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Wages, Productivity and Foreign Ownership in UK Manufacturing

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Abstract

The presumed higher productivity of foreign firms and the resulting potential for spillovers to domestic firms has led governments to offer financial incentives to foreign firms to locate in their country. We investigate if there is any productivity or wage gap between foreign and domestic firms in the UK and if the presence of foreign firms in a sector raises the productivity of domestic firms in that sector. We then relate the size of the spillover parameter to some firm and industry characteristics. Our results indicate that foreign firms do have higher productivity than domestic firms and they pay higher wages even after controlling for the sectors in which they are located and the size of affiliates. This differential is around 5% in terms of total factor productivity and wages once productivity differences are accounted for. However, we find no aggregate evidence of intra-industry spillovers, although sector and firm characteristics influence how they affect individual firms. Firms with low productivity relative to the sector average gain less from foreign firms, as do firms in sectors with low skills and low levels of foreign competition.

Outline

1. Introduction

Governments the world over intervene to try to influence the volume and pattern of foreign direct investment (FDI). Many government agencies offer incentives in the form of trade policy concessions, financial assistance, tax break and so on. There is evidence that such incentives have increased in the 1980s and the transfers involved can be very substantial. For example, the British government provided the equivalent of $30,000 per employee to attract Samsung to invest in North East England and the equivalent of $50,000 per employee to attract Siemens to Newcastle (UNCTAD 1996). These are very significant subventions from public funds and their scale demonstrates a belief on the part of government that there are benefits from attracting FDI. It has been argued that a key motivation for attracting such investment is the productivity gap between foreign owned and indigenous firms and the resulting potential for spillovers. In this paper we investigate whether there is any substance behind the belief that there is a productivity gap (and perhaps associated wage gap) between foreign owned and British firms and whether domestic firms gain from the presence of foreign firms in the economy.

This paper has two main parts. In the first part we test for any differential in the levels and growth rates of labour productivity, total factor productivity and wages between foreign and domestic firms. In the second part we test whether an increase in foreign presence in a manufacturing sector has an effect on the level and growth of productivity and wages of local firms in the same sector. We also try to relate the size of the spillover parameter to some firm and industry characteristics.

The structure of the paper is as follows. Section 2 gives an outline of why we expect a productivity differential to exist, and reviews results from other empirical works. Section 3 describes our data set, and gives some evidence on the existence of productivity and wage differentials. Section 4 addresses the issue of spillovers, discussing the available evidence and presenting our own results. Finally, Section 5 concludes.

2. Productivity and Wage Differentials

2.1 *Why do we expect productivity and wage differentials?*

Theories concerning foreign direct investment (FDI) agree on at least one major point: foreign firms must have inherent advantages that allow them to overcome the higher costs

they experience with respect to domestic firms (Hymer, 1976; Kindleberger, 1969)[1]. These higher costs are incurred as domestic firms know the local market, including contacts with suppliers, demand conditions, the culture and language, the legal environment and product standards, while foreign firms do not. The firm-specific advantages (or assets) of the foreign firms may be either tangible – for instance an improved production process or a product innovation – or intangible. Intangible benefits include brand names, better management structures or the technical knowledge of employees. Firm-specific assets are frequently intangible as this provides one motivation for firms internalising transactions and becoming multinationals rather than licensing their assets to local firms (Buckley and Casson, 1976). The intangible nature of the assets means that a market may not exist for them, increasing the difficulty of writing contracts and entering into licensing agreements. It is a combination of these factors that leads to FDI – the advantages of the firm, the need to internalise the transaction, and finally the advantages of the country in which the FDI is located (Dunning, 1977).

The assumption that multinational firms (MNCs) have firm-specific assets implies that they may also have higher productivity than domestic firms because of their superior technological knowledge, access to international networks and management structure. The assumed higher productivity of foreign firms brings two main benefits. First, it directly introduces new production facilities into the domestic economy (in the case of greenfield sites), or may rescue failing firms in the case of acquisition, raising overall output and employment and exports. Second, domestic governments hope that foreign firms will be unable to internalise their advantages fully, and as a result local firms will benefit through spillovers. The mechanisms for such spillovers will be discussed later. These two groups of benefits – both direct and indirect – provide the basis for attracting FDI into the country.

In addition to the assumed higher productivity, MNCs are also associated with higher wages. In part this is seen as a reflection of higher productivity – more productive workers have a higher marginal product and are paid commensurately higher wages. For example, Conyon *et al.* (1999) find that foreign firms pay equivalent employees 3.4% more than domestic firms and this is wholly attributable to their higher level of productivity. However, it is also often assumed that workers in foreign firms are paid a premium in addition to their higher productivity. One reason may be that foreign firms wish to attract

[1] The development of the concept of firm-specific or proprietary assets can be attributed to a number of

high quality workers, and as a result offer higher than average wages (the adverse-selection version of efficiency wage theory). In order for a differential to exist, this assumes that the management of foreign firms is more far-sighted than that of domestic firms that do not adopt this strategy. An alternative explanation is that foreign firms are more "successful" than domestic firms (for instance in terms of profitability) and that they share this success with their employees by offering a wage premium.

2.2 *What is the empirical evidence*?

The empirical evidence concerning the existence of a productivity and wage differential between foreign and domestic firms is mixed. We will concentrate on the evidence for industrialised countries, which is more relevant for our own study[2]. Starting with the UK, most studies seem to find a wage and productivity differential, however, all highlight the potential difficulties in making the comparison and the need to control for some important differences. Any aggregate analysis of differences in productivity can fail to control for differences in the industrial distribution of foreign and domestic firms (what Davies and Lyons, 1991, term the 'structural effect'). Foreign firms tend to be concentrated in high productivity sectors, a factor that needs to be controlled for in order to isolate an 'ownership' effect. In addition, foreign firms are larger on average than domestic firms introducing a scale effect; as a result it is necessary to control both for firm size and sectoral distribution when assessing productivity and wage differentials. This is one reason why recent studies have concentrated on the use of firm or plant data, rather than the earlier reliance on industry-level data as they facilitate the control of these factors.

Davies and Lyons (1991) implement a decomposition analysis on industry level data. They find that no more than half the productivity advantage of foreign firms can be attributed to structural factors. However, they are limited to using labour productivity and neglected factors such as skills and capital intensity that may influence this result. It is difficult therefore to attribute the remaining differential directly to an ownership effect. Driffield (1996) also finds a significant ownership effect when estimating a wage equation on UK plant data; however, this effect disappears in the productivity equation when firm size is accounted for. He found the result for the wage differential to be robust to industrial

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authors. See also Dunning (1977), Buckley and Casson (1976) and Caves (1971).

[2] There have been recent studies for Venezuela (Aitken and Harrison, 1999) and Mexico (Feenstra and Hanson, 1997). The former finds that FDI raises the skilled wage while the latter finds only negative spillover effects from foreign firms.

distribution and to productivity differences: foreign firms paid more even when controlling for their sector and their higher productivity. He also found this result to be robust to the age of the plant.

Griffith (1999) fails to confirm these results. She examined productivity differences in the car industry for the period 1980-1992 using establishment-level data available from the Census of Production. While she found labour productivity to be higher in foreign firms, higher levels of capital intensity and higher use of intermediate inputs in foreign firms could explain these differences. Total factor productivity did not exhibit the same differential, with the exception of US firms. But her results do confirm the existence of a wage differential between foreign and domestic firms. However, these results do only apply to a single sector – albeit one that has received a large level of FDI – and cannot therefore be generalised to the whole economy,

Aitken *et al.* (1996) report similar results for the US. Their find only a small wage differential between foreign and domestic firms (they find a larger differential in the case of Venezuela and Mexico), and that much of the apparent difference in wages is accounted for by the larger more capital-intensive nature of foreign firms in the US. Evidence for Canada (Globerman *et al*., 1994) also points to higher labour productivity in foreign establishments, but again this can largely be attributed to higher capital intensity and firm size. Once again, foreign firms are found to pay higher wages than domestic firms.

To summarise, there appears to be more evidence for the existence of a wage differential in favour of foreign firms than the existence of a productivity differential. The apparent productivity differential noted in aggregate and industry-level data can often be attributed to the larger size of foreign-owned firms, and their greater capital intensity. Care will be taken in our empirical analysis to take account of these factors.

3. Testing for Productivity and Wage Differentials

3.1 *Database construction and sample characteristics*

Our sample is large and disaggregated. Specifically we work on a dataset of domestic and foreign firms in some 175 five-digit SIC92 manufacturing sectors in the U.K for the period 1991-96. The choice of sectors and years is dictated by the availability of the five-digit level producer price indices we use as deflators. The primary source of labour and product

market information is the OneSource database of private and public companies in the U.K. OneSource gives a subsidiary indicator for each firm annually that provides information on the ownership status of the firm. In order to compare similar firms we chose domestic and foreign *subsidiaries* that experienced no change of ownership between 1991 and 1996. The resulting firms are screened for data availability on wages, employment, value added and fixed assets for at least three consecutive years. To mitigate the impact of outliers on our analysis we excluded the top and bottom 5 percentile firms in terms of value added and wages. We also excluded firms with annual wages or value-added growth exceeding 100%. The main reason for this exclusion is doubts about the reliability of these extreme data points. This leaves us with a panel of 2342 domestic and 1408 foreign affiliates. The balance of the panel is given in Table 1.

The summary statistics reported in Table 2 show that overall foreign owned manufacturing firms pay higher wages and enjoy higher productivity than their domestic counterparts. The average annual remuneration and value added per employee in foreign firms in the sample was £17,400 and £28,590 respectively. This represents an extra 13.7% and 19.6% relative to the sample means for domestic subsidiaries. In general foreign firms pay around 6% and produce 11% more than their (four-digit) industry average. In the sample foreign firms have also a higher scale and capital intensity than domestic firms. The growth rates of productivity and wages for foreign firms stand at 4.6% and 3.1% respectively, while domestic establishments experienced a more modest growth of 3.0% and 2.7%. Part of the productivity and wages differentials between foreign and domestic firms, which are evident from the summary figures, can of course be due to the sectoral and size distribution of the firms. It is therefore interesting to see whether those differentials still persist once sectoral and firm-level factors affecting wages and productivity are controlled for.

Foreign firms make up an important part of the UK manufacturing sector. On average around one third of manufacturing output is attributed to foreign firms, and as Table 3 shows, the average share of FDI is as high as two-thirds in the upper third the distribution.

This dataset has a number of attractions. First is covers a very recent period from 1991 to 1996. Second, we use highly disaggregated price deflators (at the five digit SIC 92 level) which allow us to avoid many of the problems associated with more aggregate price deflators (Griliches, 1979). Third we have been able to match firm-level data with industry variables such as union coverage, skill mix and import intensity in order to gain more

information. Finally, the use of a firm-level data set is also likely to mitigate aggregation biases by allowing us to control for a number of observable as well as unobservable firm-level characteristics.

3.2 Evidence from our data set

The basic equation used to analyse productivity and wages differentials can be expressed as:

$$Y_{it} = \delta For_{it} + \beta X_{it} + D_{sic} + D_t + f_i + \varepsilon_{it} \quad (1)$$

Where i and t index firms and years respectively, *For* is a foreign ownership dummy, D_{sic} is a five-digit SIC92 dummy for fixed industry effects. D_t represent time dummies that account for aggregate shocks, f_i is a time-invariant firm-specific *random* effect and ε denotes a possibly heteroscedastic random noise term with unrestricted (within-firm) serial correlation structure. The dependent variable y is the log of labour productivity, value added or wages and X is a vector of control variables. In the labour productivity equation, X consists of *Scale*, which is defined as the firm's output divided by average industry output. The estimation of total factor productivity (TFP) differentials is conducted via a standard Cobb-Douglas production function where scale is also used as an additional control variable[3]. In the wage equation scale and labour productivity are used as firm-level controls.

Table 4 shows that there is a 9.97% labour productivity, 5.29% TFP and 9.51% wages differential in favour of foreign firms. The difference between labour productivity and TFP suggests that foreign firms are more capital intensive (as many other studies have found). Nevertheless, although the higher wages and productivity differentials shown in Table 2 can be partly explained by the scale of production in foreign establishments and their higher capital intensity, there are still substantial differences that can be ascribed to foreign ownership. As well as controlling for scale, the estimations control for the sector in which the firm is located through the inclusion of sector fixed effects. These point estimates give the differences in productivity and wages between foreign and domestic affiliates having controlled for the sector in which the firm is located and firm size. The last few lines of Table 4 reveal that after controlling for labour productivity in the wage equation, there still

exists a 5.34% wage differential in favour of foreign firms. The difference in wages appears to exist even after differences in productivity are accounted for.

Why is it that foreign firms pay on average 5% more than domestic firms even after allowing for productivity differences? Possible explanations of both the wage and productivity differential fall into two groups: measurement errors and 'ownership' effects. Measurement errors mainly refer to productivity (which subsequently affects the wage equation) and may include the lack of control for capital utilisation and hours worked in the productivity equation. If they vary systematically over foreign and domestic firms this may influence the results. In order to explain the differential foreign firms would need to use their capital more intensively and impose longer working hours on their employees than domestic firms impose. However, it is not clear why these measurement effects would vary with ownership, rather than equally affecting both groups of firms. If for instance capital and labour utilisation is higher in foreign firms, this also points to the greater efficiency of those firms.

The second explanation is that there is an 'ownership' effect: foreign firms have inherent advantages – either in management or technology or brand names – that leads to higher productivity and wages. One possible reason is that foreign firms pay higher wages as they employ more skilled workers. However, these higher skills should be reflected in higher productivity, and that has been taken account of. Another possibility is that unions are in a better bargaining position in foreign firms and manage to obtain a higher proportion of the rents. However, foreign firms often introduce new bargaining procedures (for instance single union deals), and in addition, the employer may be in a stronger bargaining position with unions as it can credibly threaten to relocate production abroad (Driffield, 1996). It is possible that foreign firms poach the best workers by paying higher than average wage rates in order to attract high quality applications. However, it is unclear why domestic firms would ignore such a strategy. This could be attributed to more far-sighted management techniques associated with foreign-owned firms.

Growth differentials between foreign and domestic firms are also analysed by estimating Equation 1 in first differences. It can be seen from Table 4 (last column) that labour and total factor productivity growth in foreign firms is higher by about one and a half

[3] Unfortunately we have no information on either capital utilisation or hours worked; as a result the capital and labour variables cannot be corrected for these effects.

percentage points compared to domestic firms. However, the wage growth rates are not significantly different once productivity is accounted for. It could be that workers (and by implication unions) are not effective in capturing rents.

The higher growth rate of productivity indicates that convergence in productivity levels is not occurring between domestic and foreign firms. Domestic firms would need a higher growth rate than foreign firms in order to catch up, but instead, foreign firms are experiencing higher growth rates of productivity indicating that the gap between foreign and domestic productivity is widening. While this is not the case for the wage differential, there is also no evidence of convergence: domestic firms are not experiencing higher wage growth than foreign firms.

3.3 Further evidence of foreign/domestic productivity and wages differentials

The nationality of the parent company could have an influence on differences in productivity. A number of factors can vary by nationality: employment practises introduced to the firm; vintage of the investment; and the management techniques applied. Dunning (1985) reports that the financial incentives given to employees are much greater in US than in Japanese plants. Macroeconomic data show that while US investment in the UK is of an old vintage, some of it even dating from the last century, Japanese firms are in general much younger having entered the market within the last twenty years. They are also well known for introducing new management and production practises such as ‘lean production’. In order to investigate whether productivity and wages differentials are related to the home country, foreign firms are divided into groups by the nationality of their ultimate holding companies – the USA, Japan and others. Table 5 presents the results.

American firms clearly pay more and are more productive than any other group regardless of the measure used. In contrast, the wage differential of Japanese firms is the lowest of all foreign firms, and disappears altogether when productivity is controlled for in the wage equation. Workers in Japanese firms do not seem able to extract rents above their marginal products. However, wages are growing faster in Japanese firms, though this difference also disappears once productivity is controlled for.

These results contrast with those found for Canada: Globerman *et al*. (1994) found no significant differences in productivity or wage differentials based on the nationality of ownership of foreign firms. However, Griffith (1999) found that US-owned establishments

in the UK car industry have higher total factor productivity than domestic firms (although this was sensitive to the instrument used), but no difference was found for firms of other nationalities.

A noteworthy result is that Japanese firms are no more productive than their domestic peers. While the raw data suggest the labour productivity of Japanese firms is 9% above their respective four-digit industry average this appears to be entirely due to their scale of production. The much-noted difference in productivity between domestic and Japanese firms seems to be due to the larger average size of Japanese firms, rather than any inherent superiority of technology or management technique. A similar pattern can also be noted for productivity growth.

Similar results were found in Graham and Krugman (1995) who report value added per worker in Japanese affiliates in the US to be below that of domestic US firms. Blonigen and Slaughter (1999) also show that Japanese greenfield investment in the US in the 1980s was significantly correlated with lower relative demand for skilled labour. For the UK, Driffield (1996) noted that Japanese plants generally paid below average wages. These studies suggest that the assumed superiority of Japanese management and production practises is not reflected in productivity statistics.

We probe further the robustness of our results by interacting the foreign dummy with the following industry level variables: import intensity, domestic market concentration ratio and union coverage. The differential estimates are reported in Table 6. The main foreign effects (i.e. keeping the additional industry-level variables constant) show that there is still a substantial and significant productivity and wage differential in favour of foreign firms. For example, total factor productivity is higher by 5.9% and there is a wage premium of 5.5% even after controlling for productivity.

These differentials appear to be larger in the more highly concentrated industries. Domestic firms in less competitive sectors seem to lag further behind in terms of their productivity relative to their foreign peers. This is also the case with the wage equation. Controlling for productivity differences, workers in foreign firms that operate in more concentrated industries seem to be able to extract additional rents.

There is also evidence that import intensity has a negative impact on the wage differential (though not on productivity). In other words foreign firms pay (relatively) less in the more

import-intensive sectors, although an overall differential still remains. It may be that foreign firms are earning less profit in these sectors due to competition from imports, and are partly passing this on in lower wages. This suggests that the high wages in other less import-intensive sectors, may be partly due to the high profits earned by foreign firms that are subsequently passed along in higher wages. No significant unionisation effect is revealed by the data.

A one and a half percentage point differential in productivity growth is observed, and high union coverage appears to enhance this, while this is not reflected in the wage- growth equation. High union coverage does not seem to have any impact on the wage-growth differential between foreign and domestic firms, but it does increase the productivity-growth differential. This could partly be due to poor quality unionisation data and an erratic pattern of productivity growth in the sample[4].

4. Testing for Productivity and Wage Spillovers

In the previous section we established that foreign firms pay higher wages and enjoy higher productivity than their domestic counterparts. This confirms that there is a *composition* effect from FDI: a higher proportion of foreign firms in a sector is likely to raise the productivity of that sector as foreign firms have higher productivity than domestic firms have. However, we also wish to investigate the dynamic implications of FDI: does the presence of foreign firms raise the productivity of domestic firms in the same sector? In this section we attempt to isolate the effects of foreign presence on the wages and productivity of domestic firms. For this purpose, the share of foreign manufacturing employment or output at the four-digit sector measures the presence of foreign direct investment in the sector.

4.1 Spillovers of MNC Technology

There are a number of possible mechanisms through which the advantages of foreign firms may be transmitted to domestic firms, based on the diffusion of technology and skills from foreign to domestic firms and spillovers. The latter implies that an externality is involved, with the domestic firm not paying the full price for the technology or skills it is acquiring, or receiving information that the foreign firm cannot internalise successfully (Griliches,

[4] As can be seen from Table 2 the coefficient of variation of productivity growth is twice as that of wage growth.

1979). The mechanisms can be broadly split into two categories – competition effects and demonstration effects.

Competition effects occur as the entry of MNC affiliates disturbs the existing equilibrium in the market and forces local firms to take action to protect their market shares. As MNCs are prevalent in sectors that are highly concentrated, and often provide the only international competition for large domestic firms, this may be an important discipline (Caves, 1996). Spillovers can occur if the entry of an affiliate leads to more severe competition in the host economy so that domestic firms use technology and resources more efficiently (Blomstrom and Kokko, 1997). As a result the productivity of domestic firms would rise.

Demonstration effects occur when local firms improve their productivity by copying MNC affiliates operating in the local market. For instance, if foreign firms introduce new technologies, or new production processes and management techniques, domestic firms can observe and copy these procedures. This relies on the foreign firm being unable to effectively appropriate all the benefits of innovations and in-firm knowledge. These effects may occur through direct links with domestic firms – either as suppliers or consumers – or a more arms-length effect.

An additional mechanism for demonstration effects to occur is through the training of workers. Foreign firms may train workers without charging them the full price of the training, and the workers may subsequently move on to work for domestic firms, which would then gain from the improved quality of the workers. This relies on training being general rather than firm specific, and on some level of labour turnover.

The effects outlined above indicate a positive impact of foreign firms on domestic productivity. However, a number of different effects on wages are possible. A high foreign presence could have a negative impact on the wages of domestic firms if all foreign firms are doing is poaching the best workers away from domestic ones by paying them higher wages, leaving the domestic firms with low wage employees. Alternatively, if foreign firms were simply acquiring domestic firms that are already in highly productive and high wage sectors, then the foreign presence would have no impact on domestic productivity and wages. Foreign firms could have a positive impact on wages if there is a shift in labour demand in the industry with domestic firms having to raise wages in order to attract the best

workers, or if domestic firms invest more in training their staff as a result of foreign competition.

4.2 Empirical evidence from the literature

A number of surveys of the spillover effects from foreign firms already exist (see Blomström and Kokko, 1997; Caves, 1996). Much of the earlier literature refers to technology transfer to developing countries[5]. The original emphasis in the literature was on developing countries as they have the largest gap between their domestic technology and the technology of the entering MNCs and thus the largest potential gains. However, it has been hypothesised more recently that a certain level of technology and skills may be required in order to benefit from the presence of foreign firms, this can be termed an absorptive capacity (Cohen and Levinthal, 1989). Industrialised countries – that attract the greatest share of FDI – may therefore stand to gain most from it (Kokko, 1992)[6].

Early evidence for Australia (Caves, 1974) and Canada (Globerman, 1979) at the industry level indicated that the level of foreign presence was significant in influencing domestic productivity. A more recent study for the UK also using industry-level data (Liu *et al*., 1999) finds a positive spillover effect from the presence of foreign firms on the productivity of UK firms. However, using industry data has a number of limitations. For instance, it is difficult to distinguish between the composition effect of higher foreign productivity and spillovers to domestic firms, and to control for firm scale effects and general firm heterogeneity.

Nadiri (1991) examined the impact of US direct investment in three European countries and Japan; he found that increases in the capital stock of US affiliates had a positive impact on the growth of TFP of domestic manufacturing industry. Cantwell (1989) concentrated on market shares rather than productivity, and found that US firms did not always have a positive impact on the market shares of European firms. He concluded that the competitive effect only had a positive impact on domestic market shares in the case where domestic firms already had some technological capabilities, in other cases the increased competition could lead to a reduction in the market share of domestic firms. As far as wages are concerned, Driffield (1996) in a plant-level study for the UK, found some evidence that a

[5] See for instance Findlay (1978) and Lall (1980).
[6] Spillovers could also be examined from the point of view of the home country of the MNC (Blomström and Kokko, 1996).

high foreign presence in a sector tended to cause wages to rise for domestic firms, even allowing for the composition effect. This was not the case for all foreign investment as some – for instance Japanese firms – was associated with paying below-average wages.

Evidence for the US (Aitken *et al*., 1996) suggests that a larger share of foreign ownership in a sector, based on employment, is associated with higher wages for domestic firms, as well as higher average wages i.e. a spillover as well as a composition effect, in contrast to the results presented for Mexico and Venezuela, where no evidence of spillovers is found. Figlio and Blonigen (1998) support this result, finding that a rise in foreign employment in a sector has a large positive effect on county wages, and that this effect is much larger than the corresponding effect for a rise in general employment. However, this rise in wages may not be due to a rise in demand for skilled labour. Blonigen and Slaughter (1999) find that inward FDI in the US has not led to skill upgrading within sectors in the US.

To summarise, the evidence on spillovers from foreign investment in industrialised countries is mixed. One reason is the difficulty in finding an adequate testing procedure, and the problems associated with measuring and observing spillovers. There seems to be some indication that foreign ownership in the sector may raise wages for other firms in the same sector, but less evidence for widespread productivity improvements for domestic firms. The existence of a wage and productivity differential is consistent with no spillovers: in the medium or long term spillovers will act to remove any differential between foreign and domestic firms. In the next section we will try to test for spillovers in our own data set**.**

4.3 Intra-industry spillovers evidence from our data set

We estimate possible wage and productivity spillovers by replacing the foreign ownership dummy in Equation (1) with a measure foreign presence (FDI):

$$(2) \qquad y_{it} = \delta\, FDI_{it} + \beta\, X_{it} + D_{sic} + D_i + f_i + \varepsilon_{it}$$

The regressions are run on the data for the domestic firms alone. Since industry fixed effects are included, we are only exploiting within-sector variations. If the regressions were run without the industry dummies, we would have been able to exploit the between sector FDI variations as well. However, the problem with that modelling framework would be that a positive coefficient on the FDI variable can simply reflect the fact that foreign firms

invest in industries that pay higher wages and enjoy higher productivity rather than the existence of any genuine spillovers to domestic firms.

The estimation results reported in Table 7 show that, *on average*, there are no wage and productivity spillovers to domestic firms as a result of the foreign presence. We also tested the impact of foreign presence on productivity and wage *growth* by estimating:

$$\Delta y_{it} = \delta\ \Delta FDI_{it} + \beta\ \Delta X_{it} + D_t + \Delta\varepsilon_{it} \quad (3)$$

But we found no substantial evidence linking productivity and wages growth with the growth of FDI, after accounting for domestic firms' scale of production growth.

4.4 The determinants of intra-industry spillovers

The apparent absence of any link between FDI and domestic firms' wages and productivity could be due to the lack of sufficient within-sector variation in FDI, which is less than 9% of the total variation in our data. Moreover, in the above modelling framework, wages and productivity spillovers as a result of FDI are assumed to be the same across sectors and firms. From an econometric point of view, we still get an unbiased estimate of the average FDI externality even if spillover effects are heterogeneous across firms. But the average value (zero in this case) can mask the true picture of what is really going on. It obviously makes more sense to assume that the level of spillover varies according to industrial and firm level characteristics. Moreover *modelling* FDI response heterogeneity can yield some valuable economic insights into the mechanisms leading to spillovers. Wang and Blomstrom (1992) develop a model in which spillovers result from the strategic interaction between foreign subsidiaries and domestic firms. They find that the degree of spillovers is proportional to the level of host country firms learning investment (i.e. competition effects). This has the important policy implication that countries hosting multinational corporations should support domestic firms' efforts to learn from foreign subsidiaries. But they also established that, irrespective of the domestic firms learning efforts, there exists some spillover that is positively related to the size of the technology gap between foreign and domestic firms or the latter's market share (i.e. contagion effects). The larger the gap between the firms, the larger is the spillover.

However, the argument of Lapan and Bardhan (1973) suggests that technological spillovers might be negatively correlated with the technology gap, as do other studies that have found

firms need a certain absorptive capacity before they can benefit from new technologies discovered by other firms (Cohen and Levinthal, 1989). We statistically test those two competing hypotheses by re-estimating the spillover equations by postulating that:

$\delta = f$ (skill, competition, technology gap).

Here the technology gap is measured by the individual firm's total factor productivity[7] gap relative to the 90th percentile TFP of the corresponding 2-digit SIC92 industry, in the previous year. The level of competition is measured by the 4-digit SIC92 *import* penetration index and skill is defined as the ratio of skilled to unskilled employment within the 3-digit SIC92 industry (see the Appendix for details). The results are presented in Table 8.

4.5 Estimation results

An examination of Table 8 yields some interesting results. As import competition and industry skill level grow, the impact of FDI on the productivity of domestic firms increases. On the other hand, we find evidence that firms with a low initial productivity level have a slower productivity spillover rate. It is worthwhile noting that the effect of FDI on labour and total factor productivity is virtually the same. This prompts the conclusion that the effect of foreign presence on capital productivity might be negligible.

Wage spillovers follow similar patterns, except that the skill level has no significant effect. However, when productivity is controlled for in the wage equation, the FDI spillover does not depend on the extent of the firm's technological gap or the sectors' imports penetration, but a higher skill intensity appears to decrease the domestic wage effect of FDI. Apparently less skilled domestic workers have more success at extracting rents (over and above their marginal product) as the sector's FDI share increases. Another interpretation is that when the skill level in the industry is low, domestic firms have to raise the wages of the skilled workers to prevent them from being poached. Unfortunately we do no have detailed enough data to discriminate between these two competing hypotheses. The productivity and wage growth equation reveal that the impact of FDI growth is inversely related to the productivity gap, while import competition and skill have no significant impact.

[7] Scale of production is controlled for in the total factor productivity equation.

To clarify the results we estimate a few coefficients at different levels of competition and technology gaps. The overall impact of FDI on wages disappears when domestic workers' productivity level is accounted for. Any positive effects on wages can therefore be interpreted to be due to domestic firms becoming more efficient as a result of foreign competition, rather than a shift in labour demand in the industry where domestic firms have to raise wages to attract the best workers. In Table 9 we report FDI impact parameters for labour productivity and wages without the productivity term. With a 10% increase in the sector's foreign presence, the productivity spillover is positive and significant for all firms with a low technological gap. A maximum productivity increase of 4.8% is observed in high skill and high import intensity sectors. When the technology gap is set at 25% the productivity of domestic firms operating in the same sector seems to deteriorate as a result of increased foreign presence, although this negative spillover seems to disappear as the sector's competitiveness increases.

Wages follow similar patterns, although not all productivity changes are transmitted into wage gains (or losses). For example the (maximum) productivity spillover of 4.8% mentioned previously is accompanied by a wage increase of 2.3%. In this (typical) case, the FDI effect on wages is about 48% of the effect on productivity. Noting that the quasi-rent splitting parameter in the wage equation of Table 7 is about 45%, it is not surprising to see no wage spillovers when productivity differences are taken into account.

5. Conclusions

As we noted at the outset many governments provide subventions to multinational corporations in order to attract inward investment. An obvious question to ask is why this happens given that multinationals are excepted to begin with some kind of ownership advantage. The answer is that governments presumably believe there to be some form of spillover benefits from FDI to domestic firms. In this paper we have investigated whether this is in fact the case for the UK. We began by testing whether or not a productivity differential existed between foreign and domestic firms and any associated wage differential. We then investigated whether an increase in foreign presence in the UK manufacturing sector affected productivity levels and growth and wage levels and growth.

Using a panel dataset for the UK for the first half of the 1990s, we find that labour productivity in foreign firms is almost 10% higher than in domestic firms whilst total factor productivity is greater by around 5%. As one would anticipate, there is an associated wage

differential, but even after we allow for productivity differences we still find that foreign firms pay on average 5% more than domestic firms. We disaggregated our sample in order to see whether nationality makes any difference and it appears to do so. Specifically American firms appear to be the most productive and best payers, with the productivity differential being least for Japanese firms.

When we estimated our model to test for intra-industry spillover, we found that on average there were no wage and productivity spillovers to domestic firms as a result of foreign presence, whether in levels or in growth. We probed this further by introducing factors that could influence the capacity of domestic firms to benefit from spillovers – skill mix in the workforce, competitiveness of the market and any initial productivity gap. These do make a difference in that the impact of FDI on productivity appears to increase as competition and industry skill level grow. By contrast, significant technology gap seems to hamper productivity spillovers.

These are interesting results. The productivity differential between MNCs and domestic firms is not surprising and presumably reflects in parts the ownership advantages of MNCs. Perhaps more surprising is the differences by origin and particularly those associated with Japanese MNCs. This may reflect vintage effects and will be investigated further. So to will the factors behind the differential. The absence of any identifiable spillover is also surprising, though this could be due in part to the relatively short time frame. It is however interesting that once we model market characteristics which are likely to influence the capacity of domestic firms to absorb spillovers, we do find some positive effects. This is worthy of further investigation, as is the possibility of inter-industry spillovers.

Data Appendix

Employment: Average number of employees during the year including full time and part-time workers.

Wages: Average remuneration paid to employees in a year excluding tax, social security and pension payments.

Value added: The difference between turnover and the cost of bought-in materials and sources.

Fixed assets: Tangible fixed assets at their net book values.

Scale: firms output divided average four-digit level output (OneSource)

Producer Price Indices: Five-digit SIC92 level indices obtained from The Business Monitor MM 22.

Import intensity: Basic data is obtained from OECD ‘s International Trade by Commodities Statistics. Aggregation to four-digit SIC92 level is performed by using the official concordance obtained from the Office of National Statistics.

Herfindhal index: Computed at four-digit SIC92 level bases on the population of firms in OneSource.

FDI: The presence of foreign direct investment is alternatively estimated by the four-digit SIC92 sector’s foreign share of manufacturing employment or output. These are calculated by considering the population of subsidiaries in OneSource.

Union: Union coverage at the individual level obtained from New Earning Survey aggregated at four-digit SIC92 level.

Proportion of skilled workers: Three-digit SIC92 data for 1993-95 compiled from Report of Census of Production.

Table 1:
Balance of the panel

Number of time series	Domestic firms	Foreign firms
3	428	216
4	449	236
5	464	301
6	1001	655
Total	*2342*	*1408*

Table 2:
Sample means (and standard deviations)
of some firm level variables

Variables	Domestic	Foreign
Levels		
Employment	255.24 (400.18)	395.98 (525.64)
Wage rate	15.33 (4.07)	17.44 (4.34)
Output	19618.56 (48064)	44990.7 (80336)
Productivity	23.91 (10.06)	28.59 (11.96)
Capital intensity	15.55 (16.15)	24.36 (21.50)
Growth rates		
Wages	2.66% (0.09)	3.10% (0.96)
Productivity	2.98% (0.18)	4.57% (0.20)

Notes:

(i) Productivity is defined as real value added per worker.
(ii) Capital intensity is defined as real fixed assets per worker.
(iii) Wages, output, productivity and capital intensity are given in £'000.

Table 3:
Foreign direct investment at four-digit SIC92 level
Sample means (and standard deviations)

Percentile	Share of foreign Employment	Share of foreign Output
Lower	4.23 % (0.04)	4.74 % (0.05)
Medium	23.88 % (0.10)	29.10 % (0.10)
Higher	55.74% (0.19)	65.60 % (0.15)

Table 4
Labour and total factor productivity and wages
Differentials between domestic and foreign firms

	Levels	Growth rates
Labour productivity		
Scale	0.042 (13.47)	0.050 (9.10)
Foreign	**9.97% (9.24)**	**1.48 % (5.42)**
Total factor productivity		
Labour	0.794 (89.16)	0.844 (60.81)
Capital	0.145 (24.70)	0.021 (3.38)
Scale	0.057 (11.35)	0.072 (11.22)
Foreign	**5.29% (5.22)**	**1.44 % (5.32)**
Wages		
Scale	0.030 (13.57)	0.021 (7.80)
Foreign	**9.51% (13.29)**	**0.40 % (2.58)**
Wages (with productivity)		
Scale	0.012 (8.72)	0.010 (4.59)
Productivity	0.418 (54.64)	0.217 (39.23)
Foreign	**5.34% (10.06)**	**0.00 (0)**

Notes:

(i) Scale is defined as output divided by average four-digit SIC92 output
(ii) In all cases time dummies are employed and five-digit SIC92 dummies are used in the level equations.
(iii) The asymptotic t-ratios, which are given in parentheses, are based on heteroscedasticity and within-firm serial correlation consistent standard errors.
(iv) The growth rate equations are estimated as first-differenced versions of their level counterparts.
(v) The coefficients on the foreign dummies in the growth column are to be interpreted as percentage point differentials.

Table 5
Productivity and wages % differentials
By nationality of ownership

	Levels	Growth rates
Labour productivity		
USA	13.2 (8.43)	1.78 (4.25)
Japan	6.14 (1.55)	1.73 (1.61)
Others	8.45 (6.81)	1.27 (3.97)
Total factor productivity		
USA	8.93 (6.13)	1.71 (4.19)
Japan	-2.99 (0.85)	1.87 (1.76)
Others	3.87 (3.36)	1.22 (3.84)
Wages		
USA	11.39 (10.99)	0.51 (2.39)
Japan	5.24 (2.08)	1.04 (2.21)
Others	8.79 (10.75)	0.22 (1.30)
Wages (with productivity)		
USA	5.87 (7.79)	0.11 (0.61)
Japan	2.67 (1.56)	0.62 (1.49)
Others	5.26 (8.60)	0.00 (0.35)

Notes:

(i) In all cases time dummies are employed and five-digit SIC92 dummies are used in the level equation.
(ii) The asymptotic t-ratios, which are given in parentheses, are based on heteroscedasticity and within-firm serial correlation consistent standard errors.
(iii) The coefficients on the foreign dummies in the growth column are to be interpreted as percentage point differentials.

Table 6
The determinants of productivity and wages
Differentials between domestic and foreign firms

	Levels	Growth rates
Labour productivity		
Common foreign effect	0.059 (2.93)	0.015 (5.41)
Imports	-0.068 (1.45)	-0.085 (1.31)
Concentration	0.212 (2.32)	-0.010 (0.14)
Union coverage	-0.082 (1.43)	0.123 (2.36)
Total factor productivity		
Common foreign effect	0.059 (2.92)	0.015 (5.29)
Imports	-0.073 (1.57)	-0.118 (1.86)
Concentration	0.247 (2.67)	-0.010 (0.10)
Union coverage	-0.068 (1.19)	0.144 (2.81)
Wages		
Common foreign effect	0.079 (5.55)	0.004 (2.63)
Imports	-0.073 (2.18)	-0.010 (0.21)
Concentration	0.187 (2.99)	0.031 (1.14)
Union coverage	-0.036 (0.92)	0.020 (0.80)
Wages (with productivity)		
Common foreign effect	0.055 (4.87)	0.000 (0.00)
Imports	-0.045 (1.79)	0.013 (0.53)
Concentration	0.100 (2.01)	0.033 (1.42)
Union coverage	-0.003 (0.10)	-0.010 (0.27)

Notes:

(i) In all cases time dummies are employed and five-digit SIC92 dummies are used in the level equations.

(ii) Imports intensity, Herfindhal ratio of industrial concentration and the union coverage are interacted with the foreign ownership dummy.

(iii) The asymptotic t-ratios, which are given in parentheses, are based on heteroscedasticity and within-firm serial correlation consistent standard errors.

Table 7
The impact of FDI on the productivity
And wages of domestic firms

	Share of Foreign			
	Employment		**Output**	
	Level	**Growth**	**Level**	**Growth**
Labour productivity				
Scale	0.051 (8.43)	0.057 (5.94)	0.051 (8.43)	0.056 (5.94)
FDI	**0.018 (0.31)**	**-0.021 (0.47)**	**-0.026 (0.44)**	**-0.028 (0.80)**
Total factor productivity				
Labour	0.796 (66.11)	0.818 (48.07)	0.796 (66.12)	0.827 (48.14)
Capital	0.151 (21.06)	0.034 (4.21)	0.151 (21.06)	0.025 (3.75)
Scale	0.063 (6.51)	0.081 (6.54)	0.063 (6.51)	0.075 (10.69)
FDI	**0.003 (0.05)**	**-0.048 (1.06)**	**-0.030 (0.52)**	**0.052 (1.88)**
Wages				
Scale	0.033 (8.68)	0.021 (4.78)	0.033 (8.68)	0.021 (4.79)
FDI	**0.028 (0.77)**	**-0.048 (2.16)**	**0.036 (1.02)**	**-0.021 (1.06)**
Wages with productivity				
Scale	0.011 (5.47)	0.010 (2.24)	0.011 (5.47)	0.010 (2.25)
Productivity	0.449 (45.17)	0.247 (32.50)	0.449 (45.12)	0.247 (32.50)
FDI	**0.019 (0.65)**	**-0.043 (2.17)**	**0.048 (1.64)**	**-0.014 (0.77)**

Notes:

(i) In all cases time dummies are employed and five-digit SIC92 dummies are used in the level equations.
(ii) The asymptotic t-ratios, which are given in parentheses, are based on heteroscedasticity and within-firm serial correlation consistent standard errors.
(iii) The basic productivity and wages equations are similar to those described in Table 4.

Table 8
The determinants of spillovers effects of FDI on the productivity and wages of domestic firms

	Level	Growth
Labour productivity		
Skill	0.371 (3.72)	0.264 (3.88)
Productivity gap	-2.800 (29.42)	-0.916 (4.42)
Imports penetration	0.759 (3.85)	0.115 (0.72)
Total factor productivity		
Skill	0.374 (3.90)	0.276 (4.10)
Productivity gap	-2.770 (30.98)	-0.920 (4.52)
Imports penetration	0.693 (3.52)	0.066 (0.41)
Wages		
Skill	0.072 (1.26)	0.010 (0.29)
Productivity gap	-1.235 (16.30)	-0.267 (2.89)
Imports penetration	0.460 (3.86)	0.033 (0.40)
Wages with productivity		
Skill	-0.098 (2.27)	-0.053 (1.63)
Productivity gap	0.051 (0.87)	-0.045 (0.52)
Imports penetration	0.111 (1.53)	0.005 (0.07)

(i) In all cases time dummies are employed and five-digit SIC92 dummies are used in the level equations.
(ii) FDI is defined as the sector's share of foreign employment. FDI defined in terms of output yields qualitatively similar results.
(iii) The asymptotic t-ratios, which are given in parentheses, are based on heteroscedasticity and within-firm serial correlation consistent standard errors.

Table 9
The impact of FDI on the level of productivity and wages of domestic firms

	Labour Productivity		Wages	
	Low Skill	**High Skill**	**Low Skill**	**High Skill**
33% imports penetration				
10% Gap	0.094 (1.72)	0.217 (3.38)	0.052 (1.54)	0.076 (1.96)
15% Gap	-0.046 (0.87)	0.077 (1.24)	-0.009 (0.28)	0.015 (0.38)
25% Gap	-0.326 (6.19)	-0.203 (3.32)	-0.133 (3.82)	-0.109 (2.86)
50% imports penetration				
10% Gap	0.223 (2.61)	0.346 (4.04)	0.130 (2.48)	0.155 (2.92)
15% Gap	0.083 (0.98)	0.206 (2.44)	0.069 (1.31)	0.093 (1.78)
25% Gap	-0.198 (2.39)	-0.074 (0.90)	-0.055 (1.04)	-0.031 (0.60)
66% imports penetration				
10% Gap	0.352 (3.00)	0.475 (4.19)	0.209 (2.89)	0.233 (3.32)
15% Gap	0.212 (1.82)	0.335 (2.99)	0.147 (2.04)	0.171 (2.46)
25% Gap	-0.069 (0.00)	0.055 (0.50)	0.023 (0.32)	0.047 (0.49)

Notes:

(i) There is no productivity term in the wages equation. Low (high) skill is defined as the case where the skilled/unskilled ratio in the sector is one to two (two to one).

(ii) The asymptotic t-ratios are calculated by taking into account the covariance between the various components of δ.

References

Aitken, Brian J. and Ann E. Harrison (1999) Do domestic firms benefit from direct foreign investment? Evidence from Venezuela, *American Economic Review*, 89, pp. 605-18.

Aitken, Brian J., Ann E. Harrison and Robert E. Lipsey (1996) Wages and foreign ownership. A comparative study of Mexico, Venezuela and the United States, *Journal of International Economics*, 40, pp. 345-71.

Blonigen, Bruce A. and Matthew J. Slaughter (1999) Foreign-affiliate activity and US skill upgrading, NBER Working Paper 7040.

Blomstrom, M and Kokko, A (1996) Multinational corporations and spillovers, Stockholm School of Economics Working Paper Series in Economics and Finance no. 99.

Blomstrom, M and Kokko, A (1997), 'How foreign investment affects host countries' The World Bank Policy Research Working Paper 1745.

Buckley, P.J. and M. Casson (1976) *The future of the multinational enterprise*, London: Macmillan.

Cantwell, J. (1989) *Technological innovation and multinational corporations*, Oxford: Basil Blackwell.

Caves, R.E. (1971) International comparisons: the industrial economics of foreign investment, *Economica*, 38, pp. 1-27.

Caves, R.E. (1974) Multinational Firms, competition and productivity in host-country markets, *Economica*, 41, pp. 176-493.

Caves, R.E. (1996) *Multinational enterprises and economic analysis*, Second Edition, Cambridge: Cambridge University Press.

Cohen, Wesley M. and Daniel A. Levinthal (1989) Innovation and learning: the two faces of R&D, *Economic Journal*, 99, pp. 569-96.

Conyon, M ., S. Girma, S. Thompson and P. Wright (1999) The impact of Foreign Acquisition on Wages and Productivity in the U.K, GLM Research Paper 99/8, School of Economics, University of Nottingham.

Davies, Stephen W. and Bruce R. Lyons (1991) Characterising relative performance: the productivity advantage of foreign owned firms in the UK, *Oxford Economic Papers*, 43, pp. 584-95.

Driffield, Nigel L. (1996) *Global Competition and the Labour Market*, Harwood Academic Publishers: Amsterdam.

Dunning, John H. (1977) Trade, location of economic activity and MNE: a search for an eclectic approach, in B. Ohlin, P.O. Hesselborn and P.M. Wijkman (eds.) *The international allocation of economic activity*, London: Macmillan.

Dunning, John H. (1985) *Multinational enterprises, economic structure and international competitiveness*, Geneva: Wiley/IRM.

Feenstra, Robert C. and Gordon H. Hanson (1997) Foreign direct investment and relative wages: evidence from Mexico's maquiladoras, *Journal of International Economics*, 42, pp. 371-93.

Figlio, David N. and Bruce A. Blonigen (1999) The Effects of direct foreign investment on local communities, Mimeo, University of Oregon.

Findlay, R. (1978) Relative backwardness, direct foreign investment, and the transfer of technology: a simple dynamic model, *Quarterly Journal of Economics*, 92, pp. 1-16.

Globerman, Steven (1979) Foreign direct investment and 'spillover' efficiency benefits in Canadian manufacturing industries, *Canadian Journal of Economics*, 12, pp. 42-56.

Globerman, Steven, John C. Ries and Ilan Vertinsky (1994) The economic performance of foreign affiliates in Canada, *Canadian Journal of Economics*, 27, pp. 143-156.

Graham Edward M. and Krugman, Paul R. (1995) *Foreign direct investment in the United States*, 3rd Edition, Institute for International Economics: Washington.

Griffith, Rachel (1999) Productivity and foreign ownership in the UK car industry, The Institute for Fiscal Studies Working Paper Series, No. W99/11.

Griliches, Z. (1979) Issues in assessing the contribution of R&D to productivity growth, *Bell Journal of Economics*, 10, pp. 92-116.

Hymer, S.H. (1976) *The international operations of national firms: a study of direct foreign investment*, Boston: MIT press.

Kindleberger, C.P. (1969) *American Business Abroad: Six lectures on direct investment*, New Haven: Yale University Press.

Kokko,A (1994), 'Technology, market characteristics, and spillover', *Journal of Development Economics*, **43**, 279-293.

Kokko,A (1996), 'Productivity spillovers from competition between local firms and foreign affiliates. *Journal of International Development*:' **8**, 517-530.

Lall, S. (1980) Vertical interfirm linkages in LDCs: An empirical study, *Oxford Bulletin of Economics and Statistic*s, 42, pp. 203-26.

Lapan, H and Bardhan, P (1973), 'Localised technical progress and transfer of technology *Journal of Economic Theory* **6**, 585-595.

Liu, Xiaming, Pamela Siler, Chengqi Wang and Yingqi Wei (1999) Productivity spillovers from foreign direct investment: evidence from UK industry level panel data, mimeo, Aston Business School.

Nadiri, M.I. (1991) Innovations and technological spillovers, mimeo, New York University and NBER.

UNCTAD (1996) Incentives and foreign direct investment, UNCTAD, Division on transnational corporations and investment, Series A, No. 30.

Wang, J-Y. and Blomstrom, M (1992) , 'Foreign investment and technological transfer: a *European Economic Review* , **36** , 137-155.