63) from consecutive annual surveys. Respondents are denoted as "job changers" if, between the time of one survey in March and the time of the subsequent survey the following March, they either had more than one employer or had a spell of unemployment. (Note that this definition of job changers is more comprehensive than the displaced workers in Kletzer's work.) Goldberg, Tracy, and Aaronson reported that, across broad industry groups and across the time periods 1977 to 1984 and 1986 to 1996, job changers represent between 15 and 20 percent of the 123,000 matched pairs in their sample.

Goldberg, Tracy, and Aaronson used these 123,000 observations to estimate the effect of exchange rates on the probability of job change. They used a limited dependent variable model in which the dependent variable represents whether or not an individual was a job changer over the course of a year and the regressors include characteristics of the individual (including education, race, age, and marital status), characteristics of the industry in which the individual was employed (including industry fixed effects, industry-specific time trends, and industry-specific import and export exchange rates), and time-varying aggregate regressors (including the real interest rate, GDP growth and the unemployment rate). Their results suggest an asymmetric effect of exchange rate movements on the probability of changing jobs. There is evidence that, during periods of appreciation, the exchange rate influences the probability of changing jobs in manufacturing; an appreciation of the export-exchange rate lowers the likelihood of changing jobs, while an appreciation of the import-exchange rate raises the probability of changing jobs. Overall, Goldberg, Tracy, and Aaronson report that appreciations are associated with a small reduction in job instability, although there is no significant effect of depreciations on job stability, nor is there a significant effect when the regression is constrained to have appreciations and depreciations enter symmetrically.

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Table 1

Article	Sample, periodicity	Industries, countries (U.S. unless specified otherwise)	Dependent variable	Regressor	Finding
Grossman (1986)	1973–1983, monthly	Blast Furnaces and Steel Mill Products (SIC 3312)	Hours of employment for production workers	Ratio of tariff-inclusive price of foreign steel to U.S. price index	Significant unitary-elasticity
Grossman (1987)	1969–1979, monthly	Nine import-competing three-digit and four-digit SIC industries (separate regressions)	Hours of employment; average hourly earnings of production workers	Import prices	Significant effects for: Employment-one industry Wages-three industries
Branson and Love (1992)	1970–1986.I quarterly	Twenty two-digit SIC manufacturing industries (separate regressions)	Employment of production or non-production workers	Multilateral dollar real exchange rate	Significant in 13 industries elasticities from 0.13 – 0.65, with largest for durable goods and production workers
Revenga (1992)	1977–1987, quarterly	Thirty-eight three-digit and four-digit SIC manufacturing industries (pooled cross section)	Production workers: number, average number of weekly hours, average hourly earnings	Industry-specific import prices interacted with import share	Employment elasticities: 0.23 (significant), at average import, 0.16, at average + 1 standard deviation 0.29
Burgess and Knetter (1998)	1970–1988, annual	Fourteen industries (~ two-digit SIC) in G-7 countries (95 separate regressions)	Growth rate of employment in particular industries	For each country, average of six bilateral G-7 real exchange rates	Significant coefficient of expected sign in > 25% of regressions wrong sign and significant in 3%
Goldberg and Campa (2001)	1972–1995, annual	Two-digit SIC industries (panels with all industries, low and high markup, separate)	Number of jobs, total hours, wages, overtime hours, overtime wages	Industry-specific RER, decomposed into transitory and permanent, interact with exports or imports interm	RER significant for number of jobs, over time employment in low markup industries (interact with both exports and interm)
Golberg and Tracy (2000)	(date?)	Two-digit SIC industries, separate by U. S. states	Net employment wages	Industry-specific import and export RER	Differences across import and export RER, unambiguous employment response in 13 of 20 industries
Kletzer (1998, 2000)		Three-digit CIC industries	Displacement rates (gross worker flows)	Price if imported goods for particular industries, export sales	Export sales significantly lower displacement rates, not so with import prices
Goldberg, Tracy, and Aaronson (1999)	1977–1997, annual	Current population surveys, 18 two-year panel data sets	Probability of changing jobs for men across successive surveys	Two-digit SIC industry-specific import and export exchange rates.	Exchange rate significantly affects job change probability during appreciation but not depreciation and sign differs for import and export RER.
Gourinchas (1998)	1972–1988, quarterly	Gross job flows (LRD) 68 “traded” and 35 “nontraded” industries (of possible 450)	Job creation rate Job destruction rate	Developed from trend of four-digit SIC industry-specific RER	Appreciation raises both creation and destruction, and depreciation lowers both rates.

Figure 1
Schematic Diagram of the Labor Market