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An empirical assessment of the impact of trade on employment in the United Kingdom

David Greenaway *, Robert C. Hine, Peter Wright

Centre for Research on Globalisation and Labour Markets, School of Economics, University of Nottingham, Nottingham NG7 2RD, UK

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Abstract

A large number of studies have recently attempted to evaluate the impact of trade on employment, many relying on either the factor content or growth accounting approaches. With some notable exceptions, this work finds limited evidence of strong direct effects but stronger effects through induced productivity changes. This study models the effects of trade on employment in the UK in a dynamic labour demand framework, on a panel of 167 manufacturing industries. We find that when we introduce trade, increases in trade volumes, both in terms of imports and exports, cause reductions in the level of derived labour demand. When we disaggregate by origin of imports we find stronger effects in trade with the EU and US compared to trade with East Asia. This provides supportive evidence for the idea that trade affects *x*-inefficiency, with the strongest competition for UK manufacturers coming from producers in the EU and US. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

Between 1979 and 1991, more than two million jobs were lost in UK manufacturing. Table 1 shows, however, that the extent of the job losses differed

* Corresponding author. E-mail: david.greenaway@nottingham.ac.uk

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Table 1
Trade, production, wages and employment in UK manufacturing industries, 1979 and 1991
Source: ONS Business Monitor PA1002, various years.

SIC Division	Employment ('000s)			Production[a] (£million)			Wage rates[b]			Import penetration[c]			Export share[d]		
	1979	1991	% change 1979–1991	1979	1991	% change 1979–1991	1979	1991	% change 1979–1991	1979	1991	% change 1979–1991	1979	1991	% change 1979–1991
43	368.0	181.7	*−50.6*	79.4	52.3	*−34.1*	4788	7000	*46.22*	0.29	0.47	*62.1*	0.23	0.32	*39.1*
35	491.2	245.8	*−50.0*	155.3	149.2	*−3.9*	6875	10,976	*59.63*	0.35	0.46	*31.4*	0.32	0.42	*31.3*
32	967.5	547.0	*−43.5*	255.2	221.6	*−13.2*	6684	10,367	*55.11*	0.21	0.30	*42.9*	0.30	0.33	*10.0*
2	1045.5	613.9	*−41.3*	482.2	419.3	*−13.1*	6986	11,039	*58.0*	0.21	0.31	*47.6*	0.24	0.31	*29.2*
44 and 45	448.3	269.6	*−39.9*	76.1	56.5	*−25.9*	3894	5416	*39.09*	0.25	0.44	*75.0*	0.17	0.26	*52.6*
31	498.1	307.9	*−38.2*	116.9	102.1	*−12.7*	5863	8517	*45.25*	0.08	0.15	*87.5*	0.10	0.13	*30.0*
36	383.6	251.3	*−34.5*	81.2	110.2	*35.7*	6903	11,315	*63.92*	0.14	0.14	*0.0*	0.19	0.17	*−10.5*
34 and 37	797.2	547.4	*−31.3*	184.4	210.0	*13.9*	6027	9594	*59.19*	0.31	0.56	*77.9*	0.32	0.52	*60.1*
46	245.6	188.9	*−23.1*	69.2	67.0	*−3.0*	5777	7914	*37.00*	0.25	0.23	*−8.0*	0.06	0.06	*0.0*
42	265.9	216.8	*−18.5*	222.9	246.2	*10.5*	6508	10,241	*57.36*	0.08	0.12	*50.0*	0.08	0.13	*62.5*
47	533.0	441.9	*−17.1*	151.9	201.0	*32.3*	6924	10,776	*55.64*	0.15	0.17	*13.3*	0.08	0.10	*25.0*
48	267.5	223.5	*−16.5*	75.7	91.3	*20.7*	6117	9108	*48.90*	0.15	0.24	*60.0*	0.17	0.20	*17.7*
49	90.9	76.9	*−15.4*	22.2	23.2	*4.5*	4878	7098	*45.51*	0.23	0.35	*52.2*	0.22	0.22	*0.0*
41	394.4	359.8	*−8.8*	168.9	187.8	*11.2*	5013	7173	*43.11*	0.17	0.18	*5.9*	0.05	0.07	*40.0*
33	46.9	64.4	*37.3*	21.0	58.8	*179.7*	7531	13,209	*75.41*	0.50	0.51	*2.0*	0.44	0.49	*11.4*

SIC description

2 Extraction of minerals, manufacture of metals and mineral products
31 Manufacture of metal goods
32 Mechanical engineering
33 Manufacture of office machinery
34 and 37 Electrical and instrument engineering
35 Manufacture of motor vehicles
36 Manufacture of other transport equipment
41/42 Food drink and tobacco
43 Textiles
44 and 45 Manufacture of leather, footwear and clothing
48 Processing of rubber and plastics
46 Timber and wooden furniture
47 Manufacture of paper and paper products
49 Other manufacturing industries

substantially across two-digit SIC industry divisions. The manufacture of office machinery and the processing of rubber and plastics, for example, recorded increases in their workforces while three divisions — including textiles and motor vehicle manufacturing — experienced job losses of more than 50%. Such large-scale losses reflect a period of major adaptation and organisational change, particularly as the value of UK manufacturing output remained stable in real terms. At a disaggregated level, though, it is clear that the production experience of industries was very mixed, with about equal numbers of those shown in Table 1 recording an expansion or contraction over the period as a whole. The sharpest declines occurred in textiles, leather, footwear and clothing where competition from low wage economies has been particularly intense for the established industrialised countries.

The combination of falling employment and stable production in manufacturing necessarily implies rising output per person. Even at the two-digit SIC level, however, productivity improvements varied widely — for example, the value of output per person in the manufacture of office machinery rose eight times faster than in the leather industry. Relative movements in productivity appear to be reflected in changes in wages in Table 1, but the range of wage changes across industries is much more restricted than is the range of employment or production change. Thus, half of the industries had a growth in average wages per worker of between 55% and 60% over the 12-year period.

UK industry has become increasingly integrated into the international economy through trade and foreign direct investment. Between 1979 and 1991, this was particularly marked for imports, as shown in Table 1. Their (unweighted) average share in apparent consumption rose from 26% to 37%, while for exports as a share of production the proportion rose from 23% to 31%. Once again, there was a wide diversity of experiences across industries, although only one division recorded a decline in import penetration (SIC 46, timber and wooden furniture) and only one a decline in export shares (SIC 36, other transport equipment). Reflecting the dominance of intra-industry trade (IIT), movements in import penetration and export shares were positively correlated at the two-digit level. Thus, divisions 36 and 46 were ranked lowest in both import and export growth, and at the upper end, instrument and electrical engineering exemplified the growing trade orientation of most sectors of UK manufacturing.

Summing up, the UK has been through a particularly turbulent period in the development of its manufacturing industry with a combination of sharply reduced employment, stable production and marked improvements in output per person

Notes to Table 1:
[a] 1985 prices.
[b] Per person per year, 1985 £ prices.
[c] Imports as a share of apparent consumption (production + imports − exports).
[d] Exports as a share of production.

employed. This was a period also of increasing openness in the UK economy. An important issue, therefore, is the possible link between greater exposure to trade and labour market adjustments. This is explored econometrically later in this paper, taking advantage of the wide diversity of experience of individual industries which is apparent even at the two-digit level in Table 1. By combining trade, labour market and industrial organisation data, we assemble a panel of data for 167 (four-digit) industries in the UK to evaluate the impact of imports and exports on productivity and employment. This is a unique dataset and provides the opportunity to advance on the more limited factor content and accounting approaches to the problem and we would argue yields more robust and more credible results. In addition, however, our dataset also permits us to investigate the impact of trade with different groups of countries.

The remainder of the paper is organised as follows. Section 2 reviews previous evidence on trade and employment and points up the particular contribution which this paper makes. Section 3 explains our modelling strategy and sets out details of our dataset. Section 4 reports on and discusses our results, while Section 5 concludes.

2. Trade and employment: A review of previous work

The Heckscher–Ohlin–Samuelson (H-O-S) framework yields some fairly clear predictions regarding the effect of trade on employment across sectors. When trade barriers are reduced, the import substitute sector contracts while the export sector expands; ceteris paribus employment in the former declines, while in the latter it increases. The simple H-O-S message therefore is that trade results in a redistribution of employment away from the import substitute sector and towards the export sector.

This is a useful starting point. However, given that much international trade appears to be driven by non-H-O-S factors, how do these results need to be adjusted for a world of IIT, where a large proportion of trade is between countries with similar factor endowments and where the products concerned might be vertically or horizontally differentiated? [1] In principle, one might assume that increased imports (exports) are associated with employment reductions (increases), ceteris paribus. There are some differences, however. First, because expansions/contractions occur largely within industries the analysis becomes more complicated. Nevertheless, one would still be trying to establish how trade impacts differentially across industries depending upon differences between them in exposure to trade and changes therein. Second, it is conceivable that technical change, on average, affects IIT industries more than non-IIT industries because more

[1] Greenaway et al. (1994, 1995) evaluate empirically the relative importance of horizontal and vertical IIT in the UK.

(product and process) innovation occurs. Third, the sensitivity of IIT industries may be greater in the sense that adjustment to trade expansion occurs more rapidly.

There have been a number of attempts to evaluate empirically the impact of trade on employment. Two principal methodologies have been used: *factor content* and *growth accounting* approaches. In factor content studies, estimates are made of the labour required to produce a given amount of exports or being displaced by a given amount of imports. For instance, following this approach, Sapir and Schumacher (1985) show that a balanced expansion of EC trade with other OECD countries would have only minor effects on employment [2] — imports and exports have similar labour contents. However, in trade with developing countries the job intensity of European exports was only around 0.8 of the import level in the period studied (1970–1981). A balanced expansion of trade with developing countries in value terms would therefore lead to an erosion of jobs. More recently, Wood (1991, 1994) has contended that the employment impact of such trade would be greater on the grounds that imports from developing countries are 'non-competing'. As a result, conventional factor content methodologies underestimate the amount of labour in the North which imports from the South displace. He estimates that North–South trade has resulted in a net loss of nine million jobs in the North compared with one million using the standard methodology, and compared with a jobless total in the OECD countries of 35 million in 1994. However, Wood's findings have been criticised by Baldwin (1995) for overstating the extent to which imports are non-competing, and for the assumption that similar production technologies are employed in the North and South. Although they concede that the potential biases identified by Wood could result in factor content analysis underestimating the employment impact of trade with developing countries, Cortes et al. (1996) still conclude that the labour market impact of trade with low wage economies in France has been modest.

Krugman (1995) sets up a mini-CGE model to explore the employment impact of increased trade with developing countries. He argues that with rigid relative wages of unskilled and skilled labour, increased imports of unskilled labour intensive products will have two components. The first is the standard factor content effect from an increase in net imports of unskilled-labour intensive products. This is supplemented by a general equilibrium multiplier effect whose magnitude depends on the level of net exports of skilled labour intensive products and the unskilled to skilled ratio in aggregate employment. The combined effect is double that of the usual factor content estimate alone. However, the impact on employment of increased trade with developing countries remains small — an estimated 1.43% fall in employment from an import penetration rate for manufac-

[2] A small increase in Italy and decline in Germany, the Netherlands and Belgium; no change in the UK and France.

tures from Newly Industrialising Countries of 1.75% of GDP (current level in OECD countries).

In the growth accounting approach, the sources of employment change are decomposed into domestic demand, trade and productivity elements. It is generally found that trade factors have played only a minor role in recent job losses — productivity growth has been the main factor displacing labour (in the short run). Indeed, an OECD (1992) study concluded that between 1970 and 1985 trade — including trade in services — was a net source of employment gains in Denmark, France, Germany and the Netherlands, but a source of loss in the UK. For the more recent period, 1979 to 1990, Gregory and Greenhalgh (1997) found that the UK also had a gain in employment from trade changes — though this was achieved by an increase in financial services, and primary and extractive employment, and losses in manufacturing. For France, Messerlin (1995) observed again a modest and mostly positive employment effect from foreign trade between 1980 and 1992 (+0.8% per year on average), though the effect was negative during the economic expansion of 1988 to 1991.

A well-known problem with the growth accounting approach is that it is assumed that the components of change are independent. Clearly, for example, if rising imports stimulated faster productivity growth, there would be additional effects of trade not picked up by this method (see Martin and Evans, 1981; Wood, 1994). [3] There is evidence linking the growth of trade to the growth of labour productivity. For example, Cortes and Jean (1996) find a clear link for the US, France and Germany as does Lawrence (1996) for the US. Moreover, there are good reasons for believing that such an effect will be important. Trade-induced productivity growth might be stimulated via various channels. Caves and Krepps (1993) emphasise the pro-competitive impact of trade on *x*-efficiency while Borgas and Ramey (1994) point to reduced rents and employment of unionised labour. As Feenstra and Hanson (1996) argue, trade may also result in the relocation abroad of the most labour intensive stages of the production process. Neven and Wyplosz (1996) find substantial evidence of defensive changes in technique and output prices to meet competition from imports.

Clearly, therefore, theory and empirical evidence lays considerable stress on induced productivity effects. It is the principal aim of this study to quantify the importance of the trade stimulus to productivity growth and employment in the UK. [4]

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[3] Some critics (e.g., Leamer, 1994; Courakis et al., 1997) argue that the growth accounting approach is flawed in an even more fundamental way. In their view, trade is not capable of ‘explaining’ changes in aggregate employment since employment in the tradeables sector is a residual after changes in factor supplies, factor demands by non-tradeables and technology. Since both trade and technology play a role, and the critical issue is the growing globalisation of the world economy, the attempt to apportion relative importance to the two factors is seen as irrelevant.

[4] Surveys of what is now a very substantial literature can be found in Lawrence (1996), Cline (1997) and Slaughter (1999).

3. Modelling employment effects

As documented in Section 2, there are important limitations associated with the two most widely used approaches to investigating the employment effects of increased trade: the factor content and accounting decomposition methods. Instead of relying on either, we adopt a regression based approach grounded in a dynamic model of labour demand [5] to quantify possible employment losses resulting from a more efficient use of labour.

We begin by assuming a Cobb–Douglas production function where for the representative firm in industry i in period t:

$$Q_{it} = A^{\gamma} K_{it}^{\alpha} N_{it}^{\beta} \tag{1}$$

where Q = real output; K = capital stock; N = units of labour utilised; and where α and β represent the factor share coefficients and γ allows for factors changing the efficiency of the production process. A profit-maximising firm will employ labour and capital at such levels that the marginal revenue product of labour equals the wage (w) and the marginal revenue product of capital equals its user cost (c). Solving this system simultaneously to eliminate capital from the expression for firm output allows us to obtain the following expression:

$$Q_{it} = A^{\gamma} \left(\frac{\alpha N_{it}}{\beta} \frac{w_i}{c} \right)^{\alpha} N_{it}^{\beta}. \tag{2}$$

Taking logarithms and rearranging Eq. (2) allows us to derive the firm's, and therefore the industry's, derived demand for labour as

$$\ln N_{it} = \phi_0 + \phi_1 \ln(w_i/c) + \phi_2 \ln Q_{it} \tag{3}$$

where $\phi_0 = -(\gamma \ln A + \alpha \ln \alpha - \alpha \ln \beta)/(\alpha + \beta)$; $\phi_1 = -\alpha/(\alpha + \beta)$; $\phi_2 = 1/(\alpha + \beta)$.

One might expect that the technical efficiency of the production process increases over time and that the rate of technology adoption and increases in x-efficiency would be correlated with trade changes, therefore it is hypothesised that parameter A in the production function varies with time in the following manner:

$$A_{it} = \mathrm{e}^{\delta_0 T_i} M_{it}^{\delta_1} X_{it}^{\delta_2}, \quad \delta_0, \delta_1, \delta_2 > 0, \tag{4}$$

[5] There are a limited number of previous studies which use regression based techniques, the majority of which are based on US data. Abowd (1987) examines the impact of import competition on collectively bargained wage and employment outcomes in the US, with Abowd and Lemieux (1990) and Caves (1990) providing a comparison with Canada. Denny and Machin (1991) and Konings and Vandenbussche (1995), using firm-level data for the UK, also examine the impact of increased foreign competition on wages and employment.

where $T=$ time trend; $M=$ import penetration; $X=$ export penetration which implies:

$$\ln N_{it}=\phi_0^*-\mu_0 T-\mu_1\ln M_{it}-\mu_2\ln X_{it}+\phi_1\ln(w_i/c)+\phi_2\ln Q_{it} \quad (5)$$

with $\phi_0^*=-(\alpha\ln\alpha-\alpha\ln\beta)/(\alpha+\beta)$; $\mu_0=\mu\delta_0$; $\mu_1=\mu\delta_1$; $\mu_2=\mu\delta_2$; $\mu=\gamma/(\alpha+\beta)$.

3.1. Dynamics in the employment equation

If there are costs associated with employment adjustment then the level of employment may deviate from its steady state as adjustment to equilibrium takes place. This leads to the introduction of a lag on employment into the employment function. If the employment measure is an aggregation across workers with differing adjustment costs then additional lags may be necessary to allow for heterogeneity effects (Nickell, 1986). A longer lag structure may also be necessary if serially correlated technology shocks are present. Lags may also be introduced into the labour demand function once bargaining considerations are taken into account — such as sequences of bargains or expectations formation about future wage and output levels.

Purely specifying dynamics in terms of lags of the dependent variable implicitly imposes a common evolution for employment following a change in an explanatory variable. This restriction may be relaxed by additionally introducing a distributed lag structure for the independent variables. This is the approach which we adopt since we are agnostic about the source of the dynamics in the employment equation.

3.2. Data and implementation

The dataset we use has been specially assembled using a diversity of sources in order to allow the construction of an integrated database of industrial, labour market and trade statistics. Thus, we have a panel of 167 manufacturing industries, corresponding approximately to a four-digit ISIC level of aggregation, from 1979 to 1991.[6] Since the dataset has both cross-sectional and time series elements the general dynamic estimating equation for the panel of industries in our study is of the form[7]

$$\ln N_{i,t}=\lambda_i-\mu_0 T-\sum_j\mu_{1j}\ln M_{i,t-j}-\sum_j\mu_{2j}\ln X_{i,t-j}+\sum_j\phi_{0j}\ln N_{i,t-j}$$
$$+\sum_j\phi_{1j}\ln w_{i,t-j}+\sum_j\phi_{2j}\ln Q_{i,t-j}+\varepsilon_{it} \quad (6)$$

[6] Details of the data are available from the authors on request.

[7] Assuming perfect capital markets, the user cost of capital will only vary over time, so that in estimation its variation will be captured by time dummies.

where N_{it} = total employment in industry i in time t; w_{it} = average real wage in industry i in time t; Q_{it} = real output in industry i in time t; λ_i = industry specific effect.

Note that in this equation explanatory variables are assumed to have common impacts across industries. The industry specific effects allow for unaccounted differences between sectors which are constant over time.

For the purposes of estimation, the employment equation is differenced so as to transform out the industry specific fixed effects, and a dynamic equation implemented of the form

$$\Delta \ln N_{i,t} = -\mu_0 - \sum_j \mu_{1j} \Delta \ln M_{i,t-j} - \sum_j \mu_{2j} \Delta \ln X_{i,t-j} + \sum_j \phi_{0j} \Delta \ln N_{i,t-j} + \sum_j \phi_{1j} \Delta \ln w_{i,t-j} + \sum_j \phi_{2j} \Delta \ln Q_{i,t-j} + \Delta \varepsilon_{it}. \tag{7}$$

However, since the differencing will induce a bias in the coefficient on the lagged dependent variable because of the correlation between it and the unobserved fixed effects in the residual, an instrumental variable approach must be adopted. The one used is the generalised method of moments technique of Arellano and Bond (1991). This uses lags of the endogenous variables dated $t-2$ and earlier as instruments, but is efficient in the sense that it expands the instrument set as the panel progresses and the number of potential lags increases. This equation will give unbiased and consistent estimates of the regression coefficients as long as the differenced equation is free of second and higher order serial correlation. Thus, test statistics, which are distributed normally under the null of no serial correlation, are calculated and presented in the tables. The validity of the instrument set is checked using a Sargan test based on the correlation between the instruments and the residuals from the model. This is asymptotically distributed as chi-squared under the null.

4. Results

The results of our model estimations are presented in Tables 2 and 3. The first reports three sets of estimates: for the base specification alone, for the base specification augmented by total trade and for the latter also including some analysis of interactions between trade and wage effects. There are some a priori reasons for thinking that origin might matter and, as we saw, some earlier empirical work has pointed to stronger employment effects being associated with North–South trade than North–North trade. Table 3 therefore reports on our analysis when UK trade is decomposed by origin.

In the first panel of Table 2, we report on our base specification where both output and wages have the expected impacts. Output causes increases in the level of derived labour demand both in the short run and the long run whereas increases

Table 2
Employment Equations for UK manufacturing: total trade

	1		2		3	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.0001	0.0054	−0.0033	−0.4540	−0.0088	−1.2891
$\Delta \ln N_{t-1}$	0.4309	2.7136	0.3980	2.6628	0.3243	2.4432
$\Delta \ln N_{t-2}$	0.0469	0.7318	0.0419	0.7178	0.0120	0.2060
$\Delta \ln Q_t$	0.6082	8.7225	0.5255	7.5387	0.5067	7.2180
$\Delta \ln Q_{t-1}$	−0.2039	−1.7798	−0.1819	−1.6488	−0.1377	−1.3855
$\Delta \ln Q_{t-2}$	−0.0053	−0.0798	0.0368	0.5843	0.0676	1.0790
$\Delta \ln (W/c)_t$	−0.3350	−3.4110	−0.3141	−3.1464	−0.2843	−2.3993
$\Delta \ln (W/c)_{t-1}$	0.2451	1.5078	0.2831	1.8030	0.2533	1.6026
$\Delta \ln (W/c)_{t-2}$	0.0102	0.0879	0.0121	0.1057	0.0093	0.0751
Δ ln concentration	−0.0324	−1.3046	−0.0234	−0.9419	−0.0213	−0.8531
$\Delta \ln \text{import}_t$			−0.0449	−3.1716	−0.0667	−2.5131
$\Delta \ln \text{import}_{t-1}$			0.0002	0.0200	0.0030	0.3454
$\Delta \ln \text{import}_{t-2}$			0.0101	0.7810	0.0110	0.9025
$\Delta \ln \text{export}_t$			−0.0317	−2.4592	−0.0086	−0.6292
$\Delta \ln \text{export}_{t-1}$			0.0108	1.4381	0.0082	0.9962
$\Delta \ln \text{export}_{t-2}$			−0.0055	−0.3536	−0.0015	−0.0978
$\Delta \ln (W/c)_t \cdot \Delta \ln \text{import}_t$					−0.3724	−0.9219
$\Delta \ln (W/c)_{t-1} \cdot \Delta \ln \text{import}_{t-1}$					0.2398	0.6729
$\Delta \ln (W/c)_{t-2} \cdot \Delta \ln \text{import}_{t-2}$					0.0401	0.1048
$\Delta \ln (W/c)_t \cdot \Delta \ln \text{export}_t$					0.2567	1.1450
$\Delta \ln (W/c)_{t-1} \cdot \Delta \ln \text{export}_{t-1}$					−0.4128	−1.4395
$\Delta \ln (W/c)_{t-2} \cdot \Delta \ln \text{export}_{t-2}$					−0.3824	−0.9412
Instrumental validity		0.76673		0.85355		0.90328
2nd order serial correlation		0.203		−0.022		0.734

Notes:
1. The dependent variable is $\Delta \ln N_t$.
2. Heteroskedastic consistent t-ratios in parentheses.
3. All models are estimated in differences by instrumental variables.
4. Coefficients on time dummies are not reported.

in wages have a negative effect. The positive coefficient on the lagged dependent variable indicates persistence in both the wage and output effects on the level of employment. Finally, we note that the equation performs well in conventional statistical terms with no second order serial correlation and with the Sargan test for instrumental validity indicating that the instrument set and the residuals are not correlated.

Panel 2 of Table 2 reports the results of introducing import and export penetration into the base employment equation. The specification is robust to such change with the signs of the coefficients remaining unchanged and of broadly similar magnitudes. Turning to trade shares we see that the impact effect of import penetration is negative, as expected, and significant at the 1% level. What are the employment implications of these results? Over the period 1981–1991 employ-

Table 3
Employment equations for UK manufacturing: trade by origin

	1		2	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	−0.0015	−0.1863	−0.0002	−0.0234
$\Delta \ln N_{t-1}$	0.4002	2.3935	0.3988	2.3888
$\Delta \ln N_{t-2}$	0.0635	1.0188	0.0555	0.8865
$\Delta \ln Q_t$	0.5257	7.5628	0.5318	7.6063
$\Delta \ln Q_{t-1}$	−0.1784	−1.5180	−0.1784	−1.5262
$\Delta \ln Q_{t-2}$	0.0148	0.2149	0.0181	0.2624
$\Delta \ln (W/c)_t$	−0.2826	−2.8327	−0.2820	−2.8536
$\Delta \ln (W/c)_{t-1}$	0.2822	1.7271	0.2768	1.7561
$\Delta \ln (W/c)_{t-2}$	0.0146	0.1269	0.0176	0.1508
Δ ln concentration	−0.0218	−0.8742	−0.0241	−0.9766
$\Delta \ln \text{Japan}_t$	0.0059	1.3495	0.0049	1.0538
$\Delta \ln \text{Japan}_{t-1}$	0.0004	0.1059	−0.0004	−0.0893
$\Delta \ln \text{Japan}_{t-2}$	−0.0072	−1.2507	−0.0074	−1.2737
$\Delta \ln \text{USA}_t$	−0.0036	−0.5458	−0.0052	−0.7877
$\Delta \ln \text{USA}_{t-1}$	−0.0155	−2.8229	−0.0157	−2.8529
$\Delta \ln \text{USA}_{t-2}$	0.0045	0.6479	0.0061	0.8773
$\Delta \ln \text{E. Asia}_t$	−0.0057	−0.8758		
$\Delta \ln \text{E. Asia}_{t-1}$	0.0025	0.6785		
$\Delta \ln \text{E. Asia}_{t-2}$	0.0019	0.3728		
$\Delta \ln \text{Dragons}_t$			−0.0051	−0.7811
$\Delta \ln \text{Dragons}_{t-1}$			0.0005	0.1226
$\Delta \ln \text{Dragons}_{t-2}$			0.0032	0.7435
$\Delta \ln \text{Tigers}_t$			0.0003	0.1128
$\Delta \ln \text{Tigers}_{t-1}$			−0.0068	−1.8473
$\Delta \ln \text{Tigers}_{t-2}$			0.0038	0.9531
$\Delta \ln \text{EU}_t$	−0.0348	−2.8779	−0.0314	−2.5963
$\Delta \ln \text{EU}_{t-1}$	0.0129	1.2515	0.0119	1.5086
$\Delta \ln \text{EU}_{t-2}$	0.0156	0.9583	0.0151	0.9140
$\Delta \ln \text{export}_t$	−0.0250	−1.6909	−0.0244	−1.6475
$\Delta \ln \text{export}_{t-1}$	0.0111	1.7048	0.0116	1.7146
$\Delta \ln \text{export}_{t-2}$	−0.0085	−0.5233	−0.0108	−0.6757
2nd order serial correlation		0.88772		0.89507
Instrumental validity		0.160		0.297

Notes:
1. The dependent variable is $\Delta \ln N_t$.
2. Heteroskedastic consistent t-ratios in parentheses.
3. All models are estimated in differences by instrumental variables.
4. Coefficients on time dummies are not reported.

ment in manufacturing decreased from 6.107 million to 4.623 million, a reduction of 24.3%. Of this fall, our results indicate that changes in the efficiency of the use of labour as a result of increases in import penetration caused a short-run decline of 86,074 and a long run decline of 94,887. This accounts for 5.8% and 6.4%, respectively, of the 1.484 million fall in employment over the period. This excludes the direct employment displacement effects of trade which have been calculated in studies such as Wood (1991, 1994) (see Section 2). Table 4 shows the two-digit industries particularly affected by the impact of increased import penetration. The extraction of other minerals and ores (SIC 22, 23, 24) has suffered an increase in penetration of over a third, as have the leather and metal goods industries.

Perhaps more surprising, however, is the result that the sign on current export share is also negative and significant and would have accounted for declines in employment of 56,543 (3.8%) in the short run and 69,900 (4.71%) in the long run. Although the magnitude of this effect is smaller than for imports it is nonetheless notable. It suggests that there are also trade induced efficiencies in the use of labour in export oriented industries. Note that there is no strong evidence that the extent of domestic competition affects efficiency since, although the coefficient on seller market concentration is negative, it falls short of significance. [8]

The final panel of Table 2 focuses on the impact of trade changes on the slope of the derived labour demand function since, as we noted earlier, some analysts have suggested increased openness may make it easier to substitute foreign workers for domestic workers. Thus, in panel 3, import and export volumes are interacted with the wage rate. For both, the effect is to increase the wage elasticity though none of the impact effects are statistically significant at conventional levels.

In Table 3, we investigate whether UK trade with different regions impacts differentially on the derived demand for labour. Column one disaggregates imports into those originating from the European Union, United States, Japan and East Asia, which on average accounted for 80% of UK imports over the sample period. The European Union and the United States are the UK's most important trading partners and much of the trade in question is of an intra-industry type. Japan and East Asia have become increasingly important and trade here is more typically inter-industry. The second thing we do is to disaggregate the East Asian countries into the established newly industrialising countries (NICs) (Korea, Taiwan, Hong Kong and Singapore) and the new exporting countries (NECs) (Thailand, Malaysia and Indonesia). These are referred to in the table as the 'Tigers and Dragons', respectively.

Refer first to the broad country results. For all the groupings, the long run impact of import penetration is negative. These effects are rather badly determined however as import change among the regions is somewhat collinear. What is apparent, however, is that the timing and magnitude of impacts differs between regions. As can be seen from Table 5, imports from Japan and East Asia have increased proportionately faster than that from other regions over the sample period. Indeed, import penetration from the United States declined between 1981

[8] This possibility is suggested by Konings and Vandenbussche (1995).

Table 4
Changes in import penetration by industry

$\Delta \ln M < 0$	$0 \leq \Delta \ln M \leq 1/3$	$\Delta \ln M > 1/3$
26 Production of man-made fibres	25 Chemical industries	22 Metal manufacturing
33 Manufacture of office machinery	32 Mechanical engineering	23 Extraction of minerals
36 Manufacture of other transport equipment	34 Electrical engineering	24 Manufacture of non-metallic mineral products
46 Timber and wooden furniture	35 Manufacture of motor vehicles	31 Manufacture of metal goods
47 Manufacture of paper and paper products	37 Instrument engineering	44 Manufacture of leather
49 Other manufacturing industries	41 Food, drink, tobacco	
	43 Textile industry	
	45 Footwear and clothing	
	48 Processing of rubber and plastics	

Table 5
Changes in import penetration by region

Country	Average annual increase 1981–1991
United States	−1.04
Japan	3.04
European Union	0.97
East Asia	4.98

and 1991. However, the strongest induced efficiency effects are associated with imports from the USA and the European Union, though those from the EU have a more immediate impact. When one disaggregates between ‘dragons’ and ‘tigers’ the negative effect of import penetration persists with the coefficient for ‘dragons’ higher than that for ‘tigers’. The stronger impacts from the European Union and the United States are perhaps contrary to the work of Wood (1994) and others. This may reflect the fact that imports from Asia are in those industries which have already declined in importance in the United Kingdom. Labour from the United States and the European Union however more directly competes with that currently extant in the UK. [9] As a result, *x*-efficiency effects are stronger in these sectors. Our results may also be influenced by the fact that we model aggregate employment, rather than focusing on skilled and unskilled workers separately.

5. Conclusions

Throughout the post-war period, the growth in trade has consistently outstripped the growth in real output resulting in a growing integration of the world’s economies. The UK has featured prominently in this process. Recently, the impact of expanding trade on labour markets and labour market adjustment has generated growing interest. In particular, there has been concern about the effect on jobs of the growth of trade in general and the rapid expansion with low wage economies of East Asia. This interest has been acute in the UK given the sharp decline in manufacturing employment in the 1980s. Up until now, however, it has not been empirically investigated.

In this paper, we have investigated the impact of trade on industry level outcomes for a sample of 167 manufacturing industries. We build on a dynamic labour demand equation by incorporating imports and exports in a panel framework using a specially constructed database. Our base equation is well defined and robust to changes in specification. When we introduce trade we find that increases

[9] At the suggestion of an anonymous referee, we investigated whether a differential response existed between high and low IIT industries. Evidence was found that the efficiency impact of imports is stronger in high IIT industries and it is also more rapid. UK trade with the US and EU is predominantly IIT. This will be investigated further in future work.

in trade volumes, both in terms of imports and exports, cause reductions in the level of derived labour demand. This is consistent with the view that increased openness serves to increase the efficiency with which labour is utilised in the firm. Among other things, it could imply that previous work has underestimated the impact of trade by ignoring the extent to which increased import penetration induces the elimination of *x*-inefficiency and the take up of new technology. Our results, however, find limited evidence to support the proposition advanced in Rodrik (1997) that the potential for substituting foreign for domestic workers increases the wage elasticity of the derived labour demand function.

Our database allowed us to disaggregate the import data in order to see whether the region of origin affected labour demand differentially. Some evidence was reported to suggest that this may very well be the case. However, our results suggest very clearly that the disciplining effects of trade with East Asia and Japan appears to be less marked than that associated with imports from the EU. This reinforces the idea that trade affects *x*-inefficiency, with the strongest competition for UK producers coming from the EU and US rather than East Asia.

Finally, the paper points up some potentially interesting avenues for future research. Given more finely graded data, it would be useful to explore the relationship for different categories of labour. Given the extensive literature on the skill gap, disaggregation into different categories of labour is worth pursuing. Aggregating industries into a range of alternative groupings by relative factor intensities would also be worth exploring. In addition, the links between the speed of adjustment and the importance of IIT merit further investigation. This is an issue which has attracted much comment but little serious research.

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