Domestic wage determination: Regional Spillovers and inward investment

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ABSTRACT. This paper evaluates the extent of inter-industry, and inter-regional wage spillovers across the UK. A large literature exists suggesting that wages elsewhere affect wage determination and levels of satisfaction, but this paper extends the analysis to examine the effects of inward investment in the process. Thus far the specific effect of foreign wages on domestic wage determination has not been evaluated. Using industry and regional level panel data for the UK the paper reports evidence that such wage spillovers do occur, and that they are more widespread for skilled, than for unskilled workers and also lower in areas of high unemployment.

JEL Classification: J21; J30

Keywords: Wage determination; regional spillovers; alternative wage.

We are grateful to Kristof Dascher, Gilles Duranton and other participants at the conference on Agglomeration and Labour Markets at the DIW in Berlin. Thanks are also due to Sourafel Girma, Patrick Minford, Stanley Siebert, and other participants at various seminars in Lancaster, Nottingham, Birmingham and the University of Wales Colloquium for comments on earlier versions of this paper.

I. Introduction

A substantial body of literature exists which suggests that wages are influenced by spillover effects from wages set elsewhere. For example, a number of authors have considered the extent to which wages set in one region may influence wage determination in neighbouring (contiguous) areas, Manning (1994); Burridge and Gordon (1981); Molho (1982). In a similar vain researcher's have also considered the extent to which inter-industry spillovers effect wage determination. For example, Smith (1996) found that within the chemicals industry the existence of a wage leader influences the wage determination of other groups. Moreover, Latreille and Manning (2000) evaluate inter-industry and inter-occupational impacts, again finding that wages elsewhere impact on wage determination. The motivation of this paper is to add to this literature by considering inter-industry, and inter-regional wage spillovers, using the concept of contiguity, but specifically the extent to which spillovers occur between the foreign and domestic sectors of UK industry. We also make a distinction between the potential effects upon skilled and on unskilled wages, given the growing literature that suggests that foreign owned firms have higher levels of skill intensity, but also pay higher wages than the UK-owned sector. The following section provides a brief rationalisation for how such spillovers can be justified. This is followed in section III by the potential role of foreign direct investment, the theory and empirical model in section IV, an introduction to the data in section V, and results in section VI.

II. Why do fallback wages matter?

Notions of fairness and the importance of comparison incomes have long been an important notion in the psychology and sociology literature, Ross (1948); Adams

(1963), and more recently in economics, Akerlof and Yellen (1990); Rees (1993); and Smith (1996). For example, Ross (1948) argued:

"comparisons play a large and often dominant role as a standard of equity in the determination of wages under collective bargaining."

The underlying mechanism driving the importance of comparison incomes is the concept of a reference level of income against which an individual compares oneself, which is also related to issues of individual utility or satisfaction, Clark and Oswald (1996); and Hamermesh (2001). The concept of wage spillovers between industries or regions can be justified theoretically with reference to bargaining theory and migration. In bargaining models, where the aim is to maximise utility over and above some minimum level, neighbouring wages take the form of fallback wages. This provides an obvious link to models based upon migration, Harris and Todaro (1970). If its possible for workers to migrate between different industries and regions, then wage increases in adjacent industries or regions may result in workers migrating to the more attractive (in terms of wages) location. Clearly, the above are closely related and each implies that comparison wages are important. A further dimension to these "alternative wages" is the distinction between foreign and domestic firms in the UK. It is well documented that MNEs in the UK pay above average wages, for instance Girma et al. (2001), so it is feasible to suggest that wages paid by foreign owned firms may generate wage spillovers in the domestic sector. The rationale for this, and the potential limitations to the process of foreign-to-domestic wage spillovers are discussed in the following section.

There are however, some perceived limits to this process, as labour market segmentation may limit the scale and scope of wage spillovers, particularly between regions. For example, it is well understood that unskilled workers are less mobile than

skilled ones, and so inter-regional effects are likely to be smaller for unskilled workers than for skilled workers (McCormick, 1997). Further, there is also evidence that technological change generated an increase in wage inequality, see for example Machin and Van Reenen (1998), as the demand for skilled workers increased. This occurred as new technologies employed were complementary to skilled labour, or skill biased, and so disadvantaged the less skilled worker.

III. The role of foreign direct investment in wage comparisons

There are a number of studies that identify substantial differences in factor demand between foreign and domestic firms (Driffield, 1996; Conyon et al., 2002; and Girma et al., 2001). The inference here is that foreign multinationals demonstrate higher levels of labour productivity, and in turn greater demand for high quality labour. Entry by such firms therefore is expected to impact on domestic labour markets, and linked to this is the likely impact on domestic firms of the inflow of new technology that is assumed to accompany FDI. There is growing evidence for this in the UK – Driffield (1996) finds that foreign firms will pay wages above the industry average of around 7%, partly due to productivity differences. Conyon et al. (2002) find a wage differential of 3.4% wholly attributable to productivity, and Girma et al. (2001) find wage and productivity differentials of 5%. Figure 1 illustrates the differential between foreign and domestic unskilled wages over the period, while Figure 2 illustrates a

<<FIGURE 1 HERE>>

similar differential for skilled workers. These demonstrate that foreign firms pay on average 11% more to unskilled workers than domestic firms, and approximately 9%

<<FIGURE 2 HERE>>

more to skilled workers[i]. Driffield (1999) shows that as a result of these higher wages, increased inward investment acts to bid up wages, and in the short term to reduce employment. However, in this study the labour market effects of FDI were effectively constrained to intra-industry effects, which also therefore encompass the crowding out of domestic employment through product market competition. The labour market impacts of inward investment however are expected to be wider reaching than this. Foreign entrants pay higher wages than incumbent domestic firms, and therefore may attract higher quality workers. As a result, domestic firms will experience wage inflation if they are to retain workers as employees compare their wages with those available elsewhere. While this effect is likely to be strongest within the same industry and region, it is anticipated that this effect will spillover between regions (particularly contiguous regions) and between industrial sectors engaged in similar activities.

Inward investment has compounded this effect, as Barrell and Pain (1997) show that one of the major impacts of inward investment into the UK has been to introduce new technology, and generate a decline in the overall demand for unskilled labour. Further, Driffield and Taylor (2000) demonstrate that productivity spillovers from FDI are partly facilitated by domestic firms becoming more skill intensive, and as such, one may expect wage spillovers to affect the market for skilled, rather than unskilled workers. The above discussion suggests therefore, that wage spillovers from inward investment will be greater for skilled workers than for unskilled workers, in terms of both inter-regional impacts, and foreign to domestic impacts. This is an important issue for policy makers, as concern has been expressed that both skill shortages and labour market tightening have been exacerbated in certain parts of the country by inward investment. Equally, if inward investment merely bids up skilled

wages in the domestic sector, then this will increase wage inequality, not only between skilled an unskilled workers, but also across industries and perhaps more importantly across regions.

The existence of foreign-to-domestic wage spillovers, and also the extent to which segmentation between the foreign and domestic sectors exists, can be tested directly. This can be achieved with the use of contiguity matrices, following Latreille and Manning (2000), but extending their analysis to include different spillover terms for wages in the foreign and domestic sectors. Further, comparing wage spillovers in the skilled and unskilled sectors can test the hypothesis of segmentation as a restriction to spillovers. We hypothesize that segmentation will be less important in the market for skilled workers, and as such that foreign-to-domestic wages spillovers will be greater for skilled workers. Also, that wage spillovers for unskilled workers will be limited geographically, as unskilled workers are less mobile.

IV. Theory and empirical model

The theoretical approach is based upon a simple structural model of the labour market highlighting the role of alternative domestic and foreign wages as comparison incomes on the supply side. For exposition, we assume a Cobb-Douglas production function for the domestic sector, of the form: $Q = AK^{a}L_{s}^{b_s}L_{u}^{b_u}$ where Q is output, K is capital and labour L is split into skilled s and unskilled u. Production takes place subject to the cost constraint $C = w_{s}L_{s} + w_{u}L_{u} + rK$, where C is cost, w is the price of labour (for skilled and unskilled workers s, u) and r is the price of capital. From these expressions we gain the domestic marginal products for skilled and unskilled workers given as $MP_{Ls} = \partial Q / \partial L_{s} = AK^{a}b_{s}L_{s}^{b_s-1}L_{u}^{b_u}$, $MP_{Lu} = \partial Q / \partial L_{u} = AK^{a}L_{s}^{b_s}b_{u}L_{u}^{b_u-1}$ and

the marginal product of capital is $MP_K = \partial Q / \partial K = A\alpha K^{\alpha-1} L_s^{\beta_s} L_u^{\beta_u}$. Writing the relative marginal product of labour, for the g^{th} type of worker, to capital equal to price i.e. $(MP_{Lg}/MP_K) = (w_g/r)$ we can gain a function for domestic labour demand, from the Lagrangian, as follows:

$$L_g = \frac{rK\beta_g}{\alpha w_g} \tag{1}$$

However, the ability for the firm to hire workers must be seen in the context of a labour supply function. From the perspective of the firm, this is a function of the wage rate that is offered to the g^{th} type of worker in the domestic sector, W_{Dg}, the unemployment rate[ii] U and the alternative wage W_A, so

$$S_{Lg} = f(W_{Dg}, U, W_A) \tag{2}$$

In turn the alternative wage is determined by other outside wages in the domestic sector W_D and wages paid by the foreign owned sector, W_F, so $W_A = h(W_D, W_F)$. The outside domestic wage in the same industry and region[iii] is a cross wage spillover term W_{Dh} $g \neq h$, akin to Latreille and Manning (2000), to investigate whether skilled wage rates have an impact upon unskilled wage determination and vice versa. Thus, the supply of labour, based upon a Cobb-Douglas production function, can be given as:

$$S_{Lg} = \frac{U^{\gamma} w_g^{\rho}}{W_{Dh}^{\theta_1} W_F^{\theta_2}} \quad \theta_i > 0 \qquad g \neq h \tag{3}$$

Consequently we have a structural model for labour demand and supply, given by the following two equations derived from logarithmic transformations of equations 1 & 3:

$$\ln LD_g = \ln r + \ln K + \ln \beta_g - \ln \alpha - \ln W_{Dg} \tag{4}$$

$$\ln LS_g = \gamma \ln U + \rho \ln W_{Dg} - \theta_1 \ln W_{Dh} - \theta_2 \ln W_F \qquad g \neq h \tag{5}$$

The reduced form for unskilled and skilled wages, assuming $LD_g = LS_g$, is given by:

$$(1+r)\ln W_{Dg} = \ln r + \ln K + \ln b_g - \ln a - l \ln U + q_1 \ln W_{Dh} + q_2 \ln W_F \quad g \neq h \quad (6)$$

which after dividing equation 6 through by $(1+r)$ gives a log-linear model.

In standard wage determination models, see for example Willis (1986), a vector of further characteristics, or "fixed effects" such as age, experience, education, gender and ethnic group would be included. Such data is clearly not available at this level of disaggregation, but these effects can be captured by a lagged dependent variable, which by definition is correlated with these fixed effects. Thus, including a lagged dependent variable equation 6 becomes:

$$W_{Dg}(t) = \Phi W_{Dg}(t-1) + \boldsymbol{X}(t)b + q_1 \ln W_{Dh}(t) + q_2 \ln W_F(t) + e_g(t) \quad g \neq h \quad (7)$$

where $W_{Dg}(t-1)$ is the lagged dependent variable, X is a matrix of factors influencing domestic wages, the other wage terms are as defined above, in practice r and b_g from equation 6 are subsumed by time dummies, while e_g is a white noise error term. As it stands equation 7 suggests that alternative domestic wages and/or foreign wages in the same sector have a positive spillover effect upon wages, given by the coefficients q_1 and q_2, for possible reasons as discussed in sections II and III. So far the empirical model of equation 6 has only considered alternative wages in the same industry and region as $w_g(t)$ defined by the cross wage term and foreign wages. To further the analysis we consider the influence of domestic and foreign wages in adjacent regions and industries using contiguity matrices, which inform us of neighbouring industry and/or regional wages. Given the data (see section V below) we are able to split the sample into foreign and domestic sectors with details for each of the 2 digit industries and 11 regional affiliation. Given this and assuming that industry i„ j and region r„ v the contiguity matrices are defined as follows:

A. Contiguous industry domestic wage $d_1 = 1$ if 2 digit domestic industry i is in the same 1 digit industry as 2 digit domestic industry j; zero otherwise.

B. Contiguous industry foreign wage $l_1 = 1$ if 2 digit domestic industry i is in the same 1 digit industry as 2 digit foreign industry j; zero otherwise.

C. Contiguous region domestic wage $d_2 = 1$ if domestic industry r is in an adjacent region to domestic industry v; zero otherwise.

D. Contiguous region foreign wage $l_2 = 1$ if domestic industry r is in an adjacent region to foreign industry v. zero otherwise.

After defining the contiguity matrices and including them in equation 7 we get wages for the g^{th} type of worker, omitting time subscripts except for the lagged dependent variable, given as:

$$W_{Dg}(t) = \Phi W_{Dg}(t\text{-}1) + \boldsymbol{X}b + q_1 \ln W_{Dh} + q_2 \ln W_F + q_{11}\left(d_1 \times \ln W_D\right) + q_{12}\left(d_2 \times \ln W_D\right)$$
$$+ q_{21}\left(l_1 \times \ln W_F\right) + q_{22}\left(l_2 \times \ln W_F\right) + e_g \qquad g \neq h \qquad (8)$$

This is therefore suggestive of a spatial dependence model, common in the regional science literature. The econometric issues associated with such a specification are relatively well understood, and as discussed within a standard cross-sectional framework, see for example Anselin and Florax (1995) and Lesage (1999). However, the specification of (8) represents a potentially important improvement on these cross-sectional approaches, as it allows degree of the inter-regional dependency to vary across regions.

Whilst unemployment is expected to have a negative impact on wage rates, following Latreille and Manning (2000), it is also clear from Table 1, that different regions of the UK exhibit markedly different patterns of unemployment. Further,

regions with Assisted Area status have often sought to attract inward FDI in order to reduce structural unemployment.[iv] It is likely that the effects of external wages, and

<<TABLE 1 HERE>>

indeed the other explanatory variables on wage determination will differ across regions, varying with the levels of unemployment. While this is largely an empirical question, it is clearly an important consideration for the modelling of wage spillovers.

The regions with higher unemployment: North West; North; Wales and Scotland were all covered by assisted area status during the period. One common criticism of estimating a model like in equation 8 is that the unemployment variable is endogenous. Consequently, in the empirical analysis in addition to employing unemployment as an explanatory variable, we also split the sample by region in terms of assisted and non-assisted area status. When we do so equation 8 is estimated dropping the unemployment term.

A final consideration is that with two types of labour (skilled and unskilled) the estimation of equation 8 for these groups should allow for simultaneity in wage determination. This is particularly pertinent when considering the impact of cross wages, that is, the effect of skilled wages on unskilled pay, and vice versa. This is something that is hitherto ignored in previous studies, see for example Latreille and Manning (2000), Lee and Pesaran, (1993). The first-differenced versions of the skilled and unskilled wages equations are therefore estimated simultaneously via iterated three stage least squares (FD-3SLS). This method is explained in greater depth in section VI.

V. Data

The UK Office of National Statistics (ONS) provided the data used for the empirical analysis. The data set comprises information for both the foreign owned, and domestically owned sectors of UK manufacturing, and comprises industry and regional level data for the UK, covering the period 1984-1992. There are 11 standard planning regions, and 19 manufacturing sectors (2-digit level based on 1980 SICs), see Table 2. The advantage of such data, in addition to isolating domestic-foreign

<<TABLE 2 HERE>>

interactions, is that it allows one to evaluate inter- and intra-regional effects, as well as inter- and intra- industry effects. These are based on the best alternative pay, in the industry and sector, in surrounding regions, or related industries. Skilled wages SW are, in both the domestic and foreign sector, defined as annual earnings of non-manual workers and conversely unskilled wages UW are defined by the annual earnings of manual workers. The capital stock K in the domestic sector is estimated as the sum of net capital investment of the previous 7 years, depreciated by 10% per annum. The unemployment rate U is based upon regional level data and does not vary across industries. To construct the alternative wage we chose the maximum wage available in contiguous industries or regions such that it represents the best alternative wage.

<<TABLE 3 HERE>>

Table 3 shows the sample means for a number of variables. For instance, over the period 1984 to 1992 the unemployment rate across regions averaged 10 percent. The region with the highest average wage[v] in the foreign sector was the North West and for the domestic sector the North East. Looking at the ratio between the foreign and domestic wage bill the largest differential is seen in the North West, 21 percent. In terms of spillover effects and the contiguity matrices, imagine a worker employed

in industry i who lives in York & Humberside. There are a variety of spillovers that may occur in his/her wage determination. For example, the average wage bill in the domestic sector in York and Humberside is £500 less than that in the North West, so a negative effect on wage aspirations may be expected. However, if the individual remains leaving in the York & Humberside but is able to move from the domestic to foreign sector then this may yield a positive spillover, since foreign wages are around £1,500 higher. An even greater effect on his/her wages may be the possibility of moving (i.e. a migration argument Harris and Todaro, 1970) to the North West and working in the foreign owned sector, where the average wage bill differential is £4,100. Akin to this argument the differential between the average wage bill by industry and domestic/foreign sectors is also applicable.

VI. Empirical Results

We estimate first-differenced versions of the skilled and unskilled wage equations (8) using three stage least squares (FD-3SLS)[vi]. Lagged wages and capital and are employed as instruments in the first-differenced (i.e. wage growth) equations in the spirit of Anderson and Hsiao (1981) and Arellano and Bond (1991).[vii] Using the same set of instruments that would be suggested by single equation dynamic panel data procedures)[viii]. Overidentification test statistics (which are the FD-3SLS objective function evaluated at the solution points and divided by the sample size) are also computed to test the validity of the instrumental variables. Tests for spatial correlation, and autoregression are also included in the analysis. All estimates are based upon heteroscedastic robust standard errors and include a set of time dummies that all prove significant. After losing observations for first differencing and instrumenting estimation is based upon 1,330 observations. All alternative wage

variables are instrumented with lagged values due to possible endogeneity problems, as is the capital stock, and the unemployment rate. Table 4, below, shows the results of estimating equation 8 for unskilled labour, where the dependent variable is the domestic industry unskilled wage by region over time. The first column includes unemployment as an explanatory variable, whereas the final two columns split the sample by assisted area status. Similarly, Table 5, below, shows the results of

<<TABLE 4 HERE>>

estimating the same model for skilled labour, with the dependent variable being the domestic industry skilled wage by region over time. The global validity of the instruments estimation in the simultaneous estimation is confirmed (at 5% level) by the Sargan tests reported in both the skilled and unskilled wage equations towards the bottom of the tables. This is further reinforced by the absence of a second-order serial correlation in the first-differenced models under consideration.

<<TABLE 5 HERE>>

In both the skilled and unskilled domestic wage equations the lagged wage rate is significant, as found by Lee and Pesaran (1993) and Latreille and Manning (2000). However, the results differ from Latreille and Manning (2000), and indeed other single-equation estimates of wage spillovers, in that the coefficient on the "cross wage" term, that is the wages of skilled workers, is negative in Table 4. The same is also true for the cross wage term in the skilled wage equation, Table 5. When the wages for the two occupational groups are estimated simultaneously, the two groups become substitutes. Theoretically this is intuitively appealing, as it is likely that wages for both groups are settled simultaneously, although this has largely been ignored in the previous literature. This finding of two-way spillovers between unskilled and

skilled wages is consistent with the theoretical proposition advocated by Akerlof and Yellen (1990).

These results highlight the importance of employing a simultaneous equation estimator, as there are sizable differences in the cross-wage coefficients between the two estimators, these differences being highly significant in the case of unskilled workers. Once one allows for simultaneity, the importance of wage spillovers across groups becomes significantly greater, where single equation studies often fail to find this impact[ix], particularly in terms of the effect of skilled wages on unskilled workers[x], and the coefficient sign changes.

While the capital stock is positively correlated with wages, this effect is greater for unskilled workers, significantly so for the full sample. It is likely that increased capital expenditure impacts on unskilled labour productivity to a greater extent than it does on the productivity of skilled labour. Unemployment is significant in both equations and has a negative impact as expected, with a significantly greater impact on unskilled wages, again as one would expect. A 10 percentage point increase in unemployment leads to unskilled wages falling by around 3.6 percentage points. This is consistent with Blanchflower and Oswald (1994) and Cameron and Muellbauer (2000), but contrasts with Latreille and Manning (2000) who find no significant difference in the impacts of unemployment. The importance of unemployment in terms of the differential effects on skilled and unskilled wages can also be seen in the wage spillover terms, particularly when comparing assisted and non-assisted areas. There has been a sharp reduction in the responsiveness of migration to unemployment after the 1970s, Gordon and Molho (1998), so the role of unemployment in dampening the influence of wage comparability's is limited.

Contiguous inter-industry and inter-regional domestic wages are however more important in skilled wage determination than for unskilled wage determination, and less important in assisted areas both in terms of magnitude and significance. This again confirms a priori expectations, that unskilled workers, particularly those in areas of high unemployment would be the least mobile, and therefore the least likely to be experience wage spillovers. Turning to the foreign wage variables, there is evidence that the existence of higher-paying foreign firms exerts upward pressure on wages in domestically owned firms. There is a growing literature that suggests that there is a gap between wages paid in the foreign sector to those wages in the domestic sector of around 5% to 7% in favour of foreign firms (see Section III). While wage spillovers from foreign to domestic firms are largely confined to intra-industry, intra-region effects, such spillovers exist even within assisted areas, where the magnitude of the impact is actually larger. This is a potentially important result, as it suggests that even in areas of high unemployment, inward investment acts to bid up wages in the domestic sector. For skilled workers, this effect is particularly strong, a 10% increase in foreign wages will increase domestic wages by some 2.9%, suggesting that in such cases inward investment acts to greatly increase the demand for skilled workers, forcing domestic firms to pay higher wages to key workers.

When considering the impact of inter-industry or inter-regional contiguous foreign wages, the greatest effects are again found for skilled workers, with foreign wages exerting a greater effect inter-industry and inter-regionally on skilled than unskilled workers. This difference between the coefficients in the two wage equations is significant in the case of assisted areas, where there are no discernible wage spillovers for unskilled workers. This again seems a plausible result, and ties in with results reported elsewhere, which show that foreign firms are more skill intensive than

domestic firms, Driffield and Taylor (2000). Consequently, it is logical to assume that skilled workers in the domestic sector are more likely to be able to move into the foreign sector, because the foreign sector demands skilled labour. Because of this issues of fairness and comparability feed through into the skilled wage equation, and effects are smaller and insignificant in the unskilled wage equation.

VII. Conclusions

Wage spillovers do occur, but the magnitudes of these effects suggest that inter-regional or inter-sectoral wage spillovers are limited[xi]. There is evidence of wage spillovers, for both skilled and unskilled workers, both across regions, industries, and between the foreign and domestic owned sectors. However, for both inter-regional, and inter-industry effects, the impact of wages paid by foreign owned firms is limited to skilled workers. It is also worth noting, that foreign wages impact, even within the region, to a larger extent on domestic skilled wages. This adds credence to the recently expressed concerns that inward investment may act to increase wage inequality between the two groups, Driffield and Taylor (2000).

As such, there are inter-regional wage spillovers from FDI, but these are restricted to skilled workers. There are several potential explanations of why wage spillovers are greater for skilled workers. Firstly, it is widely accepted that skilled workers have greater mobility, and often their skills are more transferable between industries. It is also interesting to note that wages paid by foreign firms have a greater impact on domestic skilled wages. This may be due to skill shortages, with inward investment encouraging inter-regional mobility of skilled workers, due to the higher wages on offer.

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Figure 1: Foreign and domestic unskilled wages, not inflation adjusted.

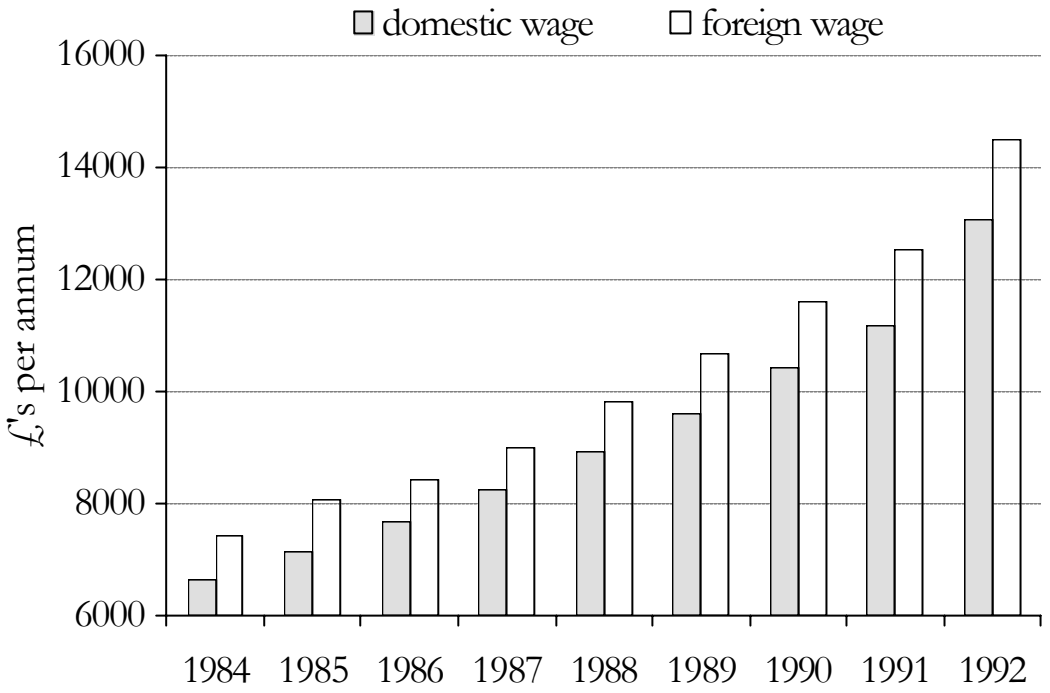

Figure 2: Foreign and domestic skilled wages, not inflation adjusted.

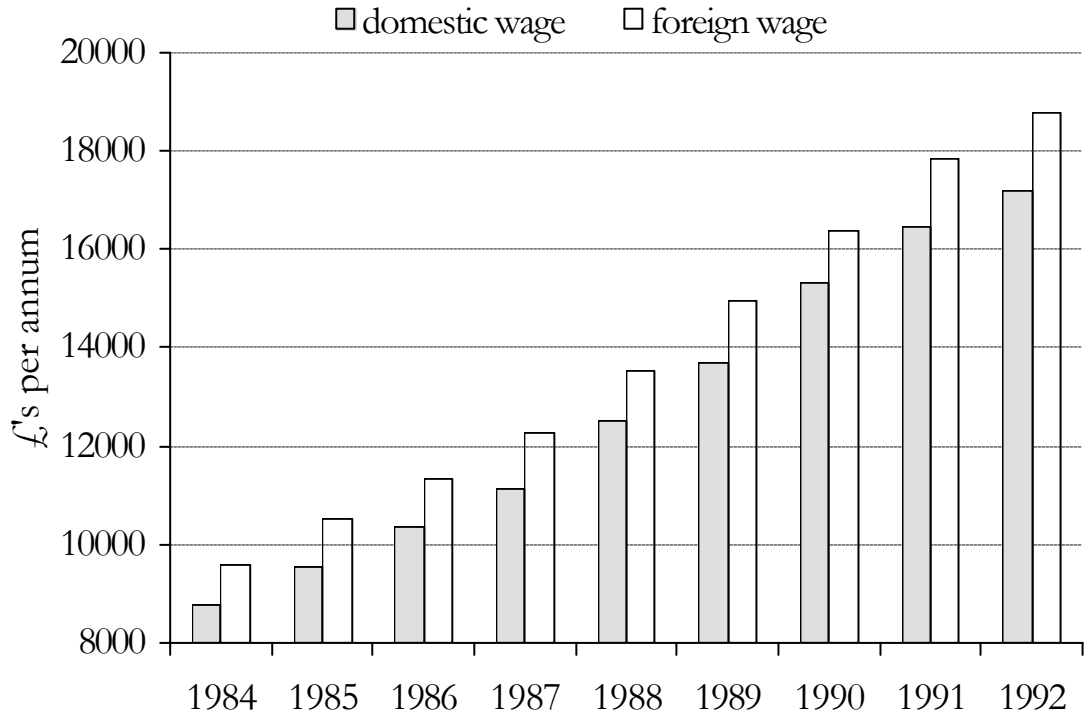

Table 1 Average unemployment rates by region over the period 1984–92

	Unemployment%
South East	6.80
East Anglia	6.40
South West	7.50
West Midlands	10.10
East Midlands	8.00
Yorkshire & Humberside	9.90
North West*	11.10
North of England*	12.50
Wales*	10.50
Scotland*	11.00

* Mostly covered by Assisted Area Status during the period.

Table 2 Definitions of regions and industries.

Regions	Industries	
	SIC code	Description
South East	22	Metal manufacturing
East Anglia	23	Extraction of minerals not elsewhere specified
South West	24	Manufacture of non-metallic mineral products
West Midlands	25	Chemical industry
East Midlands	26	Production of man-made Fibres
York and Humberside	31	Manufacture of metal goods not elsewhere specified
North West	32	Mechanical engineering
North East	33	Manufacture of office machinery & data processing equipment
Wales	34	Electrical & electronic engineering
Scotland	35	Manufacture of motor vehicles & parts
Northern Ireland	36	Manufacture of other transport equipment
	37	Instrument engineering
	41	Food, drink and tobacco
	43	Textile industry
	45	Footwear and clothing industries
	46	Timber & wooden furniture industries
	47	Manufacture of paper & paper products; printing & publishing
	48	Processing of rubber & plastics
	49	Other manufacturing industries

Table 3 Summary statistics of sample means.

Wages, capital and unemployment (000's)	
Domestic skiiled wage	£238,193
Domestic unskilled wage	£140,301
Foreign skilled wage	£335,027
Foreign unskilled wage	£213,061
Capital	£1,261,219
Unemployment	10%

Average foreign and domestic wages per head and ratio by region

	Foreign wage	Dometic wage	Ratio
South East	£19,800	£17,100	1.16
East Anglia	£17,200	£16,800	1.02
South West	£16,800	£16,800	1.00
West Midlands	£18,400	£16,400	1.12
East Midlands	£18,000	£15,500	1.16
York and Humberside	£17,800	£16,300	1.09
North West	£20,400	£16,800	1.21
North East	£19,200	£17,400	1.10
Wales	£18,100	£17,300	1.05
Scotland	£18,300	£16,700	1.10
Northern Ireland	£14,900	£14,900	1.00

Average foreign and domestic wages per head and ratio by industry

	Foreign	Domestic	Ratio
sic22	£20,000	£20,300	0.98
sic23	0	0	0.00
sic24	£17,900	£18,000	0.99
sic25	£19,200	£19,000	1.01
sic26	0	0	0.00
sic31	£17,200	£16,100	1.07
sic32	£18,400	£18,400	1.00
sic33	£20,600	£18,200	1.13
sic34	£15,800	£15,600	1.02
sic35	£22,600	£20,100	1.12
sic36	£17,300	£18,600	0.93
sic37	£15,400	£15,500	0.93
sic41	£21,000	£15,200	1.38
sic43	£14,300	£13,000	1.10
sic45	£10,700	£10,300	1.04
sic46	£13,500	£15,400	0.87
sic47	£20,700	£18,800	1.10
sic48	£19,100	£17,100	1.12
sic49	£13,600	£13,400	1.01

Definitions of industry sic codes are given in Table 2. Average wage per head = total wage bill÷employment by industry (region)

Table 4 Domestic unskilled wages W_{Du}.

	Full sample		Assisted areas		Non-assisted areas	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
$W_{Du}(t-1)$	0.419	8.56**	0.433	7.03**	0.420	6.93**
$W_{Du}(t-2)$	0.141	2.41**	0.284	3.83**	0.032	0.45
$K(t-1)$	0.312	10.50**	0.238	9.56**	0.171	4.06**
$K(t-2)$	0.109	9.45**	0.075	6.69**	0.063	3.83**
$U(t-1)$	-0.361	4.01**				
$U(t-2)$	-0.058	2.09**				
$W_{Ds}(t-1)$	-0.229	8.43**	-0.133	2.64**	-0.136	4.79**
$W_{F}(t-1)$	0.170	5.51**	0.235	3.79**	0.085	3.54**
Contiguous region domestic wage $(d_2 \times W_D)(t-1)$	0.082	2.04**	0.053	1.15	0.103	2.58**
Contiguous region foreign wage $(l_2 \times W_F)(t-1)$	0.067	1.67*	0.003	0.81	0.036	2.13**
Contiguous industry domestic wage $(d_1 \times W_D)(t-1)$	0.007	1.64*	0.004	0.38	0.040	3.02**
Contiguous industry foreign wage $(l_1 \times W_F)(t-1)$	0.003	1.21	0.001	0.65	0.061	2.82**
Observations	1,330		798		532	
Time dummies	Yes		Yes		Yes	
Sargan P-value	[0.303]		[0.359]		[0.241]	
AR(2) P-value	[0.526]		[0.413]		[0.478]	
Spatial autocorrelation p value	[0.185]		[0.214]		[0.118]	

* significant at the 10% level, ** significant at the 5% level. Time dummies are jointly significant. The test for spatial autocorrelation is based on the test statistic given by Anselin and Kelejian (1997). W_{Du} is the domestic unskilled wage, K is capital stock, U is unemployment, W_{Ds} is the domestic skilled wage rate i.e. cross wage term in the same industry & region, W_F is the foreign alternative wage in the same industry & region, and contiguous industries & regions when interacted with the terms d_1, l_1, d_2, l_2 as described in section IV. Likewise, W_D is the domestic alternative wage in contiguous industries & regions when interacted with the terms d_1, l_1, d_2, l_2.

Table 5 Domestic skilled wages W_{Ds}.

	Full sample		Assisted areas		Non-assisted areas	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
$W_{Ds}(t-1)$	0.401	2.17**	0.319	4.35**	0.445	3.19**
$W_{Ds}(t-2)$	0.105	1.63*	0.160	2.73**	0.111	1.54*
$K(t-1)$	0.101	2.82**	0.156	1.94*	0.126	2.75**
$K(t-2)$	0.040	0.23	0.014	0.97	0.023	1.02
$U(t-1)$	-0.152	2.77**				
$U(t-2)$	-0.034	0.63				
$W_{Du}(t-1)$	-0.115	3.53**	-0.093	1.90*	-0.099	3.22**
$W_{F}(t-1)$	0.179	5.09**	0.290	4.25**	0.168	5.13**
Contiguous region domestic wage $(d_2 \times W_D)(t-1)$	0.127	2.78**	0.154	1.79*	0.115	2.75**
Contiguous region foreign wage $(l_2 \times W_F)(t-1)$	0.088	0.11	0.131	1.71*	0.114	1.53*
Contiguous industry domestic wage $(d_1 \times W_D)(t-1)$	0.011	3.15**	0.002	1.18	0.039	2.34**
Contiguous industry foreign wage $(l_1 \times W_F)(t-1)$	0.003	4.33**	0.007	2.45**	0.029	3.00**
Observations	1,330		798		532	
Time dummies	Yes		Yes		Yes	
Sargan P-value	[0.498]		[0.540]		[0.591]	
AR(2) P-value	[0.423]		[0.139]		[0.333]	
Spatial autocorrelation p value	[0.139]		[0.188]		[0.126]	

* significant at the 10% level, ** significant at the 5% level. Time dummies are jointly significant.
The test for spatial autocorrelation is based on the test statistic given by Anselin and Kelejian (1997).
W_{Ds} is the domestic skilled wage, K is capital stock, U is unemployment, W_{Du} is the domestic unskilled wage rate i.e. cross wage term in the same industry & region, W_F is the foreign alternative wage in the same industry & region, and contiguous industries & regions when interacted with the terms d_1, l_1, d_2, l_2 as described in section IV. Likewise, W_D is the domestic alternative wage in contiguous industries & regions when interacted with the terms d_1, l_1, d_2, l_2.

ENDNOTES

[i] In both cases approximately 40% of this differential is due to foreign firms being more highly concentrated in high-wage industries or regions, for details of the methodology used in this disaggregation, see Davies and Lyons (1991).

[ii] The labour force LF is defined as the unemployed UE plus the employed E, LF=UE+E, thus the unemployment rate is defined as U=UE/LF.

[iii] We consider the possibility of spillovers from adjacent industries or adjacent regions (both domestic and foreign spillovers) below.

[iv] See for example Morgan (1997) for a full discussion of this.

[v] The average wage bill was calculated as: Total wage bill divided by employment, by industry and region.

[vi] Notice that in the linear context we are working with, the 3SLS estimator can be derived as a GMM estimator from the orthogonality conditions implied by the set of instrument (see Theorem 5 in Cornwell et al., 1992).

[vii] Our approach of estimating the system of dynamic panel equations is in the spirit of Holtz-Eakin et al. (1988), using lagged values as instruments to generate orthogonality conditions on differenced data, and employing GMM.

[viii] We are thankful to Sourafel Girma for suggesting this estimator.

[ix] In the unskilled and skilled wage equations the estimates on the cross wage term using single equation GMM techniques were as follows (t-statistics in parenthesis):

Cross wage term	Full sample	Assisted areas	Non assisted areas
Unskilled wage equation: $W_{Ds}(t-1)$	0.001 (1.79)	0.004 (3.69)	0.003 (1.14)
Skilled wage equation: $W_{Du}(t-1)$	0.013 (0.20)	0.0004 (2.04)	0.0003 (0.59)

[x] Apart from the cross wage term, the results from single equation GMM estimation of a dynamic panel model, Arellano and Bond (1991), were similar in terms of interpretation to those reported in the paper based upon first-differenced 3SLS.

[xi] Ingram et al. (1999) report that issues of wage comparability are becoming less important over time in the UK, as does Hamermesh (2001) for the USA.