

Do Foreign Mergers & Acquisitions Boost Firm Productivity?

Frances Ruane Marc Schiffbauer Iulia Siedschlag

Economic and Social Research Institute

PRELIMINARY VERSION

(please do not cite without permission)

First version: December 2008

This version: March 19, 2009

Abstract

This paper examines the causal relationship between foreign acquisitions and firm productivity in the UK over the period 1999-2007. While we find little evidence for positive effects of foreign acquisitions on total factor productivity, our results uncover positive and increasing effects on labor productivity from the first until the fifth year of the post - acquisition period. The results are broadly similar for firms taken over by US and EU based firms. We find that the effects of foreign acquisitions vary across industries. It appears that while foreign ownership leads to higher productivity in the office & electrical machinery industry, it has a negative effect on productivity in the renting of machinery & equipment industry. Firms acquired by foreign investors in computer services experience a higher productivity in the second year of the post-acquisition period.

1 Introduction

Over the past decade there has been a surge in cross-border mergers and acquisitions (M&A) in both manufacturing and services. Economists and policy makers tend to assume that foreign-owned firms have an advantage over domestic firms due to large endowments of intangible assets which compensate for a lack of local information and experience. There is indeed a large empirical evidence showing that foreign-owned firms are more productive than domestic firms (Doms and Jensen, 1998 for the US; Driffield, 1997; Girma and Görg, 2007; Griffith and Simpson, 2001; for the UK; De Backer and Sleuwaegen, 2002, in the case of Belgium; Pfaffermayer and Bellak, 2002, in the case of Austria; Ruane and Ugur (2004), for Ireland). More recent studies have shown that a large part of this productivity differential is between multinational firms and non-multinationals (Griffith, 1999; Oulton, 2000; Temouri, Driffield and Higon, 2008). However, most of these analyzes do not distinguish between foreign greenfield investment and mergers and acquisitions.

Existing empirical evidence on the causal link between foreign acquisition and firm productivity is inconclusive. To the extent that foreign investors acquire the best performing firms, the productivity advantage might not be associated with foreign ownership *per se*. Harris and Robinson (2003) provide empirical evidence showing that foreign investors tend to acquire firms with higher productivity in comparison with other manufacturing firms in the UK. Furthermore, the higher productivity of foreign-owned multinationals observed at the economy-wide level might simply reflect the fact that they are concentrated in high productivity sectors (Griffith et al., 2004).

While a number of studies have found positive effects of M&A on firm productivity (Lichtenberg and Siegel, 1987 for the US; Conyon et al, 2002 for the UK; Arnold and Javorcik, 2005, for Indonesia; Bertrand and Zitouna, 2008, in the case of France) other research has found that acquired firms do not reap any benefit from foreign ownership (Harris and Robinson, 2003, for the UK), has rejected a causal link (Barba Navaretti et al, 2004) or has found a positive effect only in the case of US multinationals (Benfratello and Sembenelli, 2002). Girma and Görg (2002) find that the impact on the productivity of target firms varies across industries

in the UK. It appears that foreign acquisitions had positive effects on firm productivity in the food sector but negative in electronics.

This paper examines the causal relationship between foreign acquisitions (mergers and acquisitions) and productivity at firm level. In particular, we address the following research questions: What is the profile of firms which are acquired by or merged with foreign-owned firms? To what extent do foreign investors "cherry-pick"? What is the effect of foreign acquisition on firm productivity (both total factor productivity (TFP) and labor productivity) in the short and long run? To what extent, and how, do these effects vary by country of origin of the acquiring/merging firm? How do these effects on firm productivity vary at industry level?

We focus on the United Kingdom (UK) where the number of M&A deals has been especially large. Over the period 1999-2007 we identify over 10,000 mergers and acquisitions in the UK of which foreign takeovers account for a quarter of all deals. Griffith et al. (2004) show that foreign takeover of a domestic-owned firm which was not part of a multinational group was the most frequent mode of entry by foreign firms in the UK over the period 1999-2001 in both manufacturing and services.

The question whether foreign acquisitions lead to higher productivity is interesting and relevant for both research and policy. While theoretical models suggest a positive answer to that question (Markusen, 1995; Helpman et al, 2004), as discussed above, existing empirical evidence on whether foreign acquisition *per se* leads to a better firm performance in the post-acquisition period is mixed. To the extent that foreign acquisition is perceived as a source of knowledge spillovers and productivity growth in the host economies, governments in many countries (including the UK) have designed and implemented policies aiming at attracting foreign investment including foreign acquisitions. On the other hand, some governments (e.g. in France and Italy) have tended to discourage foreign take-overs and instead encouraged the emergence of 'national champions'.

Measuring the effect of foreign acquisition on firm productivity raises two major econometric issues. First, foreign investors may acquire better performing firms (selection bias). Second, productivity and inputs might be determined simultaneously as firms may take into account productivity shocks that are unobservable in the data when choosing their input compositions

(simultaneity bias). To address the selection bias we analyze the causal effect of foreign acquisition on UK firm productivity by using propensity score matching following Rosenbaum and Rubin (1983) combined with difference-in-difference estimators (Heckman et al. 1997). To address the simultaneity bias, we estimate total factor productivity (TFP) by following the approach of Olley and Pakes (1996) which controls for the correlation between unobserved productivity shocks and firm inputs. Furthermore, we account for firm heterogeneity with respect to foreign investors and industries of the acquired firms.

Our contribution to the literature is threefold. First, in comparison with existing studies, we use a richer micro data set which covers all firms in the UK including over 2,000 foreign M&A over the period 1999-2007. Second, we use improved econometric techniques to account for selection and simultaneity biases. Third, we model and uncover heterogeneous effects of foreign acquisitions on firm productivity across foreign investors and industries of acquired firms.

Our results do not confirm the expected positive aggregate effects of foreign ownership on total factor productivity. We only find some positive evidence if the acquirer stems from the US. Moreover, we reveal that the effects of foreign acquisitions vary across industries. It appears that while foreign ownership led to higher productivity in the office & electrical machinery industry, it had a negative effect on productivity in the renting of machinery & equipment industry. Firms acquired by foreign investors in computer services experienced a higher productivity in the second year of the post-acquisition period. Further, we find positive aggregate effects of foreign acquisition on labor productivity from the first until the fifth post acquisition year. Accordingly, this increase appears to be governed by capital deepening instead of productivity effects since the former involves higher labor productivity but not higher TFP levels.

The remainder of this paper is organized as follows. Next section reviews the theoretical background of our analysis. Section 3 discusses our empirical methodology for uncovering the causal relationship between foreign acquisitions on firm productivity, our data, variables and empirical results. Finally, Section 4 concludes.

2 Theoretical background

The early theoretical literature on foreign direct investment known as the Ownership-Location-Internalization (OLI) framework (Vernon, 1966; Caves, 1974; Dunning, 1977) has focused on three characteristics of multinational firms that are likely to explain their better performance in comparison to domestic-owned firms. These characteristics are: (i) large endowments of intangible assets that compensate for the lack of knowledge of local markets, consumer preferences and business practices, hence allowing successful competition with domestic firms; (ii) location advantages that arise from being located in a foreign country rather than exporting to it; and (iii) advantages from internalizing technology rather than licensing it to foreign producers. These elements have been formalized in seminal papers by Markusen (1984, 1995, 2002), Helpman (1984, 1985), and Markusen and Venables (1997, 1998). More recently, Helpman et al. (2004) account for firm heterogeneity and show that in the presence of fixed costs to exporting and to undertaking foreign direct investment, in equilibrium, firms can be ordered in terms of productivity, as follows: the least productive exit, the more productive firms serve only the domestic market, the next more productive serve the domestic market and export, and the most productive firms serve the domestic market and undertake foreign direct investment. In other words, multinational firms are the most productive in their country of origin.

While this literature suggests that multinational firms are more productive than domestic-owned firms, it does not imply that foreign ownership *per se* leads to higher productivity. Furthermore, the theoretical literature on multinational firms does not distinguish between greenfield investment and mergers and acquisitions.

Foreign multinationals may affect the market structure and the degree of competition in the host economy. The industrial organization (I-O) literature offers further insights on the effects of M&A on firm productivity. I-O theory identifies two main effects of M&A on firm productivity in the long-run. On the one hand, incentives to concentrate market power involve a decline in competition which potentially entails lower long-run productivity growth in that industry. On the other hand, efficiency gains due to the diffusion of technological or organizational knowledge, economies of scale, or the reduction of managerial slack result in long-run productivity gains.

In contrast, the immediate impact of a take-over is expected to be negative due to the high short-run costs of re-organization. The latter effect is expected to be larger after cross-border deals due to higher adaptation costs. On the other hand, long-run productivity effects after foreign M&A are potentially more pronounced due to the larger scope for knowledge spillovers and adverse competition effects.¹

3 Empirical Analysis

3.1 Data

Our analysis is based on UK firm-level data over the period from 1999 until 2007. We employ M&A data from the Bureau van Dijk's Zephyr database which covers over 2,000 foreign M&A of UK firms from 1999 until 2007. This information is combined with the firm level data from the Amadeus database which provides detailed balance sheet data for all UK firms. The rich firm-level data sets from Amadeus and Zephyr allow us to compare the effects of domestic and cross-border deals in different industries and to distinguish potential negative short-run from positive long-run effects.

We measure output as real² value added. Capital and labor are measured as real fixed tangible assets and the number of employees, respectively. We also include gross investment, measured by the change in the capital stock plus depreciation, which is included as an instrument for the unobservable technology shock in the estimation procedure in Olley and Pakes (1996). Furthermore, we include the following firm-specific control variables in the propensity score matching: the return on capital, the ratio of interest expenses to total assets, a firm's default probability, age, size³, and a set of dummy variables. The latter describe (i) the own-

¹Nocke and Yeaple (2007) explicitly distinguish between greenfield investment and foreign M&As in their theoretical work. They show that either the most or the least efficient firms acquirer foreign targets depending on the relevance of immobile capacities (e.g. marketing expenses) for a firm. however, we are not able to test this result since we do not observe marketing expenses or other country-specific (internationally immobile) factors in our sample.

²Real variables are obtained by using output price deflators at the three digit industry level.

³We employ a firm's number of employees as a measure for a firm's size.

ership status of a firm: `public` is equal to 1 if a firm is state owned and 0 if it is private while `quoted` takes the value 1 if a firm is publicly quoted and 0 if not, and (ii) a firm’s solvency status: `exit` is equal to 1 if the firm is insolvent and 0 otherwise. Finally, we account for year fixed effects and for industry-specific fixed effects, distinguishing sectors by means of three digit NACE codes in the propensity score estimation.

Full information is not available for all of the firms which reduces the effective number of firms that can be included. In particular, we only observe value added for a limited number of firms. In addition, we restrict the sample to cover only positive observations for value added, tangible asset, and number of employees.⁴ The effective number of foreign M&As in the baseline estimation is 318 per year, while the control group of domestic firms that have not been the target of a (foreign or domestic) takeover covers over 15,000 firms. The large number of firms in the control group relative to the target group allows us to closely match target and control firms (see below). Moreover, 75% of the 318 foreign M&As represent vertical takeovers.⁵ Note that vertical foreign investments are generally considered to involve a larger scope for spillovers between foreign and domestic firms.⁶ However, we do not find significant differences between the effects of vertical and horizontal M&As (see section 3.3 and Table 10).

Table 1 displays the descriptive statistics for the foreign acquired firms and all other firms for each of the variables. The average log TFP level and labor productivity of foreign acquired firms are lower than the corresponding productivity indicators of all other firms.⁷ Moreover, foreign acquired firms are, on average, larger, older, have a higher default probability, a lower return to capital, are more likely to be quoted or publicly owned, and less likely to be insolvent. Finally, the data reveal considerable heterogeneity amongst foreign-acquired firms, since the

⁴We also eliminate duplicates from the sample. Note that we do not impose further corrections for outliers among non-target domestic firms since the matching estimator does not take observations into account which can not be matched properly. Moreover, the balancing test in Table 3 suggests that M&A target firms are appropriately matched to domestic control firms.

⁵We label a takeover “horizontal” if (a subsidiary of) the acquirer operates in the same industry, defined by four digit NACE codes, as the target firm. Otherwise, the M&A is labeled “vertical”.

⁶See, for example, Javorcik (2004).

⁷We also compute the multilateral TFP index ($ln\text{tfp} - \text{Caves}$) developed by Caves et al. (1982) as a robustness check (see below). This alternative productivity indicator is again lower for foreign acquired firms.

standard deviations of the individual series among these firms generally exceed the standard deviations among all other firms apart from labor productivity and exit.

3.2 Empirical strategy

The key empirical objective of this paper is to evaluate the causal effect of foreign acquisition on firm productivity. The main challenge is that we do not observe the productivity of acquired firms had they not been acquired. We address this missing data problem by using propensity score matching (PSM) following Rosenbaum and Rubin (1983). The central idea is to compare the productivity of foreign-acquired firms with the firm performance of a control group that includes non-acquired firms with similar observable characteristics. While matching methods account for the bias due to observable firm characteristics, selection bias might also stem from time-invariant unobserved firm characteristics. To eliminate this latter bias, we combine the propensity score matching with the difference-in-difference estimator suggested by Heckman et al. (1997).

In the first step, the propensity-score matching estimator summarizes the vector of pre-treatment characteristics, X , into a single-index variable, the propensity score $p(X)$. The latter measures the conditional probability of a firm to be acquired by a foreign owner given data on firm characteristics and past firm performance and is determined in a probit regression, i.e., the binary dependent variable defines the firm's acquisition status in year t . It is equal to 1 in the year of a foreign takeover and 0 if the firm is domestically owned and has not been acquired during the sample period. We model the probability of foreign acquisition as a function of the following firm characteristics observed in the pre-acquisition period: productivity level (TFP and labor productivity), profitability, the ratio of interest expenses to total assets, age, size, legal status, ownership status, shareholder structure, and the probability of default. In addition, we control for time and industry dummies which are based on three digit NACE codes. The corresponding sample covers all UK firms with available information for these variables.⁸

⁸Note that we do not observe the level of value added or investment for one fourth of the target firms of foreign takeovers. Thus, we lose these firms since we can not compute an appropriate TFP measure that corrects for an endogeneity and selection bias in the industry specific input elasticities.

In the second step, we estimate the average effect of foreign acquisition on firm productivity in the post-acquisition period. To do this, we use the productivity of the non-acquired domestic firms with a similar propensity score to generate counterfactual observations. To control for the possible bias that is due to selection on unobservables, we compute the effect using the difference-in-difference matching estimator (Heckman et al, 1997). Hence, we compare the evolution of productivity between foreign-acquired firms and domestic firms that exhibit an equivalent *ex ante* probability of being taken over given firm characteristics, performance indicators, and time-invariant unobservables. The average effect of acquisition on the acquired firms for the difference-in-differences matching estimator can be written as

$$\widehat{ATT} = \sum_{i \in A} (\Delta y_i - \sum_{j \in C} \omega(p_i, p_j) \Delta y_i) \quad (1)$$

where Δy is the difference between the average productivity before and after the acquisition, p_i denotes the predicted probability of being acquired for firm i in the group of acquired firms A , p_j the predicted probability of being acquired for firm j in the control group C , and $\omega(\cdot)$ is a function assigning the weights to the counterfactual firms j .⁹

The PSM method provides a reliable and robust method for estimating the foreign acquisition effect if, conditional on the propensity score, the potential outcomes before and after acquisition are independent of the 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. We test the balancing hypothesis in two ways: (i) we test the significance of differences between acquired and matched firms for each variable entering the propensity score estimation; (ii) we test whether those differences can be taken as jointly insignificant by using the Hotelling's T-square test .

Further, to distinguish the effect of foreign acquisitions *per se* on firm productivity from a potential acquisition effect, we compare productivity outcomes for foreign and domestic M&A. Next, we allow for heterogenous effects across country of origin of foreign investors and across

⁹We use the propensity score matching procedure as described in Leuven and Sianesi (2003).

industries. Productivity effects in the post-acquisition period may be different depending on the home country of the foreign investor. For example, Bloom, Sadun, and Van Reenen (2007) found that US multinationals which took over UK establishments have a higher productivity due to their ability to use new (information) technologies more efficiently in comparison to non-US multinationals. In addition, the motivation of foreign mergers and acquisitions may differ with the origin country of the foreign investor. Finally, we examine whether or not productivity effects are significantly different across (NACE3) industries or between aggregate manufacturing and service industries.

The propensity score matching combined with difference-in-difference estimators provides an appropriate framework to analyze the causal effect of foreign acquisitions on UK firm productivity in our large sample. Still, the estimation strategy will produce misleading results if the underlying productivity measure does not allow for a meaningful cross-section comparison. Thus, the quality of the results hinges crucially on the construction of a detailed and unbiased productivity measure. However, most previous studies employ potentially biased productivity indicators as the outcome variable¹⁰, i.e., labor productivity or TFP measures that are based on the income shares of capital and labor. In this regard, note that one has to determine the marginal effects of capital and labor on corporate output in order to construct residual TFP measures. In the absence of perfect competition or constant returns to scale, the marginal effects differ from the income shares of capital and labor.

In contrast, we determine the marginal input effects from a production function estimation. Since the demand for labor is most likely correlated with the unobservable productivity of a firm, it is well-known that OLS may suffer from a simultaneity bias. Therefore, we follow the approach of Olley and Pakes (1996) to estimate consistent marginal effects of the input factors which allow for the construction of an unbiased TFP measure in the presence of imperfect competition or non-constant returns to scale. The method supposes that a firm's investment decision is a function of its capital stock, age, and its unobserved productivity. Hence, the unobserved productivity parameter can be modeled as some (inverse) function of investments,

¹⁰We illustrate below that the use of an appropriate productivity measure is crucial to identify the underlying relationship between foreign acquisitions and past productivity performances in the UK

capital, and age given the assumption of a monotonic relationship between investment and productivity. The estimation of this function is carried out by a semi-parametric estimator. We account for heterogenous input elasticities across three digit (NACE) industry levels in that we estimate the marginal input effects separately for each of the three digit industries.¹¹ Thus, the procedure allows us to construct a detailed unbiased firm-level measure of TFP at the corporate level.

Table 3 summarizes the results for the balancing tests based on the different matching estimates.¹² The standardized differences between the acquired and matched control firms are smaller than 15% for foreign and domestic M&A.¹³ Moreover, the formal paired t-test between acquired and matched control firms indicates that the balancing hypothesis can not be rejected at conventional levels for most of the individual series. The balancing hypothesis is rejected at the 5% for the age of a firm in the case of the matching estimation for domestic takeovers, respectively. In addition, it is rejected for the dummy variable “quoted” at the 5% level for the US and the EU⁺, the dummy variable “public” for the EU⁺, and the interest expenses asset ratio in the manufacturing sector.¹⁴ Finally, it is rejected for the log of labor productivity and the default probability in the case of matching estimation based on labor productivity.

In addition to the t-test for the individual series, we use the Hotelling’s T-squared test which tests for a joint significance of the standardized differences between the acquired and the matched control firms. The corresponding p-values of the Hotelling’s T-squared test are outlined in the fifth and ninth column in each of the corresponding Tables that report the results of the difference-in-difference matching estimator (Table 4-8). Accordingly, the test results show that the balancing conditions are satisfied for each propensity score estimations

¹¹We also employ three digit output price deflators to deflate the output, capital, and investment series with industry specific deflators.

¹²Table 3 outlines the test results based on the matching estimator for year 0. The test results for all other years can also not be rejected but are not reported for illustrative purposes. The corresponding summaries are available from authors upon request.

¹³Even though a formal criterion as to how large a standardized bias should at most be, we follow Rosenbaum and Rubin (1983) in assuming that a value of 20% is large.

¹⁴EU⁺ represents the following European countries: Ireland, the Netherlands, Belgium, Luxembourg, France, Germany, Spain, Italy, Portugal, Greece, Austria, Finland, Denmark, Sweden, Norway, Switzerland.

and years.¹⁵

3.3 Empirical results

The first step of the estimation strategy involves the estimation of the propensity scores. Table 2 reports the results of the corresponding probit estimation. Note that all explanatory variables are lagged by one year since we aim to account for ex ante M&A firm characteristics. The first column shows that the probability of a foreign takeover is higher for larger firms. In addition, it is significantly influenced by industry-specific and year fixed effects. The coefficient of TFP is negative but not significant at conventional levels. The next columns provide the results of the probit estimations that correspond to our alternative estimation specifications. They reveal the determinants of domestic M&A, foreign takeovers of US and EU firms, and M&A in the manufacturing and service sector, respectively. The last two columns display the findings for the more crude labor productivity measure instead of TFP. Most importantly, our evidence suggests that domestic takeovers tend to favor less productive firms. We reveal similar results for foreign takeovers if we apply the inferior alternative productivity measures. In addition, the results show that foreign firms from other EU countries acquire, on average, more profitable UK firms. This suggests that “cherry-picking” for this type of M&A is based on profits instead of productivity which is harder to observe.

Table 4 reports the results of the difference-in-difference matching estimator. The first column shows the effect of foreign ownership on firm productivity in the year of completion of a takeover (0) up to 5 years thereafter. We find that foreign M&A target firms have, on average, 5.1% lower TFP-growth relative to the pre-takeover year than domestic firms that had a comparable probability of becoming a foreign M&A target in the pre-takeover year.¹⁶ The coefficient is statistically significant at a 5% level. The estimation is based on 318 foreign

¹⁵The only exceptions are the propensity score estimations based on the alternative productivity measures for some of the years.

¹⁶We employ the Epanechnikov Gaussian kernel matching estimator. The results are, however, qualitatively equivalent if we use a Gaussian kernel estimator or the nearest neighborhood matching estimator. The results are available from the authors upon request.

takeovers between 1999 and 2007. The growth difference is close to zero in the first year after the takeover, increases to 4% two years afterwards, and levels off at about 2-3% in the third and fourth year after the takeover.¹⁷ Yet, the positive growth differences in the first four years after the M&A are not statistically significant at conventional levels.

The negative initial impact of M&A indicates the presence of restructuring costs that reduce the TFP-level in the year of completion of the M&A. In contrast, we do not find evidence for positive effects of foreign M&As on the productivity of acquired firms.

The results for domestic M&As are shown in columns four to six of Table 4. The coefficients follow a different pattern over time than those for the foreign M&As. Still, they are not statistically significant apart from a positive productivity effect which is realized in the fifth year after a domestic takeover and is significant at the 10 percent level.

In summary, we find only limited evidence for positive effects on productivity from foreign or domestic takeovers in the first five years post M&A events.

The limited evidence for positive productivity effects of foreign M&A in the first five years after the takeover might be explained by heterogenous TFP performances among M&A target firms. In particular, the existence or magnitude of productivity spillovers might depend on the home country of the foreign acquirer. For example, Benfratello and Sembenelli (2002) uncover positive M&A effects only in the case of US multinationals. In Table 5, we distinguish between two different regions of origin of the foreign acquirer: the US and the EU⁺. The evolution of the TFP performance of target firms of US multinationals is comparable to the overall effect of foreign takeovers in the first four post M&A periods: the coefficient is negative in the year of completion, positive thereafter, peaks in the second year after the M&A, and levels off afterwards.¹⁸ However, the positive growth difference in the second year after the M&A is 3.5 times higher (it amounts to 14.8%) and statistically significant at the 10% level for US takeovers. Thus, we find some evidence in favor of positive TFP effects from foreign M&A

¹⁷We use the $n + 1$'s difference in log TFP-levels to compute the growth rate n years after the takeover. For example, if a foreign M&A takes place in t TFP-growth in the fourth year after the takeover is compute as $\ln TFP_{t+4} - \ln TFP_{t-1}$.

¹⁸The pattern of TFP effects due to US (or foreign) takeovers can be described by an 'S-curve'.

if the acquiring firm is based in the US. In contrast, we do not observe significant impacts of M&A from EU⁺ countries.

Table 6 distinguishes between the effects from foreign takeovers in manufacturing and service industries. The evolution of TFP for target firms in the manufacturing sector is again comparable to the overall effect of foreign takeovers in the first four post M&A periods: the coefficient, which amounts to 7.8%, is negative and significant at a 5% level in the year of completion and positive but not significant at conventional levels thereafter. In contrast, we are not able to detect a similar pattern in the service sector. The corresponding coefficients are very small and not significant.

We also analyze the impact of foreign M&A separately for 34 different three-digit industries. Table 7 displays the findings for the seven industries that are characterized by significant TFP effects due to foreign takeovers. We find a negative significant initial drop in TFP that is followed by insignificant effects thereafter relative to domestic firms in the food, beverages & tobacco industries. In two manufacturing industries, manufacture of electrical equipment & machinery and manufacture of communication equipment & apparatus, we find pronounced positive significant TFP effects due to foreign M&A. Foreign target firms in these industries outperform their domestic counterparts by 20-100% in the second to the fourth year after the takeover. We also find some evidence for positive spillovers from foreign takeovers in the printing and publishing industry two years after the M&A. Finally, we observe the opposite impacts in two different service industries. On the one hand, foreign M&A target firms experience lower TFP-growth than domestic counterparts in all post M&A periods in renting of machinery & equipment. On the other hand, they have higher TFP-growth until the second post-takeover year in computer and related activities. Thus, we find positive evidence in favor of technological or organizational spillovers from foreign acquirers to domestic target firms in the electronic manufacturing and service industries. In other words, the potential for positive productivity effects appears to be largest in the UK electronic industries.¹⁹

Moreover, we distinguished between the effects of foreign takeovers on target firm perfor-

¹⁹This finding differs from Girma and Goerg (2002) who use, however, a different data set, methodology, and a different measure of TFP.

mance in high or low technology sectors, respectively. We follow the classifications of the “OECD Science, Technology and Industry Scoreboard 2007” to identify high and low technology industries. However, we do not find significant effects of foreign M&A in these particular sub-sets of industries.²⁰ We also estimate the effect of foreign takeovers separately for vertical and horizontal M&As. The corresponding results are reported in Table 10 and appear to be qualitatively similar to the our baseline specification in both cases.

Table 8 reports the results for a different measure of productivity. That is, we use labor productivity instead of the Olley-Pakes based TFP measure. The use of labor productivity as a performance measure results in significant productivity increases due to foreign takeovers in all of the first five post acquisition periods. The coefficients for domestic M&A are, in contrast, not significant at conventional levels. These findings are consistent with the ones of Conyon et al (2002) for the UK. It follows that the use of labor productivity instead of the Olley-Pakes based TFP measure, which is a more precise and unbiased productivity indicator, entails misleading results with respect to the impact of foreign M&As. Accordingly, the increase in target firm’s labor productivity in post acquisition periods appears to be governed by capital deepening instead of productivity effects since the former involves higher labor productivity but not higher TFP levels. We suggest that the use of a the TFP is a better measure to identify the causal impact of foreign M&A on relative target firm performance.

Finally, Table 9 outlines the results for the alternative TFP measure which is based on the multilateral TFP index ($ln\text{tfp} - \text{Caves}$) developed by Caves et al. (1982). This TFP indicator, which is based on factor shares, is often used in the literature.²¹ However, in contrast to our preferred TFP measure based on Olley and Pakes (1998), it implicitly assumes the presence of perfect competition and constant returns to scale at the industry level. Table 9 shows that we do not find significant effects of foreign takeovers on domestic target firms which is consistent with the results from our baseline specification. This further confirms that the use of labor productivity leads to misleading results with respect to the impact of foreign M&A on domestic target firm performance.

²⁰The results are available from the authors upon request.

²¹For example, it is used by Bertrand and Zitouna (2008).

4 Conclusion

This paper examines the causal relationship between foreign acquisitions and firm productivity using a rich micro data set from the UK over the period 1999-2007. We use the propensity score matching combined with a difference-in-difference estimator which allows us to distinguish between causality and correlation effects of foreign ownership.

We find that large firms and firms with low labor productivity are more likely to be taken over by foreign investors. While publicly quoted firms and insolvent firms are more likely to be taken over by US-based foreign investors, being public and profitable increases the probability of a takeover by EU-based investors. Domestic acquisitions are more likely in the case of firms with low productivity - both total factor productivity and labor productivity, young firms and insolvent firms.

Our results suggest that the expected positive effects of foreign ownership on total factor productivity appear in the long term only. In contrast, we find a positive and increasing effect of foreign acquisition on labor productivity from the first until the fifth year of the post - acquisition period. The results are broadly similar for firms taken over by US and EU based firms. We find that the effects of foreign acquisitions vary across industries. It appears that while foreign ownership led to higher productivity in the office & electrical machinery industry, it had a negative effect on productivity in the renting of machinery & equipment industry. Firms acquired by foreign investors in computer services experience a higher productivity in the second year of the post-acquisition period.

Table 1: Descriptive statistics

| | Target firms | | All other firms | |
|--------------|--------------|--------------------|-----------------|--------------------|
| | Mean | Standard deviation | Mean | Standard deviation |
| lntfp-op | 0.69 | 0.60 | 0.70 | 0.56 |
| $\ln Y/L$ | 1.44 | 2.78 | 2.49 | 3.17 |
| lntfp-Caves | -1.07 | 2.94 | -0.12 | 30.37 |
| return-cap | 19.89 | 63.37 | 25.33 | 59.00 |
| debt-asset | 0.02 | 0.02 | 0.02 | 0.02 |
| labor | 1752.68 | 9032.26 | 574.00 | 4497.17 |
| default | 7.39 | 13.43 | 5.17 | 9.82 |
| age | 32.11 | 28.18 | 29.16 | 21.56 |
| public | 0.15 | 0.36 | 0.10 | 0.30 |
| quoted | 0.06 | 0.24 | 0.03 | 0.18 |
| exit | 0.02 | 0.13 | 0.03 | 0.16 |
| firms | 318 | | 9835 | |
| observations | 1660 | | 127855 | |

Table 2: Propensity score estimation

| | for M&A | dom M&A | US M&A | EU M&A | man M&A | ser M&A | for M&A | for M&A |
|-------------------------|---------------------|----------------------|--------------------|--------------------|----------------------|--------------------|----------------------|---------------------|
| ln tfp -op | -.0372 (-1.22) | -.0666*** (-2.81) | -.0246 (-.51) | -.0650 (-1.52) | -.0308 (-.51) | -.1054 (-1.41) | | |
| lnY/L | | | | | | | -.0378*** (-6.82) | |
| ln tfp -Caves | | | | | | | | -.0001** (-2.09) |
| return-cap | .0003 (1.41) | .0001 (.37) | .0003 (1.09) | .0005** (2.10) | .0006 (1.28) | .0002 (.39) | -.0001 (-.37) | .0002 (1.13) |
| debt-asset | .1174 (.20) | -.0292 (-.05) | -1.70 (-1.13) | .3245 (.54) | 2.41*** (3.23) | -4.80** (-2.01) | .4294** (2.14) | .0656 (.11) |
| labor | 2.38e-06* (1.78) | 1.49e-06 (.99) | 3.81e-06 (1.38) | 1.25e-06 (.77) | 4.01e-06** (1.98) | 2.10e-06 (.89) | -1.05e-06 (-.63) | 2.34e-06* (1.75) |
| default | .0009 (.57) | -.0005 (-.38) | .0018 (.67) | .0016 (.76) | .0019 (.75) | .0049 (1.58) | .0019 (1.55) | .0014 (.87) |
| age | -.0013 (-1.48) | -.0019** (-2.54) | -.0016 (-1.16) | -.0013 (-1.11) | -.0016 (-1.25) | -.0005 (-.24) | -.0018** (-2.13) | -.0013 (-1.44) |
| public | .0694 (1.14) | -.0846 (-1.58) | -.1002 (-.91) | .2263*** (3.34) | .0950 (.90) | .1559 (1.41) | .0356 (.63) | .0708 (1.20) |
| quoted | .0278 (.82) | -.1343 (-1.25) | .3940*** (2.77) | .0762 (.68) | -.3995* (-1.78) | -.2384 (-.96) | .0330 (.38) | .0297 (.30) |
| exit | -.0164 (-.18) | .1832*** (2.99) | .0183 (.13) | -.0335 (-.26) | .1881 (1.48) | -.3612 (-1.23) | .0546 (.65) | -.0160 (-.17) |
| year-FE | yes | yes | yes | yes | yes | yes | yes | yes |
| industry-FE | yes | yes | yes | yes | yes | yes | yes | yes |
| P-values of joint test: | | | | | | | | |
| year-FE = 0 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| industry-FE = 0 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| Observation. | 151730 | 160331 | 125329 | 127944 | 42471 | 48520 | 138025 | 151730 |
| pseudo R2 | .040 | .043 | .060 | .048 | .040 | .047 | .050 | .040 |
| ps-likelihood | -3067 | -4816 | -1197 | -1657 | -1148 | -714 | -3228 | -3068 |

Sample covers all U.K. firms with information on value added, employment, and investments between 1999-2007. M&A is a dummy variable that is equal to 1 in the year of a (foreign) takeover and 0 if the firm is domestic and has not been the target of a (domestic or foreign) takeover between 1999-2007. Explanatory variables lagged by one year. t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 3: Balancing test from kernel estimation

| | Mean | | % bias | t-test | Mean | | % bias | t-test |
|------------|--------------------|---------|--------|--------|---------------|---------|--------|--------|
| | target | control | | | target | control | | |
| | foreign M&A: | | | | domestic M&A: | | | |
| lnfp-op | .69703 | .70866 | -2.2 | -0.27 | .68016 | .70882 | -5.5 | -0.84 |
| return-cap | 31.399 | 29.345 | 3.6 | 0.56 | 31.869 | 28.863 | 4.3 | 0.67 |
| debt-asset | .0179 | .0168 | 5.4 | 0.68 | .0163 | .0168 | -3.0 | -0.47 |
| labor | 1223.8 | 543.11 | 13.2 | 1.71 | 666.32 | 576.26 | 2.3 | 0.36 |
| default | 5.9632 | 4.7983 | 11.4 | 1.43 | 5.3875 | 4.7975 | 6.1 | 0.93 |
| age | 27.676 | 29.205 | -6.6 | -0.83 | 26.274 | 29.112 | -12.9 | -1.98 |
| public | .14465 | .097 | 14.6 | 1.84 | .07643 | .09683 | -7.2 | -1.11 |
| quoted | .06289 | .03221 | 14.4 | 1.82 | .01911 | .03116 | -7.7 | -1.18 |
| exit | .01887 | .02697 | -5.4 | -0.68 | .02972 | .02766 | 1.2 | 0.19 |
| | US M&A: | | | | EU M&A: | | | |
| lnfp-op | .73755 | .7297 | 1.3 | 0.10 | .67456 | .72323 | -8.9 | -0.80 |
| return-cap | 29.047 | 30.276 | -1.8 | -0.14 | 36.806 | 30.169 | 7.6 | 0.69 |
| debt-asset | .0161 | .0169 | -3.6 | -0.27 | .0186 | .0165 | 10.4 | 0.94 |
| labor | 1372.7 | 472.07 | 14.8 | 1.11 | 1192.5 | 556.65 | 14.7 | 1.33 |
| default | 6.0667 | 4.858 | 11.2 | 0.84 | 6.0192 | 4.802 | 12.3 | 1.10 |
| age | 24.205 | 28.514 | -20.2 | -1.51 | 28.764 | 28.838 | -0.3 | -0.03 |
| public | .16071 | .0967 | 19.2 | 1.43 | .21118 | .10224 | 30.2 | 2.71 |
| quoted | .11607 | .03021 | 33.3 | 2.49 | .09317 | .03375 | 24.5 | 2.20 |
| exit | .01786 | .0266 | -5.9 | -0.44 | .01863 | .02616 | -5.1 | -0.45 |
| | manufacturing M&A: | | | | services M&A: | | | |
| lnfp-op | .54535 | .53313 | 3.2 | 0.26 | .61237 | .67227 | -11.0 | -0.66 |
| return-cap | 26.549 | 21.55 | 6.9 | 0.55 | 28.015 | 30.22 | -3.0 | -0.18 |
| debt-asset | .0236 | .0166 | 33.7 | 2.70 | .0126 | .0166 | -25.2 | -1.50 |
| labor | 950.55 | 714.64 | 4.9 | 0.39 | 1997.6 | 417.77 | 20.9 | 1.30 |
| default | 6.1144 | 4.6545 | 13.7 | 1.09 | 6.1354 | 4.1427 | 21.7 | 1.30 |
| age | 31.496 | 35.132 | -13.3 | -1.05 | 29.403 | 29.895 | -2.2 | -0.13 |
| public | .07874 | .08867 | -3.6 | -0.28 | .15278 | .08015 | 22.7 | 1.35 |
| quoted | .01575 | .0422 | -15.8 | -1.26 | .02778 | .0226 | 3.3 | 0.20 |
| exit | .01575 | .02477 | -6.4 | -0.51 | 0 | .02597 | -23.1 | -1.37 |

Table 3 continued

| | Mean | | % bias | t-test | Mean | | % bias | t-test |
|------------|--------------|---------|--------|--------|--------------|---------|--------|--------|
| | target | control | | | target | control | | |
| | foreign M&A: | | | | foreign M&A: | | | |
| $\ln Y/L$ | 1.3888 | 2.5161 | -37.1 | -5.24 | | | | |
| lnfp-Ca | | | | | -1.1207 | -.13771 | -6.3 | -0.79 |
| return-cap | 13.387 | 25.762 | -12.1 | -1.70 | 31.304 | 29.449 | 2.3 | 0.29 |
| debt-asset | .0194 | .0176 | 7.6 | 1.07 | .0179 | .0168 | 5.8 | 0.73 |
| labor | 1097.9 | 685.19 | 7.7 | 1.09 | 1230.7 | 544.47 | 13.3 | 1.71 |
| default | 8.4843 | 6.2173 | 17.8 | 2.51 | 5.9902 | 4.7976 | 11.6 | 1.46 |
| age | 27.715 | 28.874 | -4.9 | -0.70 | 27.636 | 29.219 | -6.8 | -0.86 |
| public | .15 | .1193 | 9.0 | 1.27 | .14557 | .09711 | 14.9 | 1.87 |
| quoted | .07 | .0409 | 12.7 | 1.80 | .06329 | .0323 | 14.5 | 1.83 |
| exit | .0325 | .0296 | 1.7 | 0.24 | .01899 | .02698 | -5.3 | -0.67 |

Balancing tests based on propensity score matching for year 0.

Table 4: Foreign versus domestic acquisitions

| year | foreign M&A | | | domestic M&A | | | | |
|------|-------------|---------|------------|--------------|----------|---------|------------|--------|
| | TFP-diff | | deals/obs | F-test | TFP-diff | | deals/obs | F-test |
| 0 | -.0510** | (-2.00) | 318/124494 | .359 | -.0327 | (-1.51) | 471/131094 | .472 |
| 1 | -.0130 | (0.49) | 239/102255 | .121 | -.0115 | (-0.42) | 321/108024 | .684 |
| 2 | .0402 | (1.03) | 176/84407 | .182 | -.0312 | (-0.78) | 212/89177 | .495 |
| 3 | .0315 | (0.84) | 133/68402 | .219 | .0123 | (0.32) | 155/72292 | .529 |
| 4 | .0207 | (0.49) | 92/53925 | .373 | .0347 | (0.81) | 115/56928 | .927 |
| 5 | -.0566 | (-1.03) | 72/40941 | .164 | .0903* | (1.93) | 82/43145 | .964 |

t-statistics in parenthesis. ***,**, * significant at 1%, 5%, 10%.

Table 5: US versus EU acquisitions

| year | US M&A | | | EU M&A | | | | |
|------|----------|---------|------------|--------|----------|---------|------------|--------|
| | TFP-diff | | deals/obs | F-test | TFP-diff | | deals/obs | F-test |
| 0 | -.0234 | (-0.42) | 112/102452 | .304 | -.0207 | (-0.68) | 161/104352 | .224 |
| 1 | .0557 | (1.16) | 83/84119 | .143 | -.0083 | (-0.21) | 126/85552 | .253 |
| 2 | .1477* | (1.66) | 56/69251 | .258 | .0158 | (0.39) | 96/70371 | .375 |
| 3 | .0211 | (0.35) | 45/55974 | .710 | .0550 | (0.92) | 67/56886 | .207 |
| 4 | .0358 | (0.41) | 31/43995 | .663 | -.0188 | (-0.36) | 45/44761 | .624 |

t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 6: foreign acquisitions in manufacturing versus services

| year | M&A in manufacturing | | | M&A in services | | | | |
|------|----------------------|---------|-----------|-----------------|----------|---------|-----------|--------|
| | TFP-diff | | deals/obs | F-test | TFP-diff | | deals/obs | F-test |
| 0 | -.0779** | (-2.39) | 127/35499 | .293 | -.0213 | (-0.30) | 72/40350 | .288 |
| 1 | .0160 | (0.41) | 95/29773 | .896 | -.0098 | (-0.17) | 55/33615 | .440 |
| 2 | .0283 | (0.53) | 71/25036 | .854 | .0255 | (0.48) | 49/28004 | .266 |
| 3 | .0899 | (1.32) | 57/20619 | .624 | -.0407 | (-0.64) | 36/22875 | .242 |
| 4 | .0602 | (.99) | 40/16539 | .656 | -.0346 | (-0.48) | 30/18137 | .291 |

t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 7: foreign acquisitions by two-digit NACE codes

| year | TFP-diff | | deals/obs | F-test | TFP-diff | | deals/obs | F-test |
|------|--------------------------------------|---------|-----------|--------|-----------------------------------|---------|-----------|--------|
| | Food, beverages & tobacco: | | | | Publishing & printing: | | | |
| 0 | -.1694** | (-2.13) | 16/4179 | .803 | .1154 | (1.18) | 10/3917 | .667 |
| 1 | -.0704 | (-0.82) | 11/3547 | .906 | .0141 | (0.22) | 8/3279 | .585 |
| 2 | -.0473 | (-0.36) | 10/2996 | .779 | .2989* | (1.84) | 6/2751 | .854 |
| 3 | -.0783 | (-0.77) | 8/2483 | .837 | .3201 | (0.66) | 3/2245 | .449 |
| 4 | -.1043 | (-0.60) | 5/2007 | .854 | .2502 | (1.23) | 2/1795 | .787 |
| | Manuf. of office & electrical mach.: | | | | Manuf. of communication equ.: | | | |
| 0 | -.0829 | (0.98) | 9/2499 | .578 | -.3213* | (-1.65) | 3/763 | .757 |
| 1 | .1979*** | (3.26) | 5/2076 | .668 | .1500 | (0.26) | 3/632 | .822 |
| 2 | .1430** | (2.08) | 5/1749 | .691 | 1.03*** | (2.97) | 3/520 | .575 |
| 3 | .1817*** | (2.77) | 3/1444 | .557 | 1.45 | (2.93) | 3/431 | .576 |
| 4 | .2795*** | (3.95) | 3/1160 | .593 | | | | |
| | Renting of mach. & equ.: | | | | Computer services & related act.: | | | |
| 0 | -.2324* | (-1.92) | 4/1173 | .845 | -.0324 | (-0.50) | 22/3856 | .930 |
| 1 | -.1640** | (-2.08) | 3/971 | .685 | -.1236 | (-1.03) | 13/3075 | .691 |
| 2 | -.1616** | (2.38) | 3/804 | .670 | .1990*** | (2.55) | 7/2478 | .889 |
| 3 | -.0776*** | (-4.47) | 3/648 | .706 | -.0341 | (-0.31) | 5/1967 | .938 |
| 4 | -.0712*** | (-2.82) | 2/510 | .705 | .1177 | (1.31) | 3/1502 | .967 |

The industry codes are NACE15-16, NACE22, NACE30-31, NACE32, NACE71, NACE72, NACE72, respectively.

t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 8: labor productivity

| year | foreign M&A | | | domestic M&A | | | | |
|------|-------------|---------|------------|--------------|-------------|---------|------------|--------|
| | Y/L -diff | | deals/obs | F-test | Y/L -diff | | deals/obs | F-test |
| 0 | -.0191 | (-0.83) | 400/118080 | .000 | -.0303 | (-1.27) | 546/122678 | .009 |
| 1 | .1066*** | (3.97) | 319/97969 | .000 | .0074 | (0.28) | 427/101826 | .001 |
| 2 | .0701** | (2.01) | 247/80863 | .003 | .0523 | (1.57) | 310/84040 | .036 |
| 3 | .1116*** | (2.89) | 189/65472 | .011 | .0733* | (1.70) | 245/68033 | .050 |
| 4 | .1447*** | (2.70) | 146/51467 | .080 | .0599 | (1.35) | 178/53481 | .077 |
| 5 | .2244*** | (3.56) | 105/38732 | .101 | .0503 | (1.00) | 133/40219 | .176 |

t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 9: alternative productivity measures

| foreign M&A | | | | |
|-------------|-------------|---------|------------|--------|
| year | TFP-Ca-diff | | deals/obs | F-test |
| 0 | -.1782 | (-1.13) | 316/123742 | .002 |
| 1 | -.1246 | (-0.83) | 239/101862 | .001 |
| 2 | -.1558 | (-1.08) | 176/84081 | .009 |
| 3 | -.1072 | (-0.61) | 133/68141 | .026 |
| 4 | -.1064 | (-0.49) | 91/53708 | .130 |
| 5 | -.4135 | (-1.18) | 72/40780 | .115 |

t-statistics in parenthesis. ***, **, * significant at 1%, 5%, 10%.

Table 10: foreign vertical versus horizontal acquisitions

| year | horizontal M&A | | | vertical M&A | | | | |
|------|----------------|---------|-----------|--------------|----------|---------|------------|--------|
| | TFP-diff | | deals/obs | F-test | TFP-diff | | deals/obs | F-test |
| 0 | -.0703 | (-1.59) | 80/99741 | .527 | -.0453 | (-1.48) | 238/111505 | .291 |
| 1 | .0218 | (0.49) | 52/82061 | .502 | .0089 | (0.28) | 187/91605 | .295 |
| 2 | .0340 | (0.54) | 33/67631 | .504 | .0394 | (0.86) | 143/75490 | .488 |
| 3 | .0952 | (.79) | 21/54697 | .411 | .0168 | (0.43) | 112/61139 | .408 |
| 4 | .0753 | (1.49) | 18/43046 | .667 | .0027 | (0.05) | 74/48194 | .511 |

t-statistics in parenthesis. ***,**,* significant at 1%, 5%, 10%.

References

- Arnold, J. and B.S.Javorcik** (2005) “Gifted Kids or Pushy Parents? Foreign Acquisitions and Plant Performance in Indonesia”, *CEPR Discussion Paper No. 5065*.
- Barba Navaretti, G., A.J. Venables** (2004) “Multinational Firms in the World Economy”, *Princeton University Press*.
- Benfratello, L. and . Sembenelli** (2002) “Foreign Ownership and Productivity: Is the Direction of Causality so Obvious?”, *Centro di Studi Luca d’Agliano Development Studies Working Paper no. 166*.
- Bertrand, O. and H. Zitouna** (2008) “Domestic versus cross-border acquisitions: which impact on the target firm’s performance?”, *Applied Economics*, 40, 2221-2238.
- Caves, R.** (1974) “Multinational Firms, Competition and Productivity in Host-Country Markets”, *Economica*, 41, 176-193.
- Caves, D. W., Christensen, L. R., and W. E. Diewert** (1982) “Multilateral Comparisons of Output, Input, and Productivity Using Superlative Index Numbers”, *The Economic Journal*, 92, 73-86.
- Canyon, M., S. Girma, S. Thompson and P. Wright** (2002) “The Productivity and Wage Effects of Foreign Acquisition in the United Kingdom”, *Journal of Industrial Economics*, 50, 85-102.
- De Backer, K. and L. Sleuwaegen** (2002) “Why are foreign firms more productive than domestic firms?”, *mimeo*.
- Doms, M. E. and J. Bradford Jensen** (1998) “Comparing Wages, Skills, and Productivity between Domestically and Foreign-owned Manufacturing Establishments in the United States”, *NBER Studies in Income and Wealth*, Chicago and London: University of Chicago Press, 59, 235-55.

- Driffield, N.** (1997) “Global competition and the labour market”, *Amsterdam : Harwood Academic Publishers*.
- Dunning, J.** (1977) “Trade, Location of Economic Activity and MNE: A Search for an Eclectic Approach”, in *Ohlin, B., Hesselborn, P.O. and Wikman, P.M. (eds) the International Allocation of Economic Activity*, London: MacMillan, 395-418.
- Girma, S. and H. Görg** (2007) “Multinationals’ Productivity Advantage: Scale or Technology?”, *Economic Inquiry*, 45, 350-362.
- Griffith, R. and H. Simpson** (2001) “Characteristics of Foreign-Owned Firms in British Manufacturing”, *Institute for Fiscal Studies, IFS Working Paper W01/10*.
- Griffith, R., S. Redding, and H. Simpson** (2004) “Foreign Ownership and Productivity: New evidence from the Service sector and the R&D lab”, *CEP Discussion paper No. 649*.
- Harris, R., and C. Robinson** (2003) “Foreign Ownership and Productivity in the United Kingdom. Estimates for UK Manufacturing using the ARD”, *Review of Industrial Organization*, 22.
- Heckman, J., Ichimura, H., and P. Todd** (1997) “Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme”, *Review of Economic Studies*, 64.
- Helpman, E.** (1984) “A Simple Theory of Trade with Multinational Corporations”, *Journal of Political Economy*, 92, 451-471.
- Helpman, E., and P. Krugman** (1985) “Market Structure and Foreign Trade”, *Cambridge, MA: MIT Press*.
- Helpman, E., M.J. Melitz, and S.R. Yeaple** (2004) “Exports versus FDI with heterogeneous firms”, *American Economic Review*, 93, 605-627.

- Javorcik, B. S.** (2004) “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages”, *American Economic Review*, 94, 605-627.
- Leuven, E., and B. Sianesi** (2003) “PSMATCH2: Stata module to perform full Mahalanobis and Propensity Score Matching, Common support Graphing, and Covariate Imbalance Testing”, <http://ideas.repec.org/c/boc/bocode/s432001.html>. Version 1.2.3, .
- Lichtenberg, F. and D. Siegel** (1987) “Productivity and changes in ownership of manufacturing Plants”, *Brookings Papers on Economic Activity*, 3, 643-673.
- Markusen, J.R.** (1984) “Multinationals, Multi-Plant Economies, and the Gains from Trade”, *Journal of International Economics*, 16, 205-26.
- Markusen, J.R.** (1995) “The Boundaries of Multinational Enterprises and the Theory of International Trade”, *Journal of Economic Perspectives*, 9 , 169-89.
- Markusen, J.R., and A. Venables** (1997) “The Role of Multinational Firms in the Wage-Gap Debate”, *Review of International Economics*, 5, 435-51.
- Markusen, J.R., and A. Venables** (1998) “Multinational Firms and the New Trade Theory”, *Journal of International Economics*, 46, 183-203.
- Markusen, J.R.** (2002) “Multinational Firms and the Theory of International Trade”, *MIT Press: Cambridge*.
- Nocke, V., and S. Yeaple** (2007) “Cross-border mergers and acquisitions vs. greenfield foreign direct investment: the role of firm heterogeneity”, *Journal of International Economics*, 72, 336-365.
- Olley, G. and A. Pakes** (1996) “The Dynamics of Productivity in the Telecommunications Equipment Industry”, *Econometrica*, 64, 1263-1279.

- Pfaffermayer, M. and C. Bellak** (2002) “Why foreign-owned firms are different : A conceptual framework and empirical evidence for Austria”, in *R. Jungnickel, Foreign-owned Firms : Are They Different?*, Houndsmill : Palgrave Macmillan., 13-57.
- Rosenbaum,P. and D. Rubin** (1983) “The Central Role of Propensity Score in Observational Studies for Causal Effects”, *Biometrika*, 70.
- Ruane, F. and A. Ugur** (2004) “Foreign Direct Investment and Productivity Spillovers in Irish Manufacturing Industry: Evidence from Plant Level Panel Data”, *International Journal of Economics and Business*, 53-66.
- Temouri, Y., N. L. Driffield, and D. A. Higon** (2008) ”Analysis of productivity Differences among Foreign and Domestic Firms: Evidence from Germany”, *Review of World Economics*, 144(1), 32-54
- Vernon, R.** (1966) “International Investment and International Trade in the Product Cycle”, *Quarterly Journal of Economics*, 80, 190-207.