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AN INTERNATIONAL COMPARISON OF EMPLOYMENT ADJUSTMENT TO EXCHANGE RATE FLUCTUATIONS

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ABSTRACT

This paper evaluates the response of employment to exchange rate shocks at the industry level for the G-7 countries. Using a simple empirical framework that places little *a priori* structure on the pattern of response to shocks, we find the data are consistent with the view that employment in European industries, at least France and Germany, is much less influenced by exchange rate shocks and much slower to adjust to long run steady states. The United States, Japan, Canada, the United Kingdom and Italy all appear to adjust more quickly. German and Japanese employment are quite insensitive to exchange rate fluctuations, consistent with previous research on output and markup responses to exchange rates.

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An International Comparison of Employment Adjustment to Exchange Rate Fluctuations

by Simon Burgess and Michael M. Knetter

Extremely large fluctuations in real exchange rates have been an important feature of the international economy in the post-Bretton Woods era. These real exchange rate fluctuations are far too large to be justified by changes in labor productivity across countries. Consequently, they imply large changes in relative costs across firms located in different countries. These large changes in relative costs provide fertile ground for empirical research on a number of aspects of firm behavior.

Recent empirical research in international economics has examined the response of many decision variables and performance measures to exchange rate fluctuations. The bulk of this research has been concerned with price adjustment, especially the measurement of exchange rate pass-through and pricing-to-market.[1] However, a substantial amount of research has investigated the related impact of exchange rate fluctuations on profits and profit margins, investment, domestic prices, and the entry and exit of firms in international markets.[2] This paper looks at another potential consequence of exchange rate fluctuations: changes in manufacturing industry employment across countries.

Developments in the labor markets of the United States and other industrialized countries in the 1980s and early 1990s have been marked by two important trends: a reduction in the share of jobs in manufacturing and an increase in wage inequality across workers of differing skill levels. Two of the leading explanations for these trends are: skill-biased technological change and the increased integration of manufactured goods markets. Skill-biased technological change can increase the demand for skilled workers relative to unskilled workers (leading to increased inequality) and increase output per

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[1] See for example the empirical papers on pass-through by Feenstra (1989), Hooper and Mann (1989), and Kasa (1992) and on pricing-to-market by Knetter (1989, 1993) and Marston (1990).

[2] Some of the papers in each topic area include the studies of profit margins by Mann (1986), investment by Campa and Goldberg (1995), domestic prices by Feinberg (1989) and entry and exit by Krugman and Baldwin (1987).

worker in all sectors (which may lead to fewer manufacturing jobs). The globalization of product markets may have similar effects. As developing countries increase their participation in the global economy, their abundance of unskilled labor puts downward pressure on employment and wages of unskilled workers in the industrialized countries. It is fair to say that the bulk of the evidence seems to suggest increased trade has played only a minor role in the labor markets of developed countries.[3] However, it is difficult to model the variety of ways that globalization can influence product markets, let alone nest these forces in a single model with the forces of technological change. Hence, a consensus regarding the relative contributions of trade and technology to labor market trends in the industrial countries has yet to be reached.[4]

This paper takes a different approach to examining whether international factors affect domestic labor markets. As shown by Feenstra (1989), exchange rates and tariffs affect the profits of a firm faced with international competition in a similar manner. An appreciation of the mark against the dollar has the same impact as an equivalent (in percentage terms) increase in an ad valorem tariff on German cars from the perspective of a U.S.-based automaker.[5] Just as an increase in a tariff can protect or even increase domestic manufacturing employment, so can a reduction in the value of the home currency against the currency of the foreign exporter. This paper will examine whether exchange rate fluctuations among developed countries have led to shifts in manufacturing industry employment among those countries. The sensitivity of manufacturing industry employment will help reveal the extent to which workers in different countries appear to be exposed to the forces of international competition.

In perfectly competitive markets, changes in real exchange rates should induce large changes in the pattern of production across countries, unless marginal production costs

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[3] See, for example, Lawrence and Slaughter (1993), Krugman and Lawrence (1993), or Berman, Bound, and Machin (1996).

[4] See, for example, Leamer (1996) for evidence that trade has mattered.

[5] If automakers use foreign components for some fraction of their inputs, then this symmetry condition must be modified so that it would take a proportionately larger exchange rate change to have the same impact as an ad valorem tariff.

increase rapidly with increases in output. Under imperfect competition, the response is less clear-cut. Since firms are price-setters in this case, quantities need not do all of the adjusting. Firms may adjust markups in order to offset part of the effect of exchange rate changes on foreign prices, thereby preserving market share in export markets.[6] Finally, in some situations, the regulation of product markets or labor markets may sever any link between exchange rate induced changes in relative costs and industry employment. If a nation uses quantitative restrictions to protect workers in a certain sector, there will be no relationship between domestic output or employment in that sector and exchange rates. Alternatively, if high costs of hiring and firing workers are imposed through labor market regulations, then firms may be reluctant to change employment levels, making employment relatively insensitive to demand shocks.

In this paper we present a simple model that shows how the exchange rate can influence industry employment in an open economy. We argue that both the elasticity of employment to exchange rates and the speed of adjustment to exchange rate shocks is likely to depend primarily on market structure and the regulation of international trade and the labor market, all of which may vary substantially across countries and industries. Industries where market power is substantial, perhaps due to product differentiation, will be more insulated from the effects of exchange rate fluctuations since foreign goods may not be close substitutes for domestic goods. Similarly, non-tariff barriers to trade may be used to protect certain industries from foreign competition. Finally, tighter labor market regulation may induce firms to use price adjustment to offset exchange rate shocks of uncertain duration in order to reduce volatility of employment.

We derive a simple equation for industry employment dynamics which is estimated for 14 industry categories for G-7 countries from 1970-1988. Our main finding is that

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[6] The pricing-to-market literature has found that the degree of markup adjustment varies a great deal across industries, and there is some evidence that it varies by country as well (Knetter (1993)). We would therefore expect corresponding variations in the response of both export quantities and the level of employment with respect to exchange rate fluctuations unless demand elasticities are extremely different across industries

exchange rates do influence industry employment in the expected manner: a real appreciation of a nation's currency leads to a decline in manufacturing employment. Country comparisons show that U.K. industry employment is more sensitive to exchange rate changes than U.S. employment, which in turn is more sensitive than German or Japanese industry employment. Furthermore, the adjustment to the steady state level of employment is significantly faster in the U.S. and U.K. than in either Germany or Japan. The U.S. and U.K. labor markets appear to be influenced more, and more quickly, by exchange rate induced changes in relative costs than labor markets in either Germany or Japan. This matches an aspect of conventional wisdom: the U.S. and U.K. are generally viewed as more "laissez faire" than either Germany or Japan both in terms of international trade and labor market regulation.

This paper will proceed as follows. In the next section we outline the empirical framework for studying the behavior of employment over time. Section 2 will discuss the data used in this study. Section 3 will present and analyze the main empirical findings. Section 4 concludes the paper.

1. A Simple Model

Several authors have investigated the impact of exchange rate changes on labor markets, with empirical analysis focused mainly on the U.S. labor market.[7] Most of this work asserts a theoretical link between real exchange rates and domestic industry output through the effect exchange rates have on relative costs of production. In particular, an exchange rate change that reduces the relative costs of foreign firms in an industry (i.e., an appreciation of home relative to foreign currencies, all else equal) will generally lead to lower prices of foreign goods in the industry. Lower foreign prices will reduce demand for

[7] Branson and Love (1988), Branson and Marston (1989), Revenga (1992), and Borjas and Ramey (1995) are recent examples.

domestic output in the industry. Lower domestic demand will in turn lead to lower output and/or prices for domestic goods and lower employment and/or wages, as well.

What determines the magnitude of response of output and employment to an exchange rate shock? Broadly speaking, market and regulatory forces will determine the end result. The extent of the reduction in demand is determined by the pass-through of exchange rate changes to goods prices and the degree of substitutability of foreign for domestic goods. Market conditions will obviously dictate a large part of this response. In a competitive setting, changes in foreign prices will have huge effects on the domestic industry. With extensive product differentiation and market power, there may be a smaller impact. The regulatory environment also plays an important role. If the domestic industry is protected, exchange rate changes may not lead to changes in relative prices or market shares. This will depend on the nature of protection. If protection is in the form of a tariff, relative prices may still change with exchange rates. If protection is in the form of a quantitative restriction, then no change in foreign sales is possible in the home market although relative market shares may change in other markets where firms from both countries compete. Finally, labor market regulations may influence how quickly firms adjust employment in response to changes in relative costs. If it is costly to hire and/or fire workers due to regulations, then firms are reluctant to make large changes in output in response to changes in relative costs that are of uncertain duration (due to, say, an exchange rate swing). Together, these forces, and possibly others, determine the adjustment of output and employment in the tradable goods sector.

In the empirical work we do not estimate a structural model, but this section aims to set out a framework for interpreting the results in terms of a firm's optimal choice of price and employment (see Burgess and Dolado, 1989, for the details of an optimization problem that leads to a similar framework). We assume firms maximize profits subject to a demand constraint, a production relationship, and input prices. In particular, suppose the firm has some market power and faces a downward sloping demand function, given by

$$(1)\ p = aq^{(-1/\gamma)}$$

where p is price and q is output. We have written demand in constant elasticity form, but allow for a demand shifter, a, which includes the effects of exchange rate shocks on demand. The demand elasticity faced by the firm captures one dimension of competition faced by the firm. We assume a constant-returns Cobb-Douglas production function,

$$(2)\ q = N^b K^{1-b}$$

with N and K standing for labor and capital. Maximizing a profit function in the absence of labor adjustment costs yields a log-linear employment equation:

$$(3)\ \ln N^* = c_0 + c_1 \ln a + c_2 \ln w + c_3 \ln r$$

where w is the wage rate, r the rental rate and the c's are straightforward functions of the underlying parameters. Employment depends on the wage-rental ratio and the demand shifter, a. We assume that we can write wages and rental rates as constants plus error terms and hence substitute them out of (3). One way to justify such a simplification is to assume that returns to labor and capital are set outside the industry under study, either by the world market (as may be the case for returns to capital with capital mobility) or other domestic markets (which could be the case for manufacturing labor if the service sector of the economy is large relative to individual traded goods sectors). We also define:

$$(4)\ \ln a = d_0 + d_1 \ln x + \varepsilon_4$$

with x denoting the exchange rate and ε a random demand shock. It is a shortcut to introduce exchange rates as a demand shock, rather than a determinant of the domestic currency equivalent of foreign competitor's costs of production, which in turn influences competitor's prices, and thus domestic demand. We note that the magnitude of d_1 is positively related to the degree of substitutability of foreign for domestic goods and the openness of the economy to trade in the sector. Substituting (4) into (3) gives us an equation for the frictionless optimum employment level as a function of our observable demand shock:[8]

$$(5)\quad \ln N^* = m_0 + m_1 \ln x + \varepsilon_5$$

All that remains is to introduce some form of adjustment costs to the employment decision. Costs of adjusting employment are typically thought of as "firing costs," which will also have dynamic feedback effects that influence hiring practices since a worker hired today may need to be fired in the future. We would like to parameterize these costs so that they may potentially vary across countries and industries. Differences in labor market regulations may imply differences in the shape of the marginal cost function and hence in the price and output response to a shock. Higher costs of hiring and firing workers imply a steeper marginal cost curve associated with changes in output. This in turn implies a greater price response and a smaller output and employment response to a demand shock.

There has recently been much debate on the nature of such costs (see Hamermesh, (1993)), but we make the simplest possible assumption here, namely quadratic adjustment costs: costs of adjusting the (log) level of employment are proportional to the squared change in employment. If the cost of deviations of (log) employment from its optimum

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[8] There are of course other ways of responding to demand shocks, for example changing hours of work, changing inventories or influencing the effort level. However, relative to adjusting the labor force, all of these are temporary expedients.

level are also quadratic, minimizing a one-period cost function leads to the following employment adjustment equation:

$$(6)\quad \Delta \ln N_t = f(\ln N_t^* - \ln N_{t-1})$$

where the value of f depends on the level of adjustment costs and Δ is the first-difference operator. Maximizing an intertemporal value function with strictly convex adjustment costs also produces a partial-adjustment type of equation (see Nickell, 1986), so little is lost by this simple formulation. Nickell also shows that aggregation over units with different adjustment costs can introduce further lags into (6). Bearing this in mind we allow for a second lag on employment, and substituting (5) into (6), we obtain:

$$(7)\quad \Delta \ln N_t = f(m_0 + m_1 \ln x_t - \ln N_{t-1}) + k\Delta \ln N_{t-1} + \varepsilon_7$$

which gives us an equation describing employment adjustment to exchange rate shocks. This is essentially a reduced-form version of Layard, Nickell, and Jackman's (1991) equation (Chapter 9, equation (3)).[9]

The empirical model we adopt is intended to pick up the response of employment to exchange rate shocks in a flexible way. We allow for lags for two periods on employment (standard practice in labor demand models using annual data) and parameterize the model as follows:

$$(8)\quad \Delta \ln N_{ict} = a_{ic}(\ln N_{ic,t-1} - b_{ic} \ln x_{ct}) + c_{ic} + d_{ic}\Delta \ln N_{ic,t-1} + \varepsilon_{ict}$$

where the subscripts are i = industry, c = country and t = time. Ignoring the final term, employment growth depends on the disequilibrium in employment (the difference between

[9] Ours is reduced-form by virtue of the fact we have substituted out the wage and capital stock.

the starting level and the oprtimal level detrmined by the exchange rate and other random factors), and the speed of adjustment to the optimum. Variation in the response of employment growth to exchange rates and the adjustment to equilibrium across industries or countries will depend in part, we believe, on differences in trade and labor market regulation. Various restrictions on the coefficients a, b, and d are imposed and tested in estimation, although in equation (8) they are written as having country and industry components. The key coefficients that we are interested in are a, the adjustment coefficient and b, the long-run exchange rate elasticity. The impact effect of the exchange rate is simply $-ab$. The value of d also influences the dynamic path of employment, but the crucial adjustment parameter is a. This is not least because the value of a being significantly different from zero is a good check on whether the data suggests any long run relationship between employment and the real exchange rate.

To summarize what we would expect from estimating (8) across countries with different trade policies and labor market regulations: (i) the values of a and b should both be negative (as the exchange rate is defined as units of foreign currency per unit of the home currency) if foreign competitors have some effect on the domestic industry, (ii) the values of a and b should be closer to zero (less negative) in countries with more stringent labor market regulations (i.e., higher costs of hiring and firing), and (iii) the value of b should be closer to zero in countries where barriers to trade prevent substitution of foreign for domestic labor in manufacturing as a result of exchange rate swings.[10]

To investigate this we first estimate the equation with no restrictions, so there is an (a, b, d) vector for each country-industry pair. Then we (test and) impose the restriction that each coefficient is the sum of an industry effect and a country effect. Then we test whether we can exclude the country restrictions, i.e. whether, controlling for industry, all countries are the same. Having rejected that hypothesis, we finally consider the pattern of

[10] Note that adjustment costs affect the long run as well as the short run marginal cost (as long as there are quits in equilibrium that have to be replaced). So we might expect the long run effect of a demand shock to be smaller in countries with stringent regulations.

the country differences in relation to what is known about trade and labor market regulations in these countries.

2. Data

The main data on employment are derived from the OECD's Intersectoral Database. This provides information on output, employment, profits and capital stock for around 30 industries for the 14 major OECD nations. The big advantage of the dataset is that the OECD has expended considerable effort in ensuring that the industries are defined equivalently across all the countries. The data is annual, stretching in principle from 1960 to 1989. In practice, because we wish to have balanced panel data across the G-7 countries (U.S., U.K., Germany, Japan, Canada, France and Italy) we have to restrict the sample to 1972 to 1988. The data we use are total employees.

The industries that we have chosen are listed in Table 1, along with the means of employment by country-industry. We have selected industries that have some significant linkage to international markets. This covers the manufacturing industries, agriculture, and mining, as their products are traded internationally, but we also include finance and construction for the same reason, and transport services as for most of our countries fuel is largely imported. There are three missing industries: wood products for Japan, mining for Italy, and finance for Germany. In total then we have 7 countries times 14 industries (-3) times 17 years giving 1615 observations.

To generate an exchange rate variable, we take nominal exchange rates for each country against the dollar (from IMF Financial Statistics) and generate the cross-rates. We compute a real exchange rate using aggregate wholesale prices of produced goods, from the same source. Finally, a single real exchange rate for each country is found by simply averaging all its cross rates. The simple average may be more appropriate than a trade-weighted average, since in many cases employment depends not only on the exchange rate

of the trading partner, but on those of the countries that compete in the same markets. For example, there may be little direct trade between Germany and Japan, yet the DM/Yen exchange rate may be crucial for employment in the auto industry in each country, since these countries compete with one another for the U.S. market.

3. Estimation and Results

We first estimate the model given by equation (1) without any restrictions on the coefficients across countries. For each industry in each country we estimate the equation using non-linear least squares. The parameters of main interest are the exchange rate elasticity, b, and the adjustment coefficient, a.

A selection of results of unrestricted estimation are displayed in Figures 1 and 2. Since we have 95 unrestricted estimates of the a and b coefficients, we cannot present all of these. These figures allow us to present a lot of information on the unrestricted estimates compactly, although they say nothing about statistical significance. Figure 1 compares the estimates of the adjustment coefficients for the United States, Germany and Japan by industry. The most striking feature of Figure 1 is the clustering of adjustment coefficients near zero for Germany. Chemicals, transportation and machinery and equipment are the only cases in which Germany's adjustment coefficient exceeds 0.2 in magnitude. Japan and the United States have eight and seven industries, respectively in that range of parameter values. The results for total manufacturing (the data points farthest right on the figure) present an even more stark picture. The adjustment parameter for Germany is about –0.1, for Japan –0.35, and for the United States –0.8. Adjustment to the steady state manufacturing employment in the U.S. labor market appears to be much more rapid than in Japan and Germany.

Figures 2a and 2b display the pairs of adjustment coefficients and exchange rate elasticities for the United States, Germany and Japan and the United States, the United

Kingdom and France, respectively. Upon inspection of the figures, it appears that there is little correlation between the exchange rate elasticity in a particular industry and its speed of adjustment.

Figure 2a shows markedly more variation in the elasticity of employment with respect to the exchange rate, the parameter *b* in the model. In general, we expect this coefficient to be negative, i.e., a depreciation of the home currency relative to the market basket of G-7 currencies will lead to more production and employment in the home country. In fact, most of the point estimates are negative for the country-industry pairs. Of the 95 pairs for which the model is estimated, 29 of the exchange rate elasticities are statistically different from zero.[11] Of those 29 significant coefficients, 26 of them are in fact negative. Consequently, it appears that real exchange rates do have an effect on employment and that, in particular, real appreciations tend to reduce employment growth in an industry.

While most of the coefficients are negative, Germany and Japan do not seem to fit this pattern. Positive values of *b* appear as often as negative values. In fact, all three statistically significant positive coefficients are in Germany (one) and Japan (two). The only significant negative coefficient between these two countries is in Japan. This is in contrast with eight negative significant coefficients in the U.K. and five in the U.S. For total manufacturing, the exchange rate parameter is negative and significant for the U.K. and Italy, and negative with a t-value greater than -1.5 for the U.S. and Canada. The parameter is positive and insignificant for Germany and Japan. The apparent insensitivity of Japanese employment to exchange rate shocks is consistent with the results of Branson and Marston (1989) and accords with the conventional wisdom that the Japanese market is difficult for foreign firms to penetrate, even when cost conditions are favorable. It is also consistent with existing evidence on the pattern of pricing to market in international trade. Mann (1986), Knetter (1989, 1993) and Ohno (1989) all find evidence to suggest that

[11] We adopt the 5% level of significance in making our statements.

Germany and Japan use destination-specific adjustment of markups to offset the impact of exchange rate changes on prices paid by foreign importers. Consequently, quantities of shipments and thus, employment, should be less sensitive to exchange rate changes in those countries. This research also finds very little evidence of pricing to market by U.S. exporters, which would be consistent with employment being somewhat more sensitive to exchange rate changes. The results are perhaps still surprising given that trade accounts for a relatively small share of U.S. output in comparison with Japan and Germany, but of course it is marginal, and not average, openness to trade that determines these elasticities.

In Figure 2b there is somewhat less dispersion in the exchange rate elasticities. In particular, nearly all estimates have the expected negative sign. Notable in this figure is the pattern of adjustment coefficients for France which are very similar to the estimates for Germany (i.e., near zero in many cases). Once again, speed of adjustment appears to be unrelated to the elasticity of employment with respect to the exchange rate. Based on the two figures, it appears that employment dynamics in relation to exchange rates in the United States, Japan and the United Kingdom are rather different from the dynamics in Germany and France. The continental European countries' labor markets are both little affected by, and slow to adjust to, exchange rate changes.

While it appears that exchange rates seem to matter for a substantial share of the countries and industries, it is useful to see if the data accept some restrictions on the nature of responses. Table 2 presents the results for a constrained model in which the exchange rate elasticity and the adjustment parameter are assumed to consist of country and industry components. We estimate by simultaneous equations non-linear least squares, imposing the cross equation restrictions on the parameters. Identification requires that we choose a country-industry pair for normalization of the model. We choose the U.S. chemical industry as a normalization and estimate separate effects for all other industries and countries. The country and industry effects must be interpreted as differentials relative to the response implied in the base case, U.S. chemicals. The data are sympathetic to the

restrictions imposed. An F-test relative to the unrestricted model indicates the restrictions are not rejected at the 5% level of significance.

The country effects are our main interest. In terms of the elasticity of employment with respect to exchange rates, Germany, Japan and France are all less sensitive (more positive) than the United States. Employment in Italy, Canada and the United Kingdom is more sensitive to exchange rates than U.S. employment, with the U.K. coefficient statistically significant.

In terms of speed of adjustment, the country effects for Germany and France are significant and indicate that adjustment in these countries is much slower than in the United States. The United Kingdom appears slightly slower than the United States as well, with the remaining countries very similar to the U.S. speed of adjustment. The only surprising country pattern is that Italy behaves more like the U.S. or U.K. than does the remainder of continental Europe. While the Italian labor market has a myriad of regualtions, there are also many countervailing policies including grants, that work to offset the effect of employment protection legislation. The strength of these countervailing facors may explain why Italian labor markets are different from the rest of Europe.

Regarding the industry effects, *ex ante*, one would guess that a fair amount of production shifting across countries occurs in chemicals relative to other industries, since products are fairly homogeneous and many firms in the industry have multinational operations. Non-metallic minerals, basic metal products and textiles all show more sensitivity of employment to exchange rate fluctuations than the chemical industry does. This is not terribly surprising, since these industries are perhaps more competitive than the chemical industry due to the simplicity of the products. The point estimates do indicate that the elasticity of employment with respect to exchange rates in chemicals is more responsive than construction, food products, wood products, paper, and machinery and equipment.

Recall that industries in which a high degree of pricing to market is occurring are likely to show little relationship between exchange rate and employment fluctuations.

Export prices are presumably being adjusted to act as a buffer for the exchange rate shocks, given that the employment (and therefore quantity of output) appear to be relatively insensitive to exchange rate changes. This in turn suggests that more pricing to market may be occurring in chemicals, food products, wood products, paper products, and machinery and equipment, as compared with the basic metals, minerals and textiles. In a study of 60 German and 18 U.S. 7-digit export industries, Knetter (1994) presents evidence that chemicals and industrial products are the two sectors in which pricing to market is particularly pronounced for German exporters. Likewise, paper products were one of the few areas in which U.S. exporters showed some tendency to price to market. Consequently, these findings for employment dynamics at the two-digit industry level do seem to be consistent with more disaggregated evidence on pricing behavior.

Tables 3a and 3b impose further restrictions on the data. Table 3a estimates the model where response coefficients are a function of only country effects (industry effects are constrained to zero). This restriction is strongly rejected by the data, indicating that there are indeed important differences across industries in the nature of adjustment. Nonetheless, the same basic patterns emerge regarding France and Germany in comparison with the other countries. Table 3b reports the results with just industry effects (country effects constrained to zero), a restriction which is also rejected by the data. This suggests that although the country differences were not always by themselves statistically significant, as a group they did help explain enough variation to warrant inclusion in the model. The industry patterns do not change much from Table 2. Given that elimination of country or industry effects is not accepted by the data, we did not try to impose further restrictions (e.g., both country and industry effects constrained to be zero).

The empirical results of this section do permit us to make several concrete observations about how manufacturing employment responds to real exchange rate shocks across G-7 countries for a number of two digit industries. First of all, it is quite clear that employment growth in many industries is impaired by real appreciation of the home

currency, as standard economic theory would predict. Over 25% of our 95 country-industry pairs showed statistically significant evidence that employment growth falls with real appreciation. Only 3% of the country-industry pairs showed significant evidence of rising employment growth with real currency appreciation. The fact that exchange rates are correlated with employment growth in this way does suggest that "globalization" in the form of reduced trade barriers may also contribute to declines in manufacturing employment.

We then explored whether the data can be restricted in certain ways, in particular, whether the exchange rate elasticity of employment growth and the adjustment parameter can be composed of country and industry effects only (i.e., all 95 elasticities can be reconstructed from 14 industry and seven country effects). The data accepted these restrictions. The United Kingdom was the only case where the country-specific exchange rate elasticity differed from the United States (the base case). The German and French adjustment parameters were also statistically significant, and indicated that adjustment to real exchange rate swings was substantially slower in those countries than in the U.S.

Do these patterns in country effects make sense based on what we know about trade and labor market policies in these countries. For the most part, our answer is yes. In terms of trade policy, most would view the U.S., Canada, and the U.K. as more open than some of the continental European markets or Japan. The same seems to be true of labor market regulations. Europe is viewed as protecting manufacturing labor more than the U.S., for example. This perception is supported by recent studies of labor market regulations in these countries (see for example, Emerson (1988) and Lazear (1990)). Based on these patterns we would expect employment adjustments to exchange rate changes to be larger and faster in less regulated markets, such as the U.S.

4. Conclusion

This paper has attempted to evaluate the response of employment to exchange rate shocks at the industry level for the G-7 countries. Using a simple empirical framework that places little *apriori* structure on the pattern of response to shocks, we find that employment is significantly related to real exchange rate movements in about 30% of our country-industry pairs. Real appreciations are associated with declines in manufacturing employment in most cases. The data are consistent with the view that employment in European labor markets, at least France and Germany, is much less influenced by demand shocks and much slower to adjust to long run steady states. The United States, Japan, Canada, the United Kingdom and Italy all appear to adjust more quickly. Furthermore, relative to other countries, German and Japanese employment is much less sensitive to exchange rate fluctuations. This latter finding is consistent with previous research on output and markup responses to exchange rates across industries and countries, as well as the perception that European and Japanese markets are less open to trade. It appears that in most German and Japanese industries, markups and profits act as a shock absorber for exchange rate fluctuations, with output remaining relatively stable by comparison.

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Table 1: Means of Employment by Country and Industry, 1972 - 1988
Millions

IND	US	UK	WG	JPN	FRA	ITA	CAN	SUM
AGR	3.12	0.65	1.46	7.77	1.9	2.93	0.57	18.40
MID	0.86	0.32	0.23	0.15	0.17	--	0.16	1.89
MAN	19.36	6.70	8.93	14.47	5.19	5.50	1.97	62.12
FOD	1.69	0.70	0.90	1.45	0.58	0.42	0.26	6.00
TEX	2.24	0.77	0.78	1.27	0.68	1.28	0.23	7.25
WOD	1.23	0.24	0.43	--	0.24	0.45	0.17	2.76
PAP	1.9	0.54	0.43	0.34	0.34	0.27	0.27	4.09
CHE	1.95	0.69	1.01	0.57	0.56	0.5	0.19	5.47
MNM	0.64	0.26	0.37	0.7	0.19	0.37	0.05	2.58
BMI	1.03	0.42	0.77	0.58	0.32	0.21	0.13	3.46
MEQ	8.22	2.98	4.15	6.27	2.16	1.93	0.60	26.31
MOT	0.43	0.09	0.08	3.27	0.18	0.08	0.07	4.20
CST	5.22	1.56	2.03	5.6	1.8	1.74	0.61	18.56
TRS	4.22	1.52	1.5	3.29	1.18	1.27	0.74	13.72
FNI	10.79	1.95	--	2.35	1.54	0.32	0.96	17.91
SUM	43.54	12.69	14.14	33.61	11.84	11.77	5.01	132.60

Each cell is the mean over the time period of employment in that industry in that country.
Note: "sum" means sum of these rows (excluding MAN to avoid double-counting), not total employment in each country or industry.
AGR: agriculture, MID: miming etc., MAN: manufacturing, FOD: food etc., TEX: textiles
WOD: wood products, PAP: paper etc., CHE: chemicals, MNM: nonmetallic minerals,
BMI:basic metal products ,MEQ: machinery & Equipment, MOT: other manufacturing, CST: construction, TRS: transport & communication, FNI: finance etc

Table 2: Jointly Estimated Country and Industry Effects
Sample 1972 - 1988

	Coefficients:	
	a (adjustment)	**b (exchange rate elasticity)**
Base: USA/Chemicals	-0.165 (4.17)	-0.186 (0.65)
COUNTRY EFFECTS:		
UK	0.059 (1.62)	-0.776 (2.93)
Germany	0.125 (3.56)	0.458 (1.12)
Japan	0.006 (0.24)	0.311 (1.16)
France	0.163 (4.96)	0.620 (1.22)
Italy	-0.028 (1.25)	-0.426 (1.48)
Canada	-0.042 (1.08)	-0.312 (1.23)
INDUSTRY EFFECTS:		
Agriculture	0.020 (0.57)	-0.157 (0.64)
Mining etc	0.025 (0.51)	-0.132 (0.50)
Textiles	-0.002 (0.05)	-0.571 (2.18)
Food etc.	-0.042 (0.83)	0.199 (1.02)
Wood products	-0.043 (1.21)	0.298 (1.62)
Paper etc.	-0.033 (0.80)	0.328 (1.71)
Non-metallic Minerals	-0.096 (2.21)	-0.267 (2.27)
Basic Metal Products	0.029 (0.63)	-1.093 (3.23)
Machinery and Equipment	-0.131 (2.24)	0.120 (0.92)
Other Manufacturing	-0.120 (1.74)	-0.131 (0.76)
Construction	-0.043 (1.21)	0.298 (1.62)
Transport	0.101 (2.83)	-0.147 (0.51)
Finance etc	0.145 (3.79)	-1.407 (1.52)
+ 6 country-specific and 13 industry-specific d coefficients and 95 country-industry specific constants; t statistics in parenthesis; F test against unrestricted: F(225,1235) = 1.138, with p-value = 9.63%;		

Table 3a: Just Country Effects
Sample 1972 - 1988

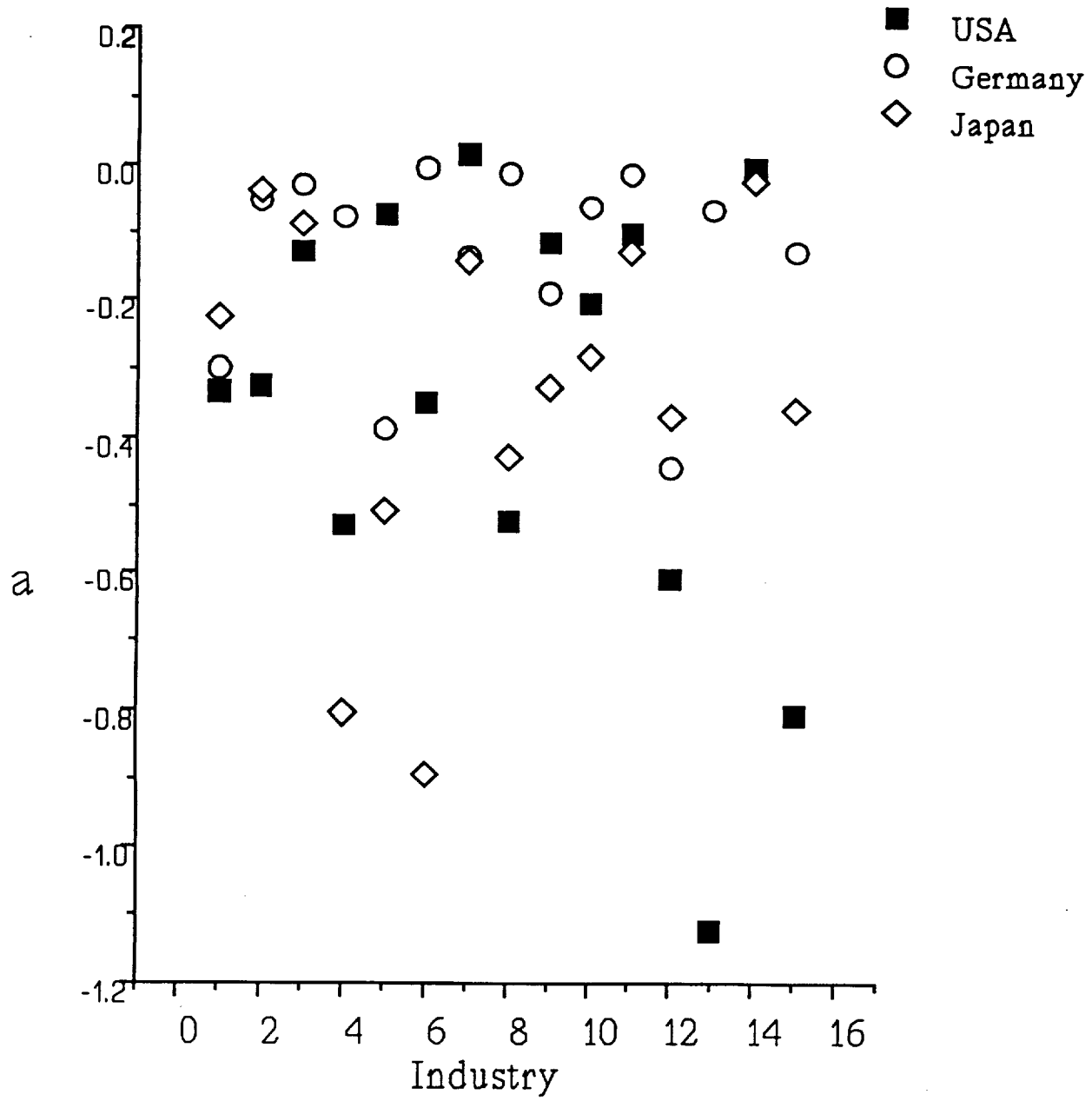
	Coefficients:	
	a (adjustment)	**b (exchange rate elasticity)**
Base: USA	-0.112 (3.45)	-0.223 (0.42)
COUNTRY EFFECTS:		
UK	0.080 (1.87)	-1.515 (1.29)
Germany	0.064 (1.65)	1.212 (1.13)
Japan	0.004 (0.10)	0.338 (0.63)
France	0.109 (3.48)	9.443 (0.38)
Italy	0.019 (0.58)	-0.585 (0.88)
Canada	-0.074 (1.10)	-0.485 (0.88)

+ country -specific d coefficients and 95 country-industry specific constants; t statistics in parenthesis; F test against unrestricted: F(264,1235) = 1.539; F test against Table 2: F(39,1460) =3.771;

Table 3b: Just Industry Effects
Sample 1972 - 1988

	Coefficients:	
	a (adjustment)	**b (exchange rate elasticity)**
Base: Chemicals	-0.124 (3.51)	-0.195 (0.82)
INDUSTRY EFFECTS:		
Agriculture	0.054 (1.52)	-0.198 (0.65)
Mining etc	0.036 (0.79)	-0.431 (1.12)
Textiles	0.063 (1.51)	-0.659 (1.23)
Food etc.	0.092 (2.89)	-0.001 (0.00)
Wood products	-0.090 (1.21)	0.039 (0.14)
Paper etc.	-0.003 (0.06)	0.371 (1.75)
Non-metallic Minerals	0.030 (0.71)	-0.301 (0.98)
Basic Metal Products	0.098 (1.97)	-3.675 (0.71)
Machinery and Equipment	-0.007 (0.18)	0.060 (0.32)
Other Manufacturing	-0.047 (0.78)	-0.321 (1.26)
Construction	-0.017 (0.44)	0.435 (1.95)
Transport	0.029 (0.83)	0.185 (0.81)
Finance etc	0.114 (3.52)	0.421 (0.34)
+ industry-specific d coefficients and 95 country-industry specific constants; t statistics in parenthesis; F test against unrestricted: F(243,1235) = 2.043;F test against Table 2: F(18,1460): 13.08		

Fig.1: Adjustment Coefficients Unrestricted Model



Industries are (in order): CHE, AGR, TEX, MOT, TRS, FOD, PAP, MNM, MID, CST, BMI, MEQ, WOD, FNI, MAN

Fig. 2a: Adjustment Coefficient (a)
and Exchange Rate Elasticity (b)

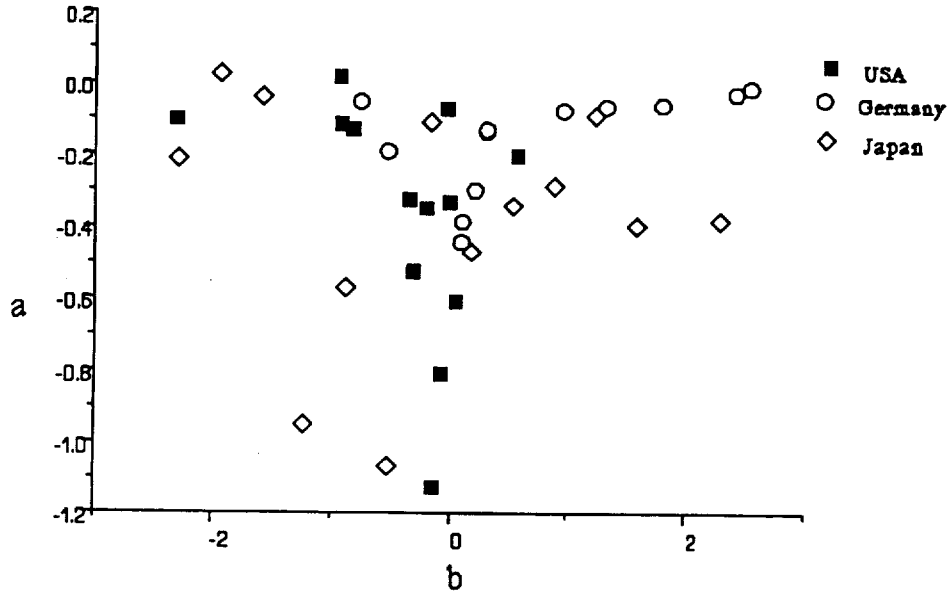


Fig. 2b: Adjustment Coefficient (a)
and Exchange Rate Elasticity (b)