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INVESTMENT ABROAD AND ADJUSTMENT AT HOME: EVIDENCE FROM UK MULTINATIONAL FIRMS

Helen Simpson

THE INSTITUTE FOR FISCAL STUDIES
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Summary

The adjustment mechanisms of multinational firms are of interest in the context of the relaxation of barriers to inward investment in relatively low-wage economies. This paper provides new empirical evidence on the effects of overseas foreign direct investment on the structure of multinational firms' home-country operations. It also provides micro-level evidence on the home-country effects of outward investment for the UK.

The paper focuses on plant exit, since plant closures and cross-border relocation are important adjustment margins for multinational firms. It presents evidence that UK multinationals investing abroad in low-wage economies are acting in line with the predictions of theories of vertical foreign direct investment. More specifically, it examines whether investment abroad in relatively low-wage economies is associated with plant closures in relatively low-skill, labour-intensive industries at home; in line with low-skill intensive production being relocated to low-wage economies.

The paper makes comparisons across industries and firms akin to a difference-in-differences analysis. It finds that plants in low skill-intensity sectors owned by UK multinationals investing in low-wage economies are significantly more likely to exit than those owned by UK multinationals that are not investing in low-wage economies, and importantly, that this difference is not mirrored for plants in high-skill sectors.

The paper also confirms previous findings that multinational firms, either domestic or foreign-owned, are more likely to shut down plants than non-multinational firms, and hence exhibit more flexibility in organisational restructuring.

Investment abroad and adjustment at home: evidence from UK multinational firms

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March 2007

Abstract: I use within-firm, plant-level data combined with geographic information on firms' overseas operations to examine how investment in low-wage economies affects firms' home-country operations. To remain close to theory I focus on changes in firms' organisational and industrial structure driven by plant closures. As predicted by models of vertical multinationals I find that investment in relatively low-wage economies is associated with plant closures in relatively low-skill, labour-intensive industries in the UK. The findings are of interest in the context of the relaxation of barriers to inward investment in low-wage economies.

Keywords: multinational enterprises; skills; wages; globalisation

JEL classification: F2

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1 Introduction

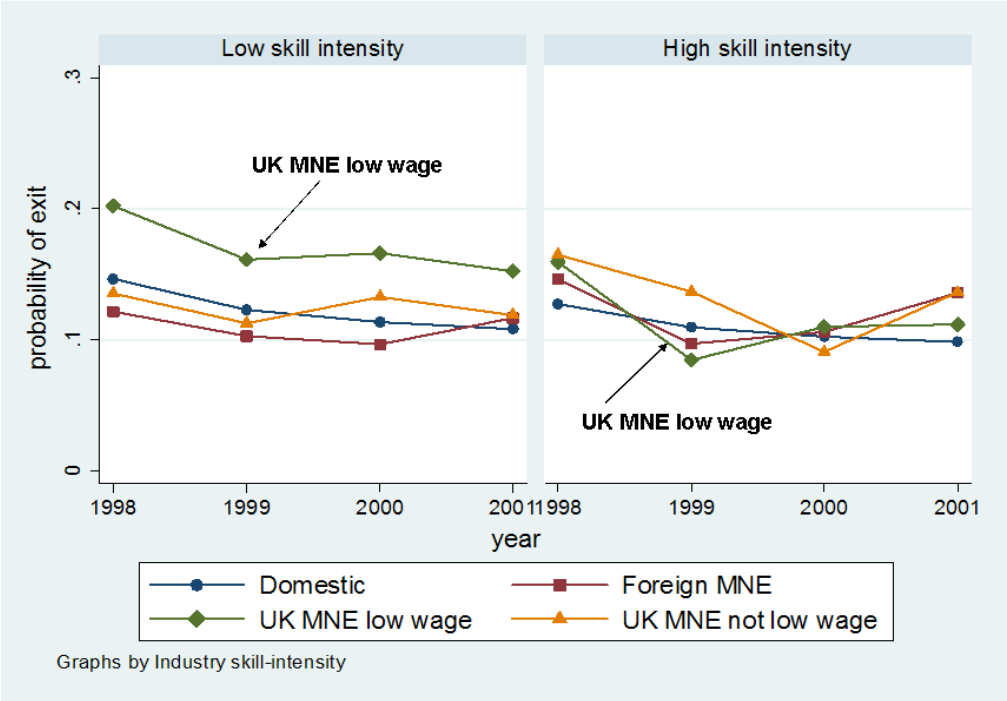
Understanding the adjustment mechanisms of multinational firms is important in the context of the relaxation of barriers to inward investment in low-wage economies, such as China's accession to the WTO in 2001. The OECD (2006) now highlights China as a major destination for FDI outside the OECD area, with estimated inflows of $72 billion in 2005. How multinational firms structure their operations globally is also of considerable interest because they make up a substantial proportion of employment in OECD economies. Bernard and Jensen (2005) report that US multinationals account for 26% of manufacturing employment in the US; in Great Britain in 2001 UK-owned multinationals accounted for 20% of manufacturing employment, with foreign-owned multinationals accounting for a further 25% (Griffith, Redding and Simpson, 2004). International restructuring can potentially affect large numbers, and particular groups of workers, and is of considerable interest to governments.

In this paper I provide new empirical evidence on the effects of overseas foreign direct investment (FDI) on the structure of multinational firms' home-country operations. I focus on vertical FDI and on plant exit, since plant closures and cross-border relocation are important adjustment margins for multinational firms. An innovative feature is that my data allow me to exploit within-firm, plant-level information on firms' organisational and industrial structure in combination with firm-level information on the geographic composition of their overseas investment activity. The paper provides novel evidence on outward FDI and within-firm adjustment in the industrial mix of home-country activity. I also provide micro-level evidence on the home-country effects of outward investment for the UK.

The question I investigate comes directly from the theory of vertical FDI. I examine whether investment abroad in relatively low-wage economies is associated with plant closures in relatively low-skill, labour-intensive industries at home. That is, I look for evidence in line with low-skill intensive production being relocated to low-wage economies. To do this I make comparisons across industries and firms akin to a difference-in-differences analysis. I demonstrate that plants in relatively low-skill industries in the UK that are owned by multinationals investing in low-wage economies are more likely to shut down compared to plants in the same industry owned by firms that are not investing in low-wage economies and compared to plants in relatively high-skill industries owned by the same group of firms, and also that within high-skill industries there is no difference in the propensity to exit across plants owned by the two types of firm.

Figure 1 presents some first-pass evidence from my raw data that, within low-skill industries, plants owned by UK multinationals (UK-MNEs) investing in low-wage economies have a higher propensity to exit than those owned by other firms, and that this is not the case in high-skill industries. For each group of industries the figure shows the probability of exit for four different types of plants: domestic-owned; plants owned by a foreign-owned multinational; plants owned by UK-MNEs that are investing in low-wage economies; and plants owned by UK-MNEs that are not investing in low-wage economies. This is based on the cohort of plants active in the UK manufacturing sector in 1998, and plants are categorised on the basis of their characteristics in each year. The left panel shows the relatively high probability of exit among plants in low skill-intensity industries owned by UK-MNEs investing in low-wage economies (UK-MNE low wage). To demonstrate that this is not simply the result of a general higher propensity to exit among plants owned by this type of firm across all industries, the right panel shows exit propensities among plants in high-skill industries. Here there is no marked difference. I confirm this finding in my econometric analysis below.

Figure 1. Probability of plant exit by industry skill-intensity and firm ownership type



Note: Skill-intensity is measured using the proportion of employees in a 4-digit industry with no qualifications. Low and high skill-intensity sectors are the top and bottom third of industries ranked on this measure. Figure based on the population of manufacturing plants present in 1998.
Source: author's calculations using ARD plant population and AFDI data (source: ONS) to identify plant exit and ownership type. Industry skill-intensity derived from the UK Labour Force Survey.

The paper extends and combines two existing strands of the literature. First, research on the home-country effects of outward investment such as Head and Ries (2002), which finds that investment in relatively low-wage economies is associated with an increase in the skill-intensity of firms' home activities as predicted by theory of vertical FDI. While Head and Ries (2002) use data on multinationals' home-country activities at the firm level, I use plant-level data allowing me to observe plant closures within firms across different industries. This permits an investigation of an important adjustment mechanism through which the documented firm-level increases in skill-intensity of production may come about, and of within-firm industrial restructuring that is directly related to the theory of vertical multinationals locating different activities geographically according to comparative advantage.

Because of the focus on closures, this research also contributes to the literature on plant exit, multinational firms and organisational structure such as Bernard and Jensen (2005), which finds that plants owned by multinational firms are significantly more likely to exit than purely domestic plants once their superior performance characteristics are accounted for.[1, 2]

The paper is structured as follows. The next section presents the theoretical background, the main hypothesis to be examined and my econometric approach. Section 3 describes the data and presents some descriptive statistics. Section 4 details the results and a series of robustness checks and section 5 concludes.

2 Outward FDI and within firm adjustment

2.1 Theoretical and empirical background

The theoretical literature on multinational enterprises (MNEs) differentiates between horizontal FDI, the replication of home country activity abroad in proximity to customers as a substitute for exporting, and vertical FDI, locating different stages of the production chain, or for multi-product firms locating the production of different goods, geographically according to countries' comparative advantage.[3] In practice MNEs can undertake both types of overseas investment

[1] Disney, Haskel and Heden (2003b) using UK data find that, without conditioning on other characteristics, stand-alone establishments are more likely to exit than establishments that are part of larger groups.

[2] This paper is also related to the literature on the effects of import competition on plant performance. Bernard, Jensen and Schott (2006) show that import competition from low-wage economies is associated with an increased probability of plant death, decreasing employment and industry switching into more capital-intensive sectors. Bernard, Redding and Schott (2006) also emphasise the importance of product switching in output growth.

[3] Examples of models of horizontal multinationals are Markusen, (1984) and Brainard (1997) and of vertical multinationals, Helpman (1984, 1985); Venables (1999) contains elements of both types of activity.

simultaneously, however horizontal and vertical FDI have different implications for the skill-intensity of an MNE's home-country operations.

The key difference is that while horizontal FDI, the replication of either all stages of production activity or of downstream production abroad to serve a particular market, could imply an increase in the skill-intensity of production at home (either through the manufacture of low skill-intensity products abroad that would otherwise have been produced at home and exported, or through the expansion of headquarter or R&D services at home), this would be expected to occur irrespective of the economic characteristics of the host economy. Whereas, if firms are engaging in vertical FDI, locating stages of production or the production of different goods in different economies according to comparative advantage, effects on home country operations would be expected to be systematically related to the economic characteristics of host economies relative to those of the home country.

Under vertical FDI firms would be expected to locate (low) skill-intensive activities in (low) skill-abundant countries. Hence the relocation of activity to a relatively low skill-abundant, low-wage country would be expected to be associated with an increase in the skill-intensity of production at home. Empirical evidence exists in support of this. Head and Ries (2002), using data on outward investment by Japanese firms, find that an increase in investment in relatively low per-capita GDP economies was associated with an increase in the skill-intensity of firms' employment in Japan. Brainard and Riker (1997) and Riker and Brainard (1997) also find evidence consistent with MNEs engaging in vertical FDI. They find that labour in affiliates in high-income countries is a substitute for labour in affiliates in other high-income countries (i.e. countries with similar skill levels) and a complement for labour in low-wage economies. They also find evidence that labour in low-wage economies competes to carry out those activities most sensitive to labour costs. Braconier and Ekholm (2000) find some evidence that home country employment in Swedish multinationals is a substitute for employment in affiliates in high-income host countries.[4]

What is pertinent for my analysis is how the theory predicts this relationship comes about. Vertical FDI concerns locating specific activities *within* the firm according to countries'

[4] Further research in this area includes Hanson, Mataloni and Slaughter (2003) who do not find strong evidence that parent and affiliate employment within U.S. multinationals are substitutes. See also Chapter 9 of Barba-Navaretti and Venables (2004) for a summary of research on home-country effects of outward FDI. Yeaple (2003) provides an industry-level analysis which finds a role for comparative advantage in explaining the pattern of U.S. outward FDI.

comparative advantage. Hence it is appropriate to use within-firm data to ascertain whether investment in low-wage economies is associated with a decrease in the extent to which MNEs carry out relatively low-skill activities at home.[5]

2.2 Estimation approach

My aim is to examine whether outward investment in relatively low-wage economies is associated with firms closing plants in relatively low-skill industries in the home country economy. To do this I use panel data at the plant level from which I can identify exit, combined with information on the location of overseas investment at the firm level, where a firm encompasses one or more plants in the home country potentially operating across a range of industries. All estimation is carried out on plants operating in the UK.

The approach I take is akin to a difference-in-differences specification. For identification purposes the underlying assumption is that in the absence of vertical FDI behaviour, the propensity to close plants in low skill-intensity industries relative to high skill-intensity industries should be the same, both for firms that are investing in low-wage economies and for a control group of firms that are not, conditional on observable characteristics. I estimate a probit model of plant death given by:

$$\begin{aligned}\Pr(D_{it,t+s} = 1) = \Phi(&X_{it}\beta + \gamma_1 FO_{it} + \gamma_2 UKmneL_{it} + \gamma_3 UKmneH_{it} \\ &+ \delta_1 FO_{it} * SI_j + \delta_2 UKmneL_{it} * SI_j + \delta_3 UKmneH_{it} * SI_j \\ &+ Ind_j + t_t + r_r)\end{aligned} \tag{1}$$

where $D_{it,t+s}$ is a one-zero indicator variable that takes the value one if the plant exits (is observed for the final time in the population) in the periods t to $t+s$. X_{it} is a vector of plant characteristics which may be related to the propensity to exit. FO_{it}, $UKmneL_{it}$ and $UKmneH_{it}$ are dummy variables indicating that, in period t, a plant is an affiliate of a foreign-owned MNE, is a plant owned by a UK-MNE that is investing in a low-wage economy or is a plant owned by a UK-MNE that is not investing in a low-wage economy, respectively.[6] The omitted category is plants that are part of firms that are not multinationals. Ind_j, are industry dummies which will

[5] See Hanson, Mataloni and Slaughter (2005) for an analysis of within-firm trade and vertical production networks, which exploits variation across affiliates operating in the same industry in different locations owned by the same firm.

[6] Note that UK-MNEs defined as investing in low-wage economies may also be investing in high-wage economies.

control for factors such as the degree of import competition facing firms in the industry, and t_t, and r_r are time and region dummies. I cluster standard errors at the firm level.

The main parameter of interest is δ_2 on the interaction term between the $UKmneL_{it}$ indicator and SI_j, which is a measure of the skill intensity of the industry j in which the plant operates. For plants owned by firms that are investing abroad in low-wage economies the propensity to exit is expected to be decreasing in the skill intensity of the industry. This relationship should also be stronger compared to the other comparison groups, i.e. compared to δ_1 and δ_3, the coefficients on the other interaction terms. If this is the case then those firms that are investing in low-wage economies are significantly more likely to close down plants in low-skill industries *relative* to plants in high-skill industries, than the three potential control groups of firms (those that are not part of MNEs, those that are affiliates of foreign-owned MNEs and those that are owned by other UK-MNEs not investing in low-wage economies).[7] Although I am not relying on time-series variation in my data, this analysis is akin to a difference-in-differences specification, because it compares the difference in the propensity to exit in high versus low skill-intensity industries across plants owned by different types of firm.[8]

To clarify, define P_{lw}^{ls} and P_{lw}^{hs} as the propensity of plants owned by UK-MNEs investing in low-wage economies to exit in low and high skill-intensity industries respectively, and P_{nlw}^{ls} and P_{nlw}^{hs} as the equivalent propensities for plants owned by firms not investing in low-wage economies. The relationship of interest can then be expressed as,

$$DD = (P_{lw}^{ls} - P_{lw}^{hs}) - (P_{nlw}^{ls} - P_{nlw}^{hs}) \tag{2}$$

where DD would be expected to be positive. Moreover, this difference across firm types in relative propensities to exit across industries should be driven specifically by UK-MNEs

[7] I am not able to determine whether the parents of foreign-owned affiliates in the UK are investing in low-wage economies. To the extent that they are, this would make them a worse control group and make it more difficult to detect a difference in exit behaviour between them and UK-MNEs investing in low-wage economies.

[8] An alternative approach would be to exploit time-series information in firms' overseas investment decisions and control for non time-varying plant or firm-level unobservable characteristics. Identification would come through within-firm time-series variation in investment decisions. I do not take this approach due to the short time span of the data and the absence of information on investment scale, making it difficult to identify new investment abroad or changes in the extent of investment. Also I do not exploit any exogenous variation for example in countries' regulations with respect to inward FDI, hence the findings should be primarily taken as providing evidence on firms' behaviour rather than the causal response to a reduction in barriers to FDI.

investing in low-wage economies having a higher propensity to close plants in low skill-intensity industries compared to other types of firms.[9] Re-arranging (2) as,

$$DD = (P_{lw}^{ls} - P_{nlw}^{ls}) - (P_{lw}^{hs} - P_{nlw}^{hs}) \tag{3}$$

this implies that it is the first term in brackets in (3) that should be positive. To confirm this I replace the interactions with SI_j with interactions with dummy variables indicating in which third of the skill-intensity distribution an industry lies. This enables me to ascertain that the results are driven by MNEs investing in low-wage economies having a higher propensity to close plants in low skill-intensity industries (rather than a lower propensity to close plants in high-skill sectors).

One issue is choosing the appropriate control group of firms. I present results using the three different types of firm described above as control groups and also just using UK-MNEs that are not investing in low-wage economies as controls. The latter may make a closer comparison group in terms of underlying characteristics. Moreover, Bernard and Jensen (2005) identify home-country multinationals in general as having a higher propensity to exit compared to purely domestic firms. I also carry out a number of further exercises and robustness checks. I investigate alternative measures of investment in low-wage economies, and check robustness against a range of indicators of industry skill-intensity.

3 Data and descriptive statistics

3.1 Overseas investment

I use information on overseas investment from the UK Office for National Statistics (ONS) Annual Inquiry into Foreign Direct Investment (AFDI) to identify UK multinational firms and to derive indicators of whether or not they are investing in low-wage economies. The AFDI register contains annual information on the population of firms undertaking outward investment from the UK and on the country of location of their overseas subsidiaries, associates and branches.[10] I use the register data over the period 1998 to 2001.

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[9] That is, it should not be driven by UK-MNEs investing in low-wage economies having a lower propensity to close plants in high-skill industries than other types of firm.

[10] No information on the size or industry of the affiliate is provided. A subsidiary is an overseas company where the UK parent holds the majority of the voting rights and can exercise a dominant influence, an overseas associate company is one where the UK parent holds at least 10% of the voting rights and can exercise a significant influence, and a branch is a permanent overseas establishment defined for the purpose of UK tax and double taxation agreements. This is a fixed place of business abroad through which the UK company operates but which is not a subsidiary or associate company. Affiliates of foreign-owned firms located in the UK are also observed to

I use these data to identify where UK-MNEs are investing, and by combining this with data on those countries' GDP per capita relative to that in the UK I create firm-level indicators for investment in low-wage economies. The main indicator I use is a dummy variable equal to one if a firm has overseas operations in any country with per capita GDP of less than 10% of that in the UK in a particular year. However in doing this I exclude overseas operations in countries designated as tax havens. This is because the register is used for the purpose of collecting FDI data which relate to all financial flows to overseas affiliates, rather than just those relating to investment in fixed capital assets. These, along with the countries with per capita GDP less than 10% of the UK where I observe overseas affiliates, are listed in table A1 in the Appendix.

3.2 Plant exit and organisational structure

My second data source is the plant population data from the British Annual Respondents Database (ARD).[11] The main analysis is carried out using information for the population of manufacturing plants for 1998 to 2002, on employment, age, 5-digit industry, ownership and firm structure. The AFDI information can be linked to the ARD data at the firm level.[12]

I define a plant as exiting in year *t* if *t* is the final year it is observed in the population. Exit is defined as closure; if instead a plant were taken over, and not closed, it would remain in the population the following year. In estimation I pool two, two-year cross sections of data for the years 1998-1999 and 2000-2001. Hence I use two cohorts, those plants present in 1998 and those present in 2000, and for each cohort a plant is classified as an exitor if it exits in *t* or *t+1*. The two year time period provides a close link between the observed characteristics in year *t* and the exit decision. As a robustness check I also use the cohort of plants present in 1998 and measure exit over a four year period.

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make outward investments from the UK. These remain classified as foreign-owned. The population of firms in the register increases over the period. Part of this may be due to the inclusion of outward investors that were previously missing from the register. This may mean I mis-classify some UK-MNEs as domestic firms, but this should only act to make it harder to identify differences in behaviour between the different firm types.

[11] See Barnes and Martin (2002) and Griffith (1999) for a full description. It is a legal requirement for firms to respond to the ARD survey. The ARD contains indicators of whether a UK-based plant is owned by a foreign multinational. This information is collected alongside the outward AFDI investment data. The definition of foreign direct investment used for statistical purposes in collecting the inward and outward FDI data is, "*investment that adds to, deducts from or acquires a lasting interest in an enterprise operating in an economy other than that of the investor, the investor's purpose being to have an "effective voice" in the management of the enterprise. (For the purposes of the statistical inquiry, an effective voice is taken as equivalent to a holding of 10% or more in the foreign enterprise.).*" Office for National Statistics (2000).

[12] See Criscuolo and Martin (2003) and Griffith et al. (2004) for analyses using these linked data.

I also use the plant population data to construct characteristics following other studies of plant exit, including age and size (log employment), (see Dunne, Roberts and Samuelson 1988, 1989 and Disney, Haskel and Heden, 2003b). Bernard and Jensen (2005) emphasise the importance of controlling for firm structure variables. I construct three indicators of multi-plant firms: whether a plant is part of a firm with other plants in the same 5-digit manufacturing industry (*multi_ind*); whether the plant is part of a firm with plants in other 5-digit manufacturing industries (*multi_man*); and, whether the firm is also active in the business services sector (*multi_bus*). All refer only to activity in the UK. These categories are not mutually exclusive. A plant belonging to a firm with all three of these characteristics can have values of one for all three of the dummy variables.

One issue is the extent to which I am able to control for other characteristics that could underlie the estimated pattern of exit propensities. Unobservable characteristics at either the firm or plant level that may be correlated with investment in low-wage economies and the propensity to close plants in low skill-intensity sectors may pose a potential problem. To overcome this to some extent I use an alternative dataset, which allows me to control for characteristics such as total factor productivity in line with Bernard and Jensen (2005), but which is less satisfactory in capturing exit accurately.

More detailed characteristics, such as productivity and capital intensity, can only be obtained by using the ARD establishment-level sample, where an establishment can comprise more than one plant in the same line of business under common ownership. I only use these data as a robustness check. This is for two reasons. First, because establishments can comprise more than one plant, exit of individual plants can be understated for multi-plant establishments.[13] Second, while my main analysis uses data on the population of plants, the detailed establishment-level data are only available for a sample. The way the sample is structured means that the probability of being sampled increases with establishment size, and hence the sample may be biased towards growing, surviving plants.

For each sampled establishment I calculate capital intensity as log capital stock per employee, and total factor productivity using a Cobb-Douglas index measure.[14] I supplement this with

[13] This is potentially problematic given that establishments that are part of multinationals are more likely to comprise more than one plant.

[14] Capital stock information not collected directly. It is constructed using the perpetual inventory method from establishment-level data on investment expenditure for three classes of assets, plant and machinery, vehicles and buildings. See Martin (2002) for details.

information on establishment exit and on organisational structure constructed from basic data on the population of establishments that is comparable to the information on the population of plants detailed above.

3.3 Industry characteristics

I derive my main measure of industry skill intensity from the UK Labour Force Survey (LFS). I use a measure of the proportion of employees in an industry who report having no qualifications. I create a time-invariant average at the 4-digit industry level using data from 1995 to 2003.[15] The average share of employees with no qualifications is shown for 2-digit industries in table A2 in the Appendix. The sectors with the lowest skill-intensities include clothing, leather, textiles and rubber and plastics.

I create a range of other measures to check robustness. First, an alternative measure from the LFS, the proportion of employees in an industry who are qualified to degree level equivalent and above. Second, three measures derived from the ARD establishment-level sample. These are the share of the total wage bill that is accounted for by skilled workers (administrative, technical and clerical workers) as opposed to unskilled workers (operatives), a measure of capital stock per worker, and the average annual wage. I construct these at the 5-digit industry level, using appropriate sampling weights, for the year 1995.[16] The wage bill share of skilled workers mirrors the measure used in Head and Ries (2002). Finally I use an alternative measure of wages. The average hourly wage at the 4-digit level derived from the UK Annual Survey of Hours and Earnings (ASHE) for 1997.

3.4 Descriptive statistics

Table 1 shows some descriptive statistics for the data on the population of plants used in the main analysis. The data tabulated are averaged over the two cohorts of plants present in 1998 and 2000. Characteristics are shown for plants owned by four different types of firm: domestic only, foreign-owned multinationals, UK-owned multinationals investing in low-wage economies (defined as those with per capita GDP less than 10% of the UK), and UK-owned multinationals that are not investing in low-wage economies.

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[15] I average over the LFS spring quarters for these years to increase the sample sizes on which the measure is based. Although it is an industry-level measure there is a concern that it will be affected by firm behaviour (exit) during this period. In my robustness checks I use other measures constructed using data which pre-date the analysis period.

[16] These measures pre-date the main estimation period. 1995 is the last year for which the wage bill information is split by administrative, technical and clerical workers and operatives.

Table 1. Descriptive statistics plant population by ownership type, 1998, 2000

	Domestic	Foreign-MNE	Low wage UK-MNE	Not low wage UK-MNE
Observations	*338,977*	*8,682*	*4,228*	*6,687*
% exit *t* or *t+1*	23%	23%	24%	24%
Age (years)	5.80	9.13	9.68	9.55
	(4.64)	*(6.84)*	*(7.24)*	*(7.09)*
Employment	14.59	159.89	154.70	128.33
	(57.11)	*(415.78)*	*(365.05)*	*(255.93)*
Multi_ind	0.11	0.61	0.86	0.72
	(0.31)	*(0.49)*	*(0.35)*	*(0.45)*
Multi_man	0.04	0.16	0.14	0.23
	(0.20)	*(0.36)*	*(0.34)*	*(0.42)*
Multi_bus	0.05	0.43	0.93	0.78
	(0.21)	*(0.50)*	*(0.26)*	*(0.42)*
Mean share no qualifications	0.16	0.14	0.14	0.16
	(0.08)	*(0.07)*	*(0.07)*	*(0.08)*
% in low skill / high skill industries	27% / 35%	23% / 48%	22% / 60%	34% / 40%

Note: calculations carried out over two cohorts of plants present in 1998, 2000. Age is truncated at 21 years. Unless otherwise stated the table shows means with standard deviations in parentheses.
Source: author's calculations using ARD plant population and AFDI data (source: ONS), and the LFS.

The first characteristic shown is the proportion of plants that exit in a two-year period (either in 1998-1999 or in 2000-2001). On average this is very similar across plants of different ownership types at 23 or 24 percent.[17,18] The table also shows that plants that are not part of multinationals are on average younger and much smaller than those owned by multinationals. As expected they are also much less likely to be part of multi-plant firms.

The final two rows provide information on the distribution of plants across industries according to the skill intensity of the industry (measured by the share of employees with no qualifications derived from the LFS). The average plant skill intensity is similar across the different ownership types at 0.14 to 0.16, a higher value indicating a higher share of workers with no qualifications and hence lower skill intensity. Finally, I rank the 4-digit industries by the industry-level skill intensity measure and split them into thirds. The final row reports the proportion of plants within each ownership category falling into the low skill-intensity third of industries and the high skill-intensity third. This shows that UK-multinationals investing in low-wage economies are, along with foreign-owned multinationals, the least likely to be operating UK plants in low skill-

[17] For comparison Disney et al. (2003a,b) report an exit rate using the establishment-level ARD population data of around 20% per annum over the period 1986-1992 for the UK. Bernard and Jensen (2005) report an exit rate of around 35% for US manufacturing plants over a 5-year period.

[18] A potential concern is the accuracy with which the ARD population data records true exit. There may be lags between true exit and the records being updated. This should not present a problem for analysis. Exit may be recorded in a more timely manner for plants that are part of larger firms such as multinationals, but this would only create a bias if exit were recorded more or less accurately for plants in particular industries *within* particular types of firms, which is unlikely to be the case.

intensity manufacturing sectors and the most likely to be operating UK plants in high skill-intensity sectors. This presents a first piece of evidence in line with these firms engaging in vertical FDI.

Table 2 presents further descriptive information in line with the findings of Head and Ries (2002), of outward investment to low-wage economies being associated with an increase in the skill-intensity of activity in the home country at the *firm* level. I take all firms present in 1998 and split them into the four ownership groups as above according to their characteristics in that year. The table shows how UK plants and employment in these firms are distributed across industries by skill-intensity in 1998 and again, to the extent that they survive, in 2002.

Table 2. Distribution of plants and employment across industries by firm type, 1998 cohort

	Distribution of plants and employment across industries									
	Domestic		**Foreign-MNE**		**Low wage UK-MNE**		**Not low wage UK-MNE**		**Total (thousands)**	
	1998	**2002**	**1998**	**2002**	**1998**	**2002**	**1998**	**2002**	**1998**	**2002**
Plants										
Low skill intensity	28%	27%	23%	25%	23%	14%	35%	32%	52	30
Med. skill intensity	37%	37%	29%	30%	17%	20%	27%	23%	66	40
High skill intensity	35%	35%	47%	46%	60%	65%	37%	45%	66	39
Total (thousands)	174	104	4	2	3	2	3	2	184	109
Employment										
Low skill intensity	37%	37%	21%	22%	23%	14%	39%	32%	1,362	701
Med. skill intensity	31%	32%	42%	38%	22%	24%	28%	27%	1,274	704
High skill intensity	32%	31%	38%	40%	55%	62%	33%	41%	1,441	809
Total (thousands)	2,653	1,446	633	328	415	215	375	225	4,077	2,214

Note: figures are calculated for the cohort of manufacturing firms present in 1998. Table shows the distribution of plants and employment across industries in 1998 and 2002 by firm ownership type.
Source: author's calculations using ARD plant population and AFDI data (source: ONS), and the LFS.

The table shows that the distribution of plants and employment in both types of UK-MNEs is shifting towards higher-skilled industries, however the rate is greater for UK-MNEs investing in low-wage economies. Starting from a base of 23% of employment in low-skill industries, this latter group of firms exhibit a 9 percentage point (or 39%) fall in the proportion of their employment in low skill-intensity sectors. This compares to a fall of 7 percentage points (or 18%) from a higher base of 39%, for UK-MNEs that were not investing in low-wage economies. The pattern for the distribution of plants is similar with UK-MNEs investing in low-wage economies exhibiting a 9 percentage point fall in the proportion in low-skill sectors, compared to a 3 percentage point fall for UK-MNEs not investing in low wage economies. The table also emphasises that although they make up a small proportion of total manufacturing plants (3% in 1998), UK-MNEs make up a substantial proportion of employment (19% in 1998).

Table 3 examines net entry (plant entry taking account of offsetting plant exit) within narrowly-defined industries for the same group of firms. The first column shows the average number of plants that each *type* of firm owns within a 5-digit industry sector, within each third of the industry skill-intensity distribution. For example in 1998 domestic firms owned on average 1.11 plants in a low-skill 5-digit industry, and the same type of firm (but not necessarily the precise same firms) owned on average 1.08 plants in a high-skill 5-digit industry. The second column shows the net entry rate between 1998 and 2002. That is, for every one plant present in 1998, it shows for that same group of firms the relative increase or decrease in that number 5 years later. As these are negative they indicate that this cohort of firms is reducing the number of plants they own in these industries. A figure of minus 0.5 implies that for every two plants present in 1998 only one plant is present in 2002.[19]

Table 3. Net entry by firm type and industry, firms present in 1998

	Net entry, 1998 to 2002							
	Domestic		Foreign-MNE		Low wage UK-MNE		Not low wage UK-MNE	
	Mean no. plants in 5-digit industry	Net entry rate	Mean no. plants in 5-digit industry	Net entry rate	Mean no. plants in 5-digit industry	Net entry rate	Mean no. plants in 5-digit industry	Net entry rate
Low skill intensity	1.11	-0.46	1.46	-0.51	3.32	-0.71	2.66	-0.58
Medium skill intensity	1.05	-0.42	1.86	-0.53	2.54	-0.58	2.16	-0.57
High skill intensity	1.08	-0.44	2.20	-0.45	5.24	-0.50	2.30	-0.49

Note: Figures are calculated for the cohort of manufacturing firms present in 1998. The table shows the average number of plants per 5-digit sector in 1998, and 5-year net entry rate by ownership and industry skill-intensity.
Source: author's calculations using ARD plant population and AFDI data (source: ONS), and the LFS.

The main point to note is the particularly high net exit rate for plants in low-skill industries that are owned by UK-MNEs operating in low-wage economies. At –0.71, this net exit rate is significantly higher than for other types of firms in low-skill industries, and significantly higher than for the same type of firm in high-skill industries. This, together with the evidence in table 2, implies that higher entry is not counteracting the results presented on exit below.

4 Results

I now detail the results of the probit estimation. Table 4 presents results building up to the specification shown in equation (1). The table shows marginal effects with z-ratios reported in

[19] While the net exit rates look very high it should be noted that they are calculated for a single cohort of firms present in the manufacturing sector in 1998. New firms will be entering over the period 1999 to 2002 to offset exit from the 1998 cohort, which means that the figures should not be taken as implying a sharp decline in the total number of manufacturing plants over the period. In the data total employment in manufacturing in 2002 was 3.6 million compared to 4.1 million in 1998, and the total number of plants was 175 thousand in 2002 compared to in 184 thousand in 1998.

parentheses. The first column confirms the findings of Bernard and Jensen (2005) for the UK. I find that plants that are part of multi-plant firms and plants that are part of multinational firms are more likely to exit than those that are single plant firms or part of firms that only operate in the UK. While Bernard and Jensen (2005) did not distinguish plants that are affiliates of foreign-owned multinationals, I find some evidence to indicate that UK affiliates of foreign-owned multinationals are more likely to exit than plants owned by UK-MNEs (although this difference is not statistically significant). This is perhaps not surprising as multinationals may adjust employment in affiliates abroad more readily than in the home country, (see for example Görg and Strobl, 2003 and Fabbri, Haskel and Slaughter, 2003 for similar findings). In line with other studies I also find that plants that are younger are more likely to exit, as are plants that are smaller in terms of employment. In Column (2) I split UK-MNEs into two different types, those investing in low-wage economies and those that are not, however I find no statistically significant difference between the estimated coefficients for the two types of firm.

Column (3) shows the main specification from equation (1). I interact each of the three ownership dummies with the skill-intensity of the industry in which the plant is operating.[20] Skill intensity is measured by the share of the workforce with no qualifications, hence a higher value indicates lower skill-intensity. I find that, compared to other types of multinational firms, the propensity of UK-MNEs investing in low-wage economies to close plants varies significantly with the skill-intensity of the industry. More specifically, UK-MNEs investing in low-wage economies have a higher propensity to close plants in low-skill intensity industries relative to high-skill intensity industries consistent with them engaging in vertical FDI.

The marginal effect on the interaction term for low-wage UK-MNEs (0.529) is significantly different to that on the interaction term for foreign-owned MNEs (0.052) and that on the interaction term for UK-MNEs not investing in low-wage economies (0.116) at the 1% and 5% level respectively. The marginal effect of 0.529 implies that for an increase in the industry skill-intensity measure (i.e. an increase in the proportion of employees in the industry with no qualifications) of 0.1, (the mean for the estimation sample is 0.16, and the standard deviation

[20] I do not include the skill-intensity measure directly in this specification as it varies only at the 4-digit industry level as do the industry dummies. The results are very similar using 3-digit industry dummies plus the industry skill-intensity measure.

0.08), there is an increase in the propensity to exit for plants owned by UK-MNEs investing in low-wage economies of around 5 percentage points.[21]

Column (4) estimates only on the sub-sample of plants owned by UK-MNEs and hence uses only those UK-MNEs not operating in low-wage economies as the control group. Using this set of firms there is no longer sufficient variation to identify the coefficient on the *multi_bus* indicator, which varies only across firms and time (the *multi_ind* and *multi_man* indicators vary at the firm-5-digit industry level and over time). The vast majority of these firms also own plants classified to the business services sector, (see table 1), which includes financial management, accountancy and legal activities. The positive and significant marginal effect on the interaction term between UK-MNEs investing in low-wage locations and industry skill-intensity implies that, relative to UK-MNEs not investing in low-wage economies, the propensity to close plants by those that are investing in low-wage economies is higher, the lower the skill intensity of the industry.

A final step is to ascertain that it is a higher propensity to exit in the lowest-skill industries that is driving this finding. To help clarify this figure 2 shows the average predicted probability of exit across plants by ownership type and 4-digit industry skill-intensity using the estimation results from column (4). For ease of exposition it also plots a linear prediction through these points for each ownership type. The figure shows that for UK-MNEs not investing in low-wage economies the predicted exit propensity is roughly even across industries, (the left panel), whereas for UK-MNEs that are investing in low-wage economies the predicted exit probability is significantly higher in less skill-intensive sectors (i.e. those with a higher share of employees with no qualifications).

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[21] The marginal effects shown are generated automatically in *Stata* which does not recognise an interaction term. Strictly the marginal effects for interaction terms should be calculated as follows for the case when a dummy variable x_1 is interacted with a continuous variable x_2:

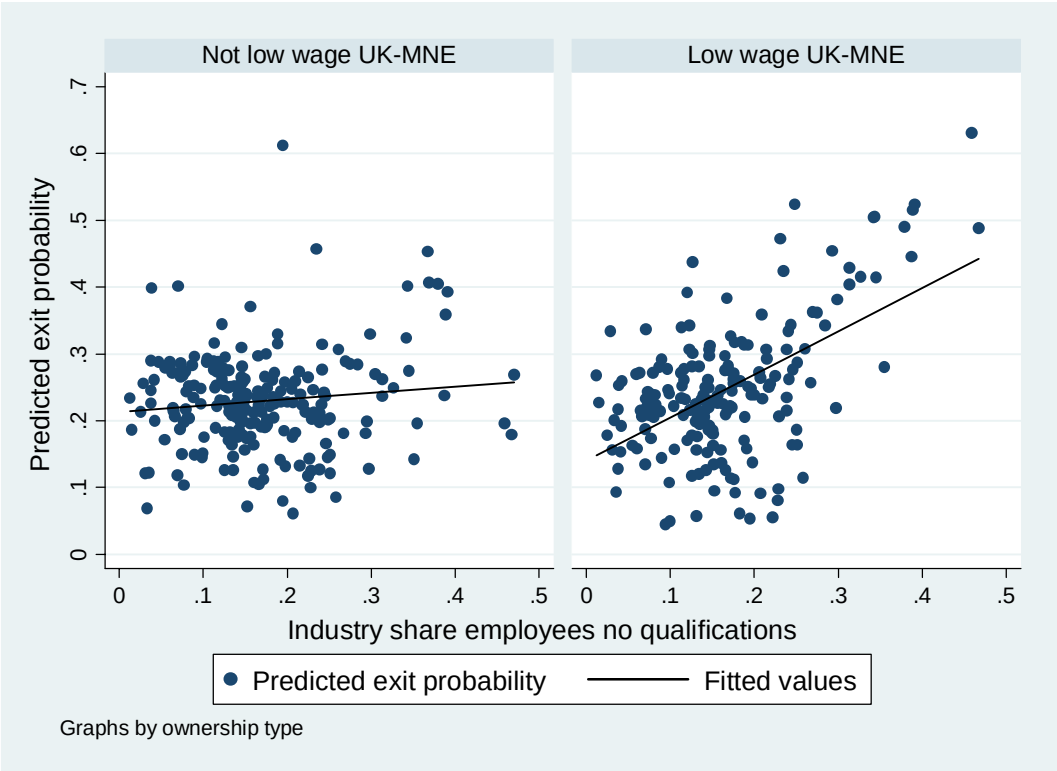
$\frac{\Delta \partial F / \partial x_2}{\Delta x_1} = (\beta_2 + \beta_{12})\phi((\beta_2 + \beta_{12})x_2 + \beta_1 + X\beta) - \beta_2\phi(\beta_2 x_2 + X\beta)$. Calculation of this for column (3) gives a mean value of 0.559 (positive for all values, ranging from 0.109 to 0.714), and for column (4) a mean value of 0.521 (from 0.108 to 0.705). These are very close to, and of the same sign as the marginal effects reported in table 4. I also estimated each specification in table 4 as a linear probability model and in each case the marginal effects on the interaction terms and the associated significance levels were very close to those reported in the table.

Table 4. Exit probits: investment in low-wage economies and exit

Dependent variable=1 if exit in *t* or *t+1*	**Exit over 2 years, pooled cross sections Marginal effects (z-statistics)**				
	All plants (1)	**All plants (2)**	**All plants (3)**	**UK-MNEs (4)**	**UK-MNEs (5)**
Age_{it}	-0.010	-0.010	-0.010	-0.008	-0.008
	(-48.15)	*(-48.15)*	*(-48.22)*	*(-9.80)*	*(-9.98)*
$Ln(empment)_{it}$	-0.029	-0.029	-0.029	-0.042	-0.043
	(-33.03)	*(-33.05)*	*(-33.14)*	*(-7.33)*	*(-8.23)*
$Multi_ind_{it}$	0.047	0.047	0.047	0.107	0.105
	(10.04)	*(10.04)*	*(10.05)*	*(3.79)*	*(3.71)*
$Multi_man_{it}$	0.031	0.031	0.031	0.085	0.081
	(6.46)	*(6.47)*	*(6.43)*	*(2.56)*	*(2.46)*
$Multi_bus_{it}$	0.076	0.076	0.076	0.010	0.014
	(7.16)	*(7.15)*	*(7.15)*	*(0.53)*	*(0.77)*
$Foreign\text{-}owned_{it}$	0.048	0.048	0.040		
	(5.39)	*(5.39)*	*(2.13)*		
$UK\text{-}MNE_{it}$	0.030				
	(2.54)				
Low wage $UK\text{-}MNE_{it}$		0.032	-0.044	-0.072	-0.014
		(1.77)	*(-1.79)*	*(-2.32)*	*(-0.60)*
Not low wage $UK\text{-}MNE_{it}$		0.029	0.009		
		(2.32)	*(0.46)*		
$Foreign\text{-}owned_{it}$ * 4-digit share employees no $quals_j$			0.052		
			(0.52)		
Low wage $UK\text{-}MNE_{it}$ * 4-digit share employees no $quals_j$			0.529	0.533	
			(3.47)	*(2.91)*	
Not low wage $UK\text{-}MNE_{it}$ * 4-digit share employees no $quals_j$			0.116		
			(1.31)		
4-digit share employees no $quals_j$				-0.147	
				(-0.91)	
Low wage $UK\text{-}MNE_{it}$ * Low $skill_j$					0.079
					(2.38)
Low wage $UK\text{-}MNE_{it}$ * Medium $skill_j$					0.015
					(0.38)
Low $skill_j$					0.010
					(0.36)
Medium $skill_j$					0.031
					(1.32)
4-digit industry dummies	Yes	Yes	Yes		
2-digit industry dummies				Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
LL	-185432.5	-185432.5	-185413.5	-5663.3	-5662.3
Obs	358,573	358,573	358,573	10,915	10,915

Note: estimation is on two cross sections 1998-1999 and 2000-2001. Standard errors clustered at the firm level. The table shows marginal effects and z-ratios in parentheses. Low wage UK-MNEs have outward FDI to countries with GDP per capita less than 10% of the UK.
Source: author's calculations using ARD plant population and AFDI data (source: ONS), and the LFS.

Figure 2. Predicted probability of exit by industry skill-intensity and firm ownership type



Note: Skill-intensity is measured using the proportion of employees in a 4-digit industry with no qualifications. Predicted exit probabilities are averages derived from column (4) of table 4.
Source: author's calculations using ARD plant population and AFDI (source: ONS) and the LFS.

This is also shown in column (5) of table 4 where the continuous measure of skill-intensity is replaced with dummy variables for the third of the distribution of industry skill-intensities in which a plant lies, *Low skill*$_j$ (lowest skill-intensity third) and *Medium skill*$_j$ (middle third), with the highest skill-intensity third as the omitted category. This specification also ensures that the previous results are not driven by outlying values of the continuous measure of skill-intensity. As shown by the positive and significant marginal effect on the interaction between the dummy for a UK-MNE investing in a low wage economy and *Low skill*$_j$, it is in the lowest-skill industries that plants owned by UK-MNEs investing in low-wage economies are significantly more likely to exit. The results also show that there is no significant difference in the propensity to exit across plants owned by the two types of UK-MNEs in the other two thirds of the industry skill distribution. This suggests that these firms are behaving in a manner consistent with vertical FDI, and more specifically are decreasing UK activity in the lowest-skill sectors in line with the theoretical predictions of these models. The results imply that plants in the lowest-skill industries, for example in the textiles and clothing sectors, that are owned by UK-MNEs

investing in low-wage economies, are around 8 percentage points more likely to close than those owned by UK-MNEs that are not investing in low-wage economies.

Table A3 in the Appendix performs a sample split underlying these results, and estimates separately on plants in the top and bottom thirds of industries ranked by skill-intensity, allowing all coefficients to vary across the two groups of industries. Again, the results show that plants in the least skill-intensive industries are more likely to close if they are part of UK-MNEs investing in low-wage economies, compared to those owned by UK-MNEs that are not, and that there is no difference in the propensity to exit across the two firm types in high-skill industries.

Finally, table A4 in the Appendix re-estimates the specifications from columns (3) and (4) of table 4 on a single cross section of data with exit defined over a four year period 1998 to 2001. In columns (1) and (2) of table A4 low wage UK-MNEs are defined based on their investment status in 1998 (year *t*), and in column (3) on the basis of whether they are observed to have overseas activity in a low wage economy at any point over the period 1998 to 2001. The results based on exit over this longer period are in line with my main findings. I now go on to present a series of further exercises to check the robustness of my results.

4.1 Robustness 1: alternative definitions of investment in low-wage economies

Table 5 shows results using alternative definitions of low-wage economies. All results are based on UK-MNEs only. Columns (1) and (2) use definitions of a low-wage economy as one with GDP per capita of less than 5% and less than 25% of UK per capita GDP respectively. The results are very similar to those in column (4) of table 4, with a lower estimated marginal effect using the less than 25% of UK per capita GDP definition which includes a larger group of low-wage countries.

Column (3) uses specific groups of countries from the outward FDI data. I use three groups: South and East Asia, including China and India, Eastern Europe and Africa. Estimation is thus relative to firms only undertaking outward investment to all other economies. For plants owned by firms that are investing in South and East Asia, I continue to find that the propensity to exit is higher, the lower the skill intensity of the industry. If anything the pattern is opposite for plants that are owned by firms investing in Eastern Europe, where the interaction term is negative but insignificant.[22] I find no systematic pattern for firms investing in Africa. Investments in African

[22] Konings and Murphy (2001) do not find evidence of substitutability of manufacturing employment between EU parent firms and their affiliates in Central and Eastern Europe.

economies may be driven by access to natural resources, and hence may not be substitutes for UK-based activity.

Table 5. Alternative definitions of investment into low-wage economies

Dependent variable=1 if exit in *t* or *t+1*	**UK-MNEs (< 5% UK GDP per capita) (1)**	**UK-MNEs (< 25% UK GDP per capita) (2)**	**UK-MNEs (Country groups) (3)**
Low wage UK-MNE$_{it}$	-0.066 *(-2.11)*	-0.064 *(-2.07)*	
Low wage UK-MNE$_{it}$ * 4-digit industry share employees no quals$_j$	0.522 *(2.88)*	0.451 *(2.59)*	
Eastern Europe$_{it}$			0.046 *(1.16)*
Africa$_{it}$			0.012 *(0.32)*
South and East Asia$_{it}$			-0.105 *(-2.80)*
Eastern Europe$_{it}$ * 4-digit industry share employees no quals$_j$			-0.217 *(-1.08)*
Africa$_{it}$ * 4-digit industry share employees no quals$_j$			0.116 *(0.54)*
South and East Asia$_{it}$ * 4-digit industry share employees no quals$_j$			0.606 *(2.65)*
4-digit industry share employees no quals$_j$	-0.127 *(-0.76)*	-0.160 *(-0.96)*	-0.184 *(-1.13)*
Controls: Age$_{it}$, Ln(empment)$_{it}$, Multi_ind$_{it}$, Multi_man$_{it}$, Multi_bus$_{it}$	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
LL	-5663.5	-5665.8	-5656.6
Obs	10,915	10,915	10,915

Notes: estimation is on two cross sections 1998-1999 and 2000-2001. Standard errors clustered at the firm level. Table shows marginal effects and z-ratios in parentheses. Column (1), (2) low wage UK-MNEs have outward FDI to countries with GDP per capita less than 5%, 25% of the UK respectively.
Source: author's calculations using ARD plant population and AFDI data (source: ONS) and the LFS.

4.2 Robustness 2: alternative measures of industry skill intensity

Table 6 checks robustness against alternative definitions of industry skill intensity. Columns (1), (2) and (3) use 5-digit industry level measures constructed from the ARD establishment-level sample: capital intensity (capital stock per employee); the skilled worker share of the wage bill; and the average annual wage. Column (4) uses an alternative 4-digit industry wage measure, the hourly wage as measured in the ASHE. The final column uses a further 4-digit industry level measure derived from the LFS, the share of employees reporting having degree level or equivalent or above qualifications. Contrary to the skill-intensity measure used so far, all of these measures would be expected to be *increasing* in the skill-intensity of the industry.

The estimated marginal effects on the interaction terms for the first two measures, capital intensity and the skilled worker share of the wage bill, are negative and significant at the 1% and 10% level respectively and provide support for my main findings. The first measure indicates that for plants owned by UK-MNEs investing in low-wage economies the propensity to exit is decreasing in the capital intensity of the industry, or put another way, it is higher the more labour-intensive is the industry. An increase in capital intensity of 100 (the mean and standard deviation are 87.8 and 133.5 thousands of pounds per worker) is associated with a decrease in the propensity to exit of around 7 percentage points. The second measure is equivalent to the main variable used to measure the skill intensity of production in Head and Ries (2002). The results imply that an increase in the skilled worker wage bill share of 0.10 (the mean is 0.46 and the standard deviation 0.16), is associated with a decrease in the propensity to exit of around 2 percentage points for plants owned by UK-MNEs investing in low-wage economies, over and above that for plants owned by UK-MNEs that are not investing in low-wage economies.

Table 6. Alternative definitions of low-skill, low-wage industries in the UK

Dependent variable=1 if exit in *t* or *t+1*	**UK-MNEs**	**UK-MNEs**	**UK-MNEs**	**UK-MNEs**	**UK-MNEs**
	Capital intensity (ARD)	**Skilled workers wagebill share (ARD)**	**Mean annual wage (ARD)**	**Mean hourly pay (ASHE)**	**Share degree (LFS)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Low wage UK-MNE$_{it}$	0.066	0.095	0.044	0.037	0.004
	(2.68)	*(1.89)*	*(0.54)*	*(0.40)*	*(0.16)*
Low wage UK-MNE$_{it}$ * Industry characteristic	-0.0007	-0.175	-0.002	-0.003	0.038
	(-3.65)	*(-1.78)*	*(-0.49)*	*(-0.33)*	*(0.27)*
Industry characteristic	-0.0001	-0.205	0.004	-0.002	-0.130
	(-1.24)	*(-2.86)*	*(1.03)*	*(-0.23)*	*(-1.27)*
Controls: Age$_{it,}$ Ln(empment)$_{it,}$ Multi_ind$_{it,}$ Multi_man$_{it,}$ Multi_bus$_{it}$	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
LL	-5649.7	-5652.6	-5672.7	-5673.5	-5672.0
Obs	10,915	10,915	10,915	10,915	10,915

Notes: capital intensity: £1000s capital stock per employee, 1995. Mean annual wage: £1000 per year, 1995. Mean hourly pay £1997. ARD industry characteristics vary at the 5-digit industry level, LFS and ASHE characteristics at the 4-digit level. Estimation is on two cross sections 1998-1999 and 2000-2001. Standard errors clustered at the firm level. Table shows marginal effects and z-ratios in parentheses. Low wage UK-MNEs have outward FDI to countries with GDP per capita less than 10% of the UK.
Source: author's calculations using ARD plant population, establishment sample and AFDI data (source: ONS), the LFS and the ASHE.

The interaction terms using the final three measures are not statistically significant. It is possible that these provide less precise measures of skill-intensity. The share of employees with degree level or above qualifications is unlikely to capture the characteristics of low-skill industries as

accurately as my main measure (the share of employees with no qualifications). The two wage measures will also be affected by factors other than industry skill levels.

4.3 Robustness 3: controlling for further characteristics

Finally I use the establishment-level sample to control for further characteristics. These data, described in section 3.2, enable me to include establishment-level measures of capital intensity and total factor productivity in line with the study by Bernard and Jensen (2005). These data do have some problems in that they will understate exit by multi-plant establishments, and the sample will likely be biased towards large (and hence surviving) establishments. To try to deal with this second issue to some extent I weight observations by the inverse of their sampling probabilities.

As expected the results in column (1) of Table 7 indicate that the probability of exit is decreasing in establishment capital intensity and productivity, although only the latter variable is statistically significant. Conditional on total factor productivity, size (measured by employment) is no longer significant. The results also suggest that on average establishments owned by UK-MNEs investing low wage economies are more likely to exit than those owned by other types of firm. Column (2) includes the interaction terms. The estimated marginal effect on the interaction term using the dummy for UK-MNEs investing in low-wage economies is positive and is larger than that for the other two types of multinational firms, but it is only statistically significant at the 15% level.

In the final two columns I split the sample of establishments into those in the lowest-skill third of the industry skill intensity distribution and those in the highest-skill third. Column (3) shows that in low-skill industries it is only those establishments owned by UK-MNEs investing in low-wage economies that are significantly more likely to exit compared to the other groups. The marginal effect for low wage UK-MNEs (0.107) is significantly different to those for the other two types of multinationals at the 5% level. Column (4) shows that establishments owned by UK-MNEs investing in low-wage economies are also the most likely to exit in high-skill industries, but in this case the marginal effect is not statistically different to the estimated marginal effects for the other two types of multinationals. Overall this pattern of results is supportive of my main findings.

Table 7. Exit probits, establishment-level data

Dependent variable=1 if exit in t or t+1	All estabs (1)	All estabs (2)	All estabs Low-skill industries (3)	All estabs High-skill industries (4)
Age_{it}	-0.003 *(-7.25)*	-0.003 *(-7.23)*	-0.003 *(-4.13)*	-0.003 *(-4.33)*
$Ln(empment)_{it}$	-0.003 *(-1.34)*	-0.003 *(-1.33)*	-0.004 *(-0.96)*	-0.005 *(-1.17)*
$Ln\ (K/L)_{it}$	-0.005 *(-1.53)*	-0.005 *(-1.53)*	-0.012 *(-2.17)*	-0.011 *(-1.78)*
$Ln\ (TFP)_{it}$	-0.009 *(-2.00)*	-0.009 *(-1.98)*	-0.025 *(-2.25)*	-0.002 *(-0.35)*
$Multi_ind_{it}$	0.098 *(6.96)*	0.098 *(6.98)*	0.120 *(5.15)*	0.095 *(4.12)*
$Multi_man_{it}$	0.053 *(4.75)*	0.053 *(4.77)*	0.071 *(3.75)*	0.061 *(3.05)*
$Multi_bus_{it}$	0.021 *(1.82)*	0.021 *(1.78)*	0.018 *(0.94)*	0.018 *(0.93)*
$Foreign\text{-}owned_{it}$	0.025 *(2.55)*	0.053 *(2.15)*	-0.0002 *(-0.01)*	0.038 *(2.21)*
Low wage $UK\text{-}MNE_{it}$	0.066 *(3.31)*	0.015 *(0.51)*	0.107 *(2.50)*	*0.070* *(2.70)*
Not low wage $UK\text{-}MNE_{it}$	0.023 *(1.87)*	0.020 *(0.75)*	0.018 *(0.90)*	0.035 *(1.59)*
$Foreign\text{-}owned_{it}$ * 4-digit share employees no $quals_j$		-0.161 *(-1.23)*		
Low wage $UK\text{-}MNE_{it}$ * 4-digit share employees no $quals_j$		0.270 *(1.51)*		
Not low wage $UK\text{-}MNE_{it}$ * 4-digit share employees no $quals_j$		0.020 *(0.15)*		
4-digit share employees no $quals_j$		-0.025 *(-0.35)*	-0.185 *(-1.17)*	0.330 *(1.38)*
2-digit industry dummies	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
LL	-4505.7	-4503.3	-1541.9	-1595.2
Obs	13,387	13,387	4,584	4,456

Notes: estimation is on two cross sections 1998-1999 and 2000-2001. Standard errors clustered at the firm level. Table shows marginal effects and z-ratios in parentheses. Low wage UK-MNEs have outward FDI to countries with GDP per capita less than 10% of the UK. All specifications are weighted using inverse sampling probabilities.
Source: author's calculations using ARD establishment sample, establishment population and AFDI data (source: ONS) and the LFS.

5 Conclusions

This paper has presented empirical evidence that UK multinationals investing abroad in low-wage economies are acting in line with the predictions of theories of vertical foreign direct investment. Specifically, I find that plants in low skill-intensity sectors owned by UK multinationals investing in low-wage economies are significantly more likely to exit than those

owned by UK multinationals that are not investing in low-wage economies, and importantly, that this difference is not mirrored for plants in high-skill sectors.

By comparing the behaviour of multinational firms making different geographic outward investments, I extend the literature on firm characteristics and plant closures. I also confirm previous findings that multinational firms, either domestic or foreign-owned, are more likely to shut down plants than non-multinational firms, and hence exhibit more flexibility in organisational restructuring.

Given increasing geographic mobility of economic activity and the fact that multinational firms make up significant proportions of employment in economies such as the US and UK, these findings have potential implications for the industrial composition of employment in OECD economies. However the findings in this paper were restricted to the manufacturing sector. A natural extension would be to examine effects of outward FDI on mobile service sector activities.

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Appendix

Table A1. Low wage countries and tax havens

Low-wage economies			
Albania	Ecuador	Jordan	Rwanda
Algeria	Egypt	Kenya	Senegal
Angola	El Salvador	Laos	Sierra Leone
Bangladesh	Equatorial Guinea	Madagascar	Sri Lanka
Benin	Ethiopia	Malawi	Sudan
Bolivia	Ghana	Mali	Suriname
Bulgaria	Guatemala	Morocco	Syria
Burkina Faso	Guinea	Mozambique	Tanzania
Cameroon	Guyana	Nicaragua	Togo
Cape Verde	Haiti	Niger	Tonga
Central African Republic	India	Nigeria	Vietnam
Chad	Indonesia	Pakistan	Zaire
China	Israel	Papua New Guinea	Zambia
Congo	Iran	Paraguay	Zimbabwe
Djibouti	Ivory Coast	Philippines	
Dominican Republic	Jamaica	Romania	
Tax havens			
Antigua	Bermuda	Isle of Man	St Kitts and Nevis
Bahamas	Channel Islands	Liechtenstein	St Lucia
Bahrain	Cyprus	Luxembourg	St Vincent
Barbados	Gibraltar	Macao	Turks and Caicos Islands
Belize	Grenada	Netherlands Antilles	

Table A2. Industry skill intensity: share of employees with no qualifications 2-digit industry average

2-digit industry	**Share no qualifications**
15 Food and beverages	0.17
16 Tobacco	0.15
17 Textiles	0.30
18 Clothing	0.41
19 Leather	0.33
20 Wood and wood products	0.20
21 Pulp, paper and paper products	0.19
22 Publishing and printing	0.10
23 Coke, refined petroleum products	0.05
24 Chemicals	0.11
25 Rubber and plastics	0.23
26 Other non-metallic mineral products	0.21
27 Basic metals	0.15
28 Fabricated metal products	0.18
29 Machinery and equipment	0.12
30 Office machinery and computers	0.07
31 Electrical Machinery	0.17
32 Radio, TV and communication equipment	0.13
33 Medical, precision and optical instruments	0.11
34 Motor vehicles	0.16
35 Other transport equipment	0.12
36 Furniture, manufacturing not elsewhere classified	0.21
37 Re-cycling	0.21
Total	*0.18*

Note: average across 4-digit industries within 2-digit industry
Source: author's calculations using LFS spring quarters 1995 to 2003.

Table A3. Sample split, investment in low-wage economies and exit, UK-MNEs

Dependent variable=1 if exit in *t* or *t+1*	**Low-skill industries All UK-MNEs (1)**	**High-skill industries All UK-MNEs (2)**
Low wage UK-MNE $_{it}$	0.078	0.006
	(2.80)	*(0.28)*
Controls: Age_{it}, $Ln(empment)_{it}$, $Multi_ind_{it}$, $Multi_man_{it}$, $Multi_bus_{it}$,	Yes	Yes
2-digit industry dummies	Yes	Yes
Region dummies	Yes	Yes
Time dummies	Yes	Yes
LL	-1648.0	-2614.8
Obs	*3,195*	*5,156*

Notes: estimation is on two cross sections 1998-1999 and 2000-2001. Standard errors clustered at the firm level. Table shows marginal effects and z-ratios in parentheses. Low wage UK-MNEs have outward FDI to countries with GDP per capita less than 10% of the UK. Low and high skill industries are the top and bottom thirds of the industry skill distribution.
Source: author's calculations using ARD plant population and AFDI data (source: ONS) and the LFS.

Table A4. Investment in low-wage economies and exit, single cross-section

Dependent variable=1 if exit in *t* to *t+3*	**Exit over 4 years**		
	All plants Low wage UK-MNE defined 1998 (1)	**UK-MNEs Low wage UK-MNE defined 1998 (2)**	**UK-MNEs Low wage UK-MNE defined 1998 to 2001 (3)**
Foreign-owned$_i$	0.098		
	(2.39)		
Low wage UK-MNE$_i$	-0.021	-0.048	-0.078
	(-0.48)	*(-0.84)*	*(-1.74)*
Not low wage UK-MNE$_i$	-0.022		
	(-0.46)		
Foreign-owned$_i$ * 4-digit share employees no quals$_j$	-0.197		
	(-1.01)		
Low wage UK-MNE$_i$ * 4-digit share employees no quals$_j$	0.520	0.503	0.621
	(2.23)	*(1.57)*	*(2.54)*
Not low wage UK-MNE$_i$ * 4-digit share employees no quals$_j$	0.297		
	(1.28)		
4-digit share employees no quals$_j$		-0.023	-0.453
		(-0.08)	*(-1.71)*
Controls: Age_{it}, $Ln(empment)_{it}$, $Multi_ind_{it}$, $Multi_man_{it}$, $Multi_bus_{it}$,	Yes	Yes	Yes
4-digit industry dummies	Yes		
2-digit industry dummies		Yes	Yes
Region dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
LL	-119089.9	-3310.9	-5662.3
Obs	181,264	5,243	10,915

Notes: estimation is on a single cross section 1998-2001. Standard errors clustered at the firm level. Table shows marginal effects and z-ratios in parentheses. Low wage UK-MNEs have outward FDI to countries with GDP per capita less than 10% of the UK. Columns (1) and (2) define low wage UK-MNEs based on 1998 investments. Column (3) defines a low wage UK-MNE as a firm that is observed to be investing in a low wage economy in any year 1998 to 2001.
Source: author's calculations using ARD plant population and AFDI data (source: ONS) and the LFS.