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Abstract

This paper seeks to identify the causal effect of foreign acquisitions on wages of skilled and unskilled workers, using difference-in-differences propensity score matching estimators. Our results suggest that there is substantial heterogeneity in the post-acquisition wage effect depending on the nationality of the foreign acquirer and the skill group of workers. We find sizable post acquisition wage effects on skilled and unskilled wages following an acquisition by a US firm. No such impacts result from acquisitions by EU multinationals. Also we discern some positive wage effects for unskilled workers resulting from acquisitions by multinationals from the rest of the world.

Keywords: multinationals, acquisitions, wages, difference-in-differences, matching estimator

JEL Classification: F23, J31

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1 Introduction

It is by now almost accepted as a stylised fact that foreign multinational enterprises (MNEs) perform better than domestic firms for a number of indicators. In particular, recent analyses of micro level data commonly find that MNEs pay higher wages than their domestic counterparts.[1] This is an important finding, as studying the implications of multinationals on domestic workers is arguably of great consequence to the economy, not least from a policy maker's perspective.[2]

However, even when controlling for observable and time invariant unobservable characteristics (e.g., in a fixed effects estimation), there remains a fundamental problem in identifying the performance difference that is attributable to multinationality *per se*. As Tybout (2000), for example, points out, multinationals may be attracted to more technology intensive industries, which are also more productive and pay higher wages. Hence, there would be an endogeneity problem in the regressions and the wage differential between foreign and domestic firms would be difficult to interpret. The inclusion of some industry and firm characteristics might go some way towards reducing this bias, though the inclusion of all possible relevant control variables is a difficult if not impossible task.

In this paper we try to overcome this problem by analyzing the effects of an acquisition of a domestic establishment by a foreign multinational enterprise on wages for skilled and unskilled workers using establishment level data for the UK. Assuming that an acquisition does not change any of the main characteristics of the takeover target (at least in the short run) a possible effect of the foreign acquisition on wages in the domestic target can be attributed to the change in ownership from domestic to foreign. We use a

[1] See, for example, Feliciano and Lipsey (2006) for the US, Girma, Greenaway and Wakelin (2001) for the UK and Lipsey and Sjöholm (2004) for Indonesia. These papers control for some observable firm and industry characteristics.

[2] Of course, productivity effects of multinationals are also important to the economy. These have been the subject of many recent studies, see, for example, Girma and Görg (2006) and Doms and Jensen (1998).

difference-in-differences propensity score matching approach to identify the average effect of foreign acquisitions (the treatment) on wages in the domestic target.

There have been a couple of earlier empirical studies which are related to our paper. Lipsey and Sjöholm (2002) study the wage premium following a foreign acquisition using plant level data for Indonesia. They relate the average wage in a plant to a number of ownership and plant characteristics and conclude that foreign takeovers are associated with higher wages even when controlling for firm and industry characteristics. However, this can only be interpreted as the causal effect of ownership change on wages if the foreign takeover is exogenous to unobserved shocks to plant level average wages. While the authors control for unobserved time invariant plant level effects in the model, exogeneity is still a strong assumption as there are a number of time varying facts that are plausibly correlated with average wages.

Conyon et al. (2002) study the effect of foreign acquisitions on wages in the domestic target using company level data for UK manufacturing. They find that foreign acquired firms pay 3.4 percent higher wages than non-acquired firms, controlling for firm size as well as fixed firm and industry specific effects.[3] They acknowledge the potential endogeneity of the acquisition decision and identify the acquisition wage effect based on a simple instrumental variable estimation, using the probability of acquisition (conditional on, inter alia, lagged wages) as an instrument. This approach is only valid under the (arguably strong) assumption that the probability is uncorrelated with contemporaneous wages. It should also be noted that their data identify acquisitions of whole companies rather than plants. Furthermore, acquisitions cannot be observed directly in the data, but only indirectly as firms that change their ownership status from being "independent" to

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Another related, yet different, research question is whether multinationals increase the demand for skilled labour. See, for example, Slaughter (2000) and Figini and Görg (1999) for such studies.

[3] However, this differential disappears when labour productivity is added as a regressor, indicating that the wage difference can be wholly attributed to productivity differences between foreign and domestic firms.

being a subsidiary of another firm. This, thus, excludes possible acquisitions of companies or plants that were subsidiaries of other enterprises prior to takeover.

We extend and improve upon these earlier papers in a number of ways. First, we use a non-parametric difference-in-differences propensity score matching approach to be able to identify the causal effect of the takeover on wages.[4] Matching estimators, in particular combined with the difference-in-differences technique, are arguably more appropriate compared to a simple instrumental variable approach as no strong exclusion restrictions are needed (e.g., Blundell and Costa Dias, 2000). Such an estimation approach is novel for the analysis of a foreign wage premium. In line with the recent statistical literature, we are also careful to assess the credibility of the matching procedure using a number of balancing tests.

Secondly, in contrast to earlier studies we allow for different effects of acquisitions by firms from different home countries, in particular from the US and the EU. As we discuss below, these distinctions bring up interesting differences in results for the two groups of workers and different firm nationalities. Thirdly, while Conyon et al. (2002) look at average wages per firm, our data set allows us to distinguish the effect of an acquisition on wages for skilled and unskilled workers separately, similar to Lipsey and Sjöholm (2002). Fourthly, our data set is at the establishment (mostly plant) level and allows us to identify takeovers directly in the raw data (in contrast to Conyon et al., 2002).

In the empirical analysis below we do find that foreign acquisitions lead to changes in domestic wages for skilled and unskilled workers, although there is substantial heterogeneity in the magnitude of the effects depending on skill group of workers and

[4] Subsequent to our analysis, Martins (2004) conducted a study using a propensity score matching approach to identify the link between foreign acquisition and wages. He uses linked firm-employee data for Portuguese manufacturing firms over the period 1991 to 1999. He finds negative effects of acquisitions on wage growth, while simple OLS estimations show a positive relationship between foreign ownership and wages. Our estimation approach may be considered more appropriate as we implement a combined difference-in-differences propensity score matching estimator. Also in contrast to Martins (2004) we are careful to explore the appropriateness of the matching procedures using a number of balancing tests.

nationality of the acquirer. The remainder of the paper is structured as follows. In Section 2 we briefly outline the background for why we would expect an effect of foreign acquisition on wages. Section 3 describes the empirical methodology while Section 4 introduces the data set. Section 5 presents some balancing tests performed in order to ensure the reliability of the matching approach. Section 6 describes the results of the matching estimations and Section 7 concludes.

2 Background

Why would affiliates be expected to pay higher wages after having been acquired by a foreign-owned multinational? An explanation that is linked quite closely to the industrial organization theory of multinationals starts from the assumption that multinationals have access to some form of firm specific asset (Markusen, 2002). This can be a superior production technique, know-how, or management strategy, and has at least some of the characteristics of a public good and enables the firm to locate profitably abroad. This firm specific asset implies that multinationals use a "superior" level of technology and, hence, explains why they are usually expected to have higher levels of productivity compared to purely domestic firms.

If this implies that the foreign multinational has higher marginal productivity of homogeneous labour then, in a competitive labour market, it would be advantageous for the firm to expand output rather than increase wages. However, if one assumes that the efficient use of the firm specific asset requires "better" (in the sense of more productive) workers, then one may observe higher wages after the transfer of the firm specific asset to the takeover target. Another explanation based on the firm specific asset idea which can be used to justify why multinationals pay higher wages to identical workers is that MNEs may want to minimize the amount of labour turnover in order to prevent the leakage of the firm

specific asset. In order to do so they may pay higher wages to provide an incentive for workers not to quit.[5]

Apart from the possession and transfer of a firm specific asset, is there any reason to expect any additional effects of a foreign takeover on wages? The change in ownership may bring with it a change in industrial relations practices which may have impacts on the wage structure. Budd et al. (2005) argue and provide evidence that multinationals share rents with workers across borders, i.e., the wage level in the foreign affiliate is linked to profits in the parent company. The implementation of these rent sharing arrangements may increase wages after the ownership change. Another industrial relations argument has been made by Carmichael (1992) who argues that US multinationals in the UK paid higher wages than domestic firms in order to "bribe" workers to avoid industrial relations disputes. Furthermore, Conyon et al. (2002) point out that multinationals, in particular from Japan, may actually bring with them successful work practices, industrial relations arrangements etc. which will be implemented in their foreign subsidiaries. In order to implement these new arrangements "peacefully" workers may be compensated with higher wages.

An interesting question to ask is whether takeovers by multinationals from different home countries should be expected to have different effects on post-acquisition wages. We may expect this for at least two reasons. First, in terms of technology as a firm specific asset, it is widely accepted that the US is the technological leader which gives the average US multinational a technological leadership vis-à-vis comparable UK companies (Crisuolo and Martin, 2004). Foreign firms from other EU countries may, however, have less of such a technological advantage compared with the average UK firm as they may be expected to

[5] Lipsey (2004) provides a number of other reasons for why multinationals pay higher wages, in particular that workers may have an inherent preference to work for domestic firms and therefore need to be compensated, or that multinationals due to lack of knowledge of the local labour markets must pay higher wages to attract good workers. However, these reasons do not seem applicable for explaining relative short term changes in wages after a foreign acquisition of a domestic firm.

have access to a fairly similar level of technology.[6] Hence a wage premium may be expected to be higher for affiliates taken over by US multinationals than by others.

On the other hand, considering industrial relations, we may expect less of a difference between US and UK firms, who have similar "Anglo-Saxon" industrial relations regimes, while firms from other continental EU countries (such as Germany and France) have very different labour market institutions (see, for example, Boeri et al., 2001). Hence, we may expect different effects also from that point of view between EU and US firms.

3 Empirical methodology

The aim of the paper is to analyse whether there is a causal effect from an acquisition of a domestic establishment by a foreign owner on wages in the domestic target. In other words, the empirical modelling problem is the evaluation of the causal effect of foreign acquisition on *y*, where *y* represents skilled or unskilled wages in the target establishment.

Let $ACQ_{it} \in \{0,1\}$ be an indicator of whether establishment *i* is acquired by a foreign MNE at time period *t*, and let y^1_{it+s} be wage at time $t+s$, $s \geq 0$, following acquisition. Also denote y^0_{it+s} as the wage of the plant if it had not been acquired. The causal effect of foreign ownership for firm *i* at time period $t + s$ is then defined as:

$$y^1_{it+s} - y^0_{it+s} \ . \tag{1}$$

The fundamental problem of causal inference is that the quantity y^0_{it+s} is unobservable for plants that have been acquired (i.e., for which we observe y^1_{it+s}). Thus the analysis can be viewed as confronting a missing-data problem. Following the

[6] This should not distract, however, from the general idea that foreign firms must have a technological advantage in order to operate successfully abroad.

microeconometric evaluation literature (e.g. Heckman et al, 1997, Dehejia and Wahba, 2002), we define the *average* effect of acquisition on the acquired firms as

$$E\left\{y_{t+s}^{1} - y_{t+s}^{0} \mid ACQ_{it} = 1\right\} = E\left\{y_{t+s}^{1} \mid ACQ_{it} = 1\right\} - E\left\{y_{t+s}^{0} \mid ACQ_{it} = 1\right\} \qquad (2)$$

where causal inference relies on the construction of the counterfactual for the last term in equation (2), which is the outcome the acquired establishments would have experienced, on average, had they not been acquired. This is estimated by the average wage of the plants that remained in domestic hands, $E\left\{y_{it+s}^{0} \mid ACQ_{it} = 0\right\}$.

This is, of course, only a valid approximation if there are no contemporaneous effects that are correlated with *ACQ* and that are not controlled for. If that is not the case then the empirical analysis is plagued with endogeneity and simultaneity bias. Hence, an important feature in the accurate construction of the counterfactual is the selection of a valid control group. The approach we take is to employ matching techniques. The purpose of matching is to pair each foreign acquired plant with a domestic establishment that has not undergone any ownership change on the basis of some observable variables, in such a way that the domestic establishments' wage dynamics can be studied to generate the counterfactual for the newly foreign owned plants.[7] This type of matching procedure is preferable to randomly or indiscriminately choosing the comparison group, because it is less likely to induce estimation bias by picking firms with markedly different characteristics.

Since matching involves comparing acquired and non-acquired establishments across a number of observable pre-acquisition characteristics (e.g., productivity, size, industry characteristics), it is desirable to perform the matching on the basis of a single index that captures all the information from those variables. We adopt the method of

[7] Since the purpose of this paper is to compare foreign acquired with domestic plants any plant that remains in domestic hands is a valid control. This could also include domestic establishments that were taken over by

propensity score matching due to Rosenbaum and Rubin (1983), which suggests the use of the probability of receiving treatment (foreign acquisition in the present context) conditional on those characteristics, to reduce the dimensionality problem. Accordingly, we first identify the probability (or *propensity score*) of being acquired using a probit model

$$P(ACQ_{it} = 1) = F(X_{it-1}) \tag{3}$$

where X is a vector of covariates observed in the time period before acquisition. This vector consists of the pre-acquisition levels of establishment size (proxied here by capital stock), productivity, skilled and unskilled wages, as well as a dummy variable indicating whether or not a plant is located in an assisted area in the UK and a full set of time dummies.

The choice of covariates is influenced by the empirical literature on foreign acquisitions (e.g. Conyon et al, 2002, Harris and Robinson, 2002). Existing evidence suggests that establishment size is an important determinant for acquisitions. Also, high productivity plants are commonly found to be more likely to be taken over, indicating that foreign firms may be "cherry picking" the best performing establishments. Wages by skill groups prior to acquisition are included to address the argument that foreign firms may take over high or low wage establishments (see Lipsey and Sjöholm, 2002).

Now let p_i denote the predicted probability of being acquired for plant i in the group of acquired plants (say group A) and let p_j denote the predicted probability of being acquired for plant j in the control group (say group C). A standard matching estimator of the causal effect of foreign acquisition can be written as

$$\mu = \sum_{i \in A} \left(y_i - \sum_{j \in C} g(p_i, p_j) y_i \right) \tag{4}$$

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other domestic owners, or that are likely to be targets for domestic takeovers. In our version of the ARD we

where g(.) is a function assigning the weights to be placed on the comparison firm *j* while constructing the counterfactual for acquired firm *i*. The different matching estimators proposed in the literature (such as nearest neighbour matching and kernel matching estimators) differ from each other in the choice of the weighting function they employ. For example, the Gaussian kernel function used in this paper is defined as follows:

$$g(p_i, p_j) = \frac{K\left[\frac{(p_i - p_j}{h}\right]}{\sum_{k \in C} K\left[\frac{(p_i - p_k)}{h}\right]} \tag{5}$$

where $K(\mu) \propto \exp(\frac{-\mu^2}{2})$ the Gaussian normal function, h is is the bandwidth parameter and C denote the set of non-acquired plants.

Since we have longitudinal data, we do not employ this matching estimator in levels but rather use a difference-in-differences (DID) matching estimator on the matched plants instead. This is motivated by recent studies which argue that standard matching estimators are usually unsatisfactory (e.g., due to the strong assumption of "selection on observables"), but in combination with difference-in-differences methodology can have the potential to "...improve the quality of non-experimental evaluation results significantly" (Blundell and Costa Dias, 2000, p. 438). The difference-in-differences matching estimator has the additional advantage of eliminating unobserved time-invariant differences in wages between acquired and non-acquired firms that standard matching estimators fail to eliminate (Smith and Todd, 2005a).[8]

The DID matching estimator is defined as follows. Let Δy be the difference between the average wage before and after the change of ownership. Then following Heckman et al (1997) the estimator can be expressed as:

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are not able to adequately observe domestic acquisitions.

$$\delta = \sum_{i \in A} \left(\Delta y_i - \sum_{j \in C} g(p_i, p_j) \Delta y_i \right). \quad (6)$$

We employ variants of this DID matching estimator for the empirical analysis below.[9]

4 Description of the data

We use data from the Annual Respondents Database (ARD), which is provided by the Office for National Statistics (ONS) in the UK under controlled conditions. The dataset consists of individual establishments' records underlying the Annual Census of Production and the data used cover the period 1980 to 1994. As Barnes and Martin (2002) provide a useful introduction to the data set, we only include a brief discussion of some of its features relevant to the present work.

In the period covered by our data, the ARD consists of two files. What is known as the 'selected file', contains detailed information on a sample of establishments that are sent inquiry forms. The second file comprises the 'non-selected' (non-sampled) establishments and only basic information such as employment, location, industry grouping and foreign ownership status is recorded. During our study period, some 14,000-19,000 establishments are selected each year, based on a stratified sampling scheme. The scheme tends to vary from year to year, but over the period under consideration establishments with more than 100 employees were always sampled.

In the data, an establishment is defined as the smallest unit that is deemed capable of providing information on the Census questionnaire. Thus a 'parent' establishment reports for more than one plant (or 'local unit' in the parlance of ARD). For selected multi-

[8] Hence, while the combined estimator still requires the assumption of "selection on observables", DID purges all unobserved time invariant plant characteristics.

[9] One caveat of this estimator is that to the extent that there are positive (negative) wage spillovers from acquisition FDI to the control group of domestic establishments, the difference-in-differences procedure is likely to underestimate (overestimate) the causal effects of international takeovers on the wages of acquisition targets.

plant establishments, we only have aggregate values for the constituent plants. Indicative information on the 'children' is available in the 'non-selected' file. In the sample period considered in this paper over 95 percent of the establishment in both the electronics and food industries are single-plant firms. In the actual sample we used for the econometric estimation this figure is around 80 percent for both sectors. Thus most of the data we used is actually plant level data. As a result we tend to use the terms plant and establishment interchangeably.

In this paper we focus on two broad industries, namely electronics and food, rather than pooled data for the whole manufacturing industry.[10] In this way we avoid the potential problem of pooling plants that operate in very heterogeneous sectors and rather focus on relatively homogenous sets of plants within the two sectors. We focus on these two particular industries for two reasons. First, foreign-owned firms are important players in both sectors, accounting for about 19 percent of employment in electronics and 10 percent of employment in the food industry in 1996 (see Griffith and Simpson, 2003, Table 4). Second, we may expect the two sectors to be different in their technology usage, and hence, there may be differences in the determinants of foreign acquisition and its effects on skilled and unskilled wages.

We define skilled and unskilled workers in terms of non-production and production workers, respectively, in line with the recent literature (e.g., Machin and van Reenen, 1998; Slaughter, 2000). While this could be considered a rough measure of skills we can take some support for this classification from the previous literature. Berman et al. (1994) show that the proportion of non-production workers matches quite closely over time with the proportion of white collar and more educated workers. Also, Head and Ries (2002) show that non-production workers are on average more skilled than production workers.

In the ARD a consistently defined nationality indicator identifies whether an establishment is domestic or foreign owned. Foreign acquisition is said to have occurred in year t when an establishment that has been in domestic hands up to year $t-1$ becomes a subsidiary of a foreign-based multinational and changes its nationality indicator.[11] Since the matching process described in the previous section requires data on the pre-acquisition period, we consider foreign take-overs that took place between 1981 and 1994. Overall, there were 203 and 100 acquisitions in the electronics and food industries over that period, respectively, for which the necessary pre and post acquisition information is available.

Table A1 in the appendix shows some summary statistics on the main variables used in the analysis, and the number of establishments in the data. The panel used is unbalanced. Table A2 shows the short run post-acquisition trajectories of employment for the two types of labour, and capital intensity in the acquired plants, by nationality of the acquirer. As is notable, there are only few statistically significant changes.

5 Testing the reliability of the propensity score matching method

Balancing and sensitivity tests

The propensity score matching method will provide a reliable and robust method for estimating the foreign acquisition effect if, conditional on the propensity score, the potential outcomes y^1 and y^0 are independent of the incidence of acquisition. Under the assumption of independence conditional on observables, the pre-acquisition variables should be balanced between the acquired and non-acquired groups. Lack of balance points to a possible mis-specification of the propensity score estimation. Hence, as emphasised by

[10] More precisely, using SIC 1980 classification, SIC 33 (manufacture of office machinery and data processing equipment), SIC 34 (electrical and electronic engineering), and SIC 41/42 (food, drink and tobacco).

[11] Establishments that appear to have experienced more than one change of ownership between 1980 and 1994 are excluded from the analysis. This is partly to avoid conflating the effects of different events, and partly because we suspect the presence of measurement error problems.

Rosenbaum and Rubin (1983) and Dehejia and Wahba (2002) it is important to verify that this balancing condition is satisfied by the data. In this paper we perform a number of balancing tests suggested in the recent literature (Dehejia, 2005, Smith and Todd, 2005b).

The first balancing test examines the standardised difference (or bias) for all variables in X (that is the vector of covariates used in the propensity score estimation) as described in Smith and Todd (2005b). For example, the standardised bias for the *size* variable is defined as the difference in means between the foreign acquired sample of firms (group *A*) and the appropriately matched comparison group of firms (group *C*) scaled by the average variances of the *size* variable in groups A and C. Based on *N* acquired firm this is given as

$$SDIFF(size) = \frac{100\frac{1}{N}\sum_{i\in A}\left[size_i - \sum_{j\in C} g(p_i, p_j) size_j\right]}{\sqrt{\frac{Var_{i\in A}(size) + Var_{j\in C}(size)}{2}}} \quad . \qquad (7)$$

Note that the lower the standardised difference, the more balanced or similar the treatment and comparison groups will be in terms of the variable under consideration. Although there is no formal criterion as to how large a standardised bias should be for it to be considered serious, we follow Rosenbaum and Rubin (1985) and assume that a value of 20 is large. Furthermore, for each variable entering the propensity score model we perform a formal paired t-test between acquired and matched comparison to satisfy ourselves that no significant differences exist.

Whereas the above balancing test calculates the cross-sample difference of each variable entering the probit model separately, there also exists a test that considers whether those differences can be taken as *jointly* insignificant. This test is known as the Hotelling's T-squared test and it has the flexibility of being based either on all observations or for separate segments of the sample defined by the propensity score estimates. In this study we

divide the sample by propensity score quintile and conduct the Hotelling's T-squared test for each sub-sample.[12]

The third balancing test we explore is suggested by Todd and Smith (2005b) and it is cast within a regression framework. Let $\hat{P}(X)$ denote the estimated propensity score and let D be a dummy variable assuming a value of 1 if a plant is foreign acquired. Then for each variable included in the matching algorithm, the following regression function that is quartic in $\hat{P}(X)$ is estimated (again using the *size* variable as an example):

$$SIZE = \beta_0 + \sum_{k=1}^{4} \beta_k \hat{P}(X)^k + \sum_{k=1}^{4} \gamma_k D\hat{P}(X)^k + \varepsilon \qquad (8)$$

and the joint significance of the coefficient on the terms involving the acquisition dummies (that is the γs) is tested. As explained by Todd and Smith (2005b), if the propensity score satisfies the balancing condition, D should not provide any additional information and we should expect the γs to be jointly statistically insignificant.

Following the suggestion of Dehejia (2005), a fourth diagnostic that we undertake regarding the propensity score method is to check the sensitivity of the matching estimates to minor changes in the propensity score model. If the results are not sensitive to such minor changes, the propensity score specification can be deemed robust and reliable.

Evidence on balancing

Table 1 reports the balancing test results based on Gaussian kernel matching. The standardised differences between acquired and comparison sample are all less than 8% in

[12] The extent of overlap between acquired and non-acquired plants on the propensity score is shown in Table A3 in the appendix.

[14] These are based on the Gaussian Kernel matching as discussed above. We also considered the single nearest neighbour matching to check for robustness of our results to changes in the matching procedure. The results are very similar to the ones obtained using Kernel matching. Furthermore, we also compared our results with those obtained from a simple DID estimator. See Table A4 in the appendix for some of these results. Further results are not reported here to save space, but can be obtained from the authors.

the matched sample. The substantial bias reduction as a result of adopting the matching method is also apparent from the figures in Table 1.

The regression-based tests also corroborate the success of the propensity score-matching approach adopted in this paper. For all variables, we fail to reject the joint hypothesis that the γs are all equal to zero. It is thus comforting that both standardised differences and regression tests are doing very well, suggesting that the propensity score specification we have chosen is effective in accounting for factors that determine selection into the treatment (i.e. foreign acquisition). Table 2 summarises the results from the Hotelling test and reassuringly we find that the balancing conditions are satisfied within each propensity score quintile

[Table 1 and Table 2 here]

6 Difference-in-differences matching estimates

Having established that conditional on the propensity score, the comparison and treatment group of firms are comparable, we now present in Table 3 the difference-in-differences matching estimates.[14] These give the causal effects of foreign ownership on (log) skilled and unskilled wages, and hence the figures in this table can be interpreted as percentage changes in wages. Throughout we impose the common support condition and confine our attention to the comparison group establishments that fall within the support of the propensity score distribution of the acquired plants.

[Table 3 here]

The top half of Table 3 reports the foreign acquisition impact estimates based on the preferred propensity score specification - that is the specification that passed the balancing tests as described above. The post-acquisition period is given by *t* ranging from 1 (first year of foreign ownership) to 4. The estimates show that the average causal effect of

foreign ownership on skilled wages is 2.6% in the first year of acquisition. The estimates turn, however, statistically insignificant in later years, indicating that the accuracy of our estimator falls with *t*. Interestingly, the impact on unskilled wages exhibits a different profile, with coefficients being statistically significant up to 3 years after the acquisition. The average impact is also higher compared with skilled wages: starting from 5.4% in the first year of acquisition and reaching 7.5% after three years. However, it is worth noting that the level of skilled wages is more than 40% higher than unskilled wages (see Table 1). Nonetheless this finding suggests that there is no evidence that FDI exacerbates income inequality, as unskilled wages appear to change by more than the average skilled wage.

The next step in the analysis is to check the sensitivity of the results by making a slight change to the propensity score specification suggested by Dehejia (2005). Here we add a quadratic size term to the original list of covariates, and the impact estimates are given in the lower half of Table 3.[15] It is clear that these are comparable to the ones discussed above, both in magnitude and statistical significance. This is further illustration of the appropriateness of propensity score specification.

In search of industry specific effects

The estimates reported in Table 3 are the average impact of the 303 foreign acquisitions, and as such may mask some interesting heterogeneity. Here we ask whether the wage effects are the same in the two broad sectors under consideration: the skill-intensive electronics sector in which 203 foreign takeovers are observed in our sample, and the low-tech food sector. The estimates presented in Table 4 shed some light on the issue. It seems that in both sectors unskilled workers receive on average higher wages as a result of their plant's newfound status as a subsidiary of a multinational company. The absence of a robust statistically significant effect of foreign ownership on skilled wages within both

[15] This specification also passed the balancing tests. These are not reported here to save space.

sectors appears to be due to lower test power when dividing the observations into subsamples. The results suggest that industry specific effects perhaps do not capture the underlying technology. In the next subsection we explore whether the nationality of the foreign acquirer can shed more light on the issue.

[Table 4 here]

Are there country specific effects?

As pointed out in Section 2, given the differences in technology and industrial relations institutions in different source countries, it is an interesting question to ask whether takeovers by multinationals from different countries have different effects on post-acquisition wages. In our data set we are able to distinguish three categories of nationalities, namely, US, EU and others. Overall, slightly more acquisitions were carried out by US multinationals (108) than by firms from the two other nationality categories (EU: 104, others: 91) over the time period analyzed. The difference-in-differences matching estimates reported in Table 5 indeed reveal substantial differences across the nationality groups.

[Table5 here]

There is a robust and economically significant wage effect for both skilled and unskilled workers acquired by US multinationals. For skilled workers, this takes effect a period after acquisition and stands at more than 8%. The impact on unskilled wages is discernible at the period of acquisition and reaches nearly 13% after two years post-acquisition. In stark contrast, no evidence is found for any causal effect on wages, skilled or unskilled, following acquisition by EU based multinationals. Finally we document positive unskilled wage effects the first two years (4.4% and 6.8%) following acquisition by multinationals from the rest of the world.

To sum up the difference-in-differences matching estimates indicate that there is substantial heterogeneity in the post acquisition effects on wages of acquisitions by firms from different home countries. Hence, not taking account of this heterogeneity may miss out valuable information in the identification of the causal effect of foreign direct investment on wages.

7 Conclusions

This paper provides a systematic empirical analysis of wage differences between foreign multinationals and domestic firms. In order to identify adequately the effect of foreign ownership we investigate the impact on wages of the takeover of a domestic establishment by foreign owners. We pay particular attention to identifying the causal effect, using a difference-in-differences propensity score matching approach, and examine differences in post acquisition effects depending on the nationality of the acquirer.

Our results suggest that there is substantial heterogeneity in the post-acquisition wage effect depending on the nationality of the foreign acquirer, the industry in which the firms operate and the skill group of workers. In particular, we find that both skilled and unskilled workers, on average, experience a post acquisition increase in the wage rate following an acquisition by a US firm. However, no such effects are discernable following acquisitions by EU firms. The finding of substantial heterogeneity in the post acquisition effects suggests that studies that do not account for heterogeneity in worker types and nationality of ownership may be subject to considerable shortcomings.

An interesting remaining question to ask is whether the observed post acquisition wage premium, in particular for US acquisitions, is something desirable. This largely depends on the reason for the higher wage. If, as we assume, the higher wage reflects the fact that the firm specific asset is utilized efficiently and/or that some of the rents are shared

between firm and workers, then this seems to be a desirable outcome. If, however, wages are higher because "better" workers are employed after the takeover, then there does not appear to be any particularly positive effect, even more so if the workers were poached from domestic firms who have to reallocate labour internally as a result of the poaching. A potential judgment about welfare implications becomes even more complicated if one takes into account the effects of a higher wage rate on domestic competitors, which may be priced out of the market. In order to address this question a full theoretical analysis would be necessary, which should then be backed up by detailed micro evidence on characteristics of workers and firms. This is a tall order that needs to be tackled in future research.

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Table 1:
Balancing tests from kernel matching

Variable	Mean Acquired	Control	% bias	% bias reduction	t-test t-stat (p-value)	Regression-based tests F-stat (p-value)
Skilled wage	8.9442	8.9287	4.5	93.6	1.29 (0.198)	0.26 (0.9347)
Unskilled wage	8.5177	8.4923	6.5	85.1	1.91 (0.056)	0.38 (0.8643)
Assisted area	0.36704	0.36612	0.2	98.9	0.06 (0.955)	0.40 (0.8479)
Productivity	10.5	10.459	4.9	82.3	1.43 (0.153)	0.54 (0.7466)
Size (capital)	15.361	15.152	6.9	78.7	1.84 (0.066)	0.20 (0.9630)
Year	1987.6	1987.4	7.1	93.5	1.97 (0.049)	0.18 (0.9699)

Definition of variables included in the matching:

Skilled wage: log of average wage per employee for non-production workers
Unskilled wage: log of average wage per employee for production workers
Assisted area: Dummy = 1 if plant located in area specially designated as "assisted"
Productivity: value added (total output – materials inputs) per employee
Size: log capital stock
Year: Time trend

Table 2:
Hotelling's T-squared tests by propensity score quintile

Quintile	T-squared statistics	F-test statistics	p-value
First	4.818	0.516	0.783
Second	6.179	0.772	0.604
Third	9.163	1.383	0.241
Fourth	6.720	1.073	0.383
Fifth	8.669	1.418	0.208

Table 3 :
The impact of foreign acquisition on the log of skilled and unskilled wages

	Skilled wage		Unskilled wage	
Preferred propensity score model				
t	Matching estimate	Standard error	Matching estimate	Standard error
1	0.026	0.015**	0.054	0.017***
2	0.029	0.024	0.071	0.020***
3	0.030	0.023	0.075	0.028**
4	0.046	0.031	0.049	0.032
Modified propensity score model				
1	0.037	0.022*	0.044	0.020**
2	0.033	0.023	0.068	0.022***
3	0.061	0.050	0.071	0.030**
4	0.031	0.058	0.036	0.032

Notes:
(i) significant at 10%; ** significant at 5%; *** significant at 1%
(ii) Estimation is based on 336 foreign acquisitions.

Table 4:
In search of industry-specific effects

	Skilled wage		Unskilled wage	
Electronics sector				
t	Matching estimate	Standard error	Matching estimate	Standard error
1	0.017	0.019	0.059	0.024**
2	0.021	0.026	0.072	0.027***
3	0.016	0.040	0.082	0.031**
4	0.029	0.035	0.042	0.042
	Food sector			
1	0.036	0.034	0.037	0.019*
2	0.020	0.038	0.048	0.026*
3	0.010	0.043	0.058	0.120
4	0.022	0.055	0.047	0.118

Notes:
(i) significant at 10%; ** significant at 5%; *** significant at 1%
(ii) Estimation is based on 203 [100] foreign acquisitions in the electronics [food] sector.

Table 5:
Wage effects of acquisition FDI by country of origin

	Skilled wage		Unskilled wage	
	USA			
t	Matching estimate	Standard error	Matching estimate	Standard error
1	0.036	0.024	0.085	0.041**
2	0.083	0.038**	0.090	0.041**
3	0.089	0.038**	0.129	0.059**
4	0.092	0.047**	0.067	0.058
	EU			
1	0.011	0.022	-0.003	0.021
2	-0.016	0.020	0.030	0.027
3	-0.017	0.039	0.039	0.040
4	0.012	0.044	0.003	0.059
	OTHERS			
1	0.007	0.020	0.063	0.026**
2	-0.012	0.044	0.072	0.030**
3	-0.052	0.043	0.017	0.041
4	-0.030	0.039	0.014	0.034

Notes:
(i) significant at 10%; ** significant at 5%; *** significant at 1%
(ii) Estimation is based on 108 USA, 104 EU and 91 others acquisitions.

Appendix

Table A1
Some summary statistics

	Non-acquired Plants		Acquired plants	
	Mean	Standard deviation	Mean	Standard deviation
Log skilled labour	3.849	1.315	4.670	1.244
Log unskilled labour	4.828	1.186	5.256	1.198
Log skilled wage	8.811	0.350	8.933	0.313
Log unskilled wage	8.433	0.382	8.532	0.348
Log total output	15.606	1.406	16.308	1.338
Log capital stock	14.976	2.789	15.456	2.471
Log productivity	10.365	0.818	10.508	0.777
Number of plants	3200		303	
Total observations	22722		2974	
Unbalanced panel	Yes		Yes	

Table A2
Short run post-acquisition trajectories of labour and capital intensity

	USA Acquisitions			EU Acquisitions			Others Acquisitions		
	Labour		**Capital**	**Labour**		**Capital**	**Labour**		**Capital**
Post-acquisition period	Skilled	Unskilled		Skilled	Unskilled		Skilled	Unskilled	
1	-0.109	-0.032	-0.500	-0.036	-0.006	0.317	0.048	-0.019	-0.661
	(2.76)***	(0.58)	(1.46)	(1.10)	(0.12)	(1.19)	(1.01)	(0.35)	(1.13)
2	-0.060	-0.034	-0.407	-0.075	0.051	0.485	0.046	-0.007	-0.703
	(1.39)	(0.67)	(1.38)	(2.40)**	(1.09)	(1.66)	(1.12)	(0.12)	(1.50)
3	-0.046	-0.056	-0.030	-0.090	0.079	0.032	-0.041	-0.092	-0.549
	(1.39)	(1.29)	(0.11)	(2.53)**	(0.91)	(0.11)	(1.02)	(2.07)**	(1.19)

Notes:
(i) All regressions include year dummies
(ii) All variables are in log
(iii) Robust t statistics in parentheses
(iv) * significant at 10%; ** significant at 5%; *** significant at 1%

Table A3:
Frequency distribution of acquired and non-acquired plants by propensity score quintile

Quintile	Acquired plants	Non acquired plants
First	42	698
Second	16	761
Third	27	633
Fourth	60	560
Fifth	158	548
Total	303	3200

Table A4 :
The impact of foreign acquisition on skilled and unskilled wages: Further results

	Skilled wage		Unskilled wage	
Difference-in-differences combined with nearest neighbour matching estimates				
t	Matching estimate	Standard error	Matching estimate	Standard error
1	0.018	0.008**	0.065	0.017***
2	0.029	0.034	0.094	0.044***
3	0.051	0.043	0.081	0.044*
4	0.016	0.055	0.016	0.052
Simple difference-in-differences estimates				
1	0.007	0.014	0.041	0.019***
2	0.006	0.022	0.059	0.022***
3	-0.010	0.023	0.053	0.029*
4	0.002	0.028	0.019	0.032

Notes:
(i) Robust t statistics in parentheses
(ii) * significant at 10%; ** significant at 5%; *** significant at 1%

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