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Productivity and the Internationalization of Firms

Cross-border Acquisitions versus Greenfield Investments

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Michaela Trax[1]

Productivity and the Internationalization of Firms – Cross-border Acquisitions versus Greenfield Investments

Abstract

This paper extends the literature on the determinants of international activity at the firm level towards cross-border acquisitions and greenfield investments as different modes of FDI using a rich dataset of British firms. While multinational firms are characterized by higher productivity levels than exporters on average, the productivity ranking predicted by Helpman et al. (2004) does not hold within all types of industries and across all modes of foreign direct investment. In line with Nocke & Yeaple (2007) it matters whether multinational firms engage abroad via greenfield investments or cross-border acquisitions. Cross-border deals involve the most productive firms in sectors with a high share of intangible assets, but the least productive group of all internationally active firms in other industries.

JEL Classification: F23, G34, L23, D24

Keywords: Foreign entry; cross-border M&A; greenfield investment; productivity

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1 Introduction

This paper adds to the empirical literature on the determinants of international activity at the firm level. In particular, it analyzes the sorting pattern of firms into different modes of foreign market entry depending on their productivity level with a focus on two different types of FDI, namely greenfield entry and cross-border mergers and acquisitions (M&A). The contribution of the present paper is to test for the first time the productivity ranking of internationally active firms established in the theoretical model by Nocke & Yeaple (2007). The results show that FDI does not always involve the most productive firms within a sector as soon as it is accounted for the different modes of foreign investments. Thus, the paper provides new empirical evidence on the Helpman et al. (2004) predictions that hold on average, but not across all types of FDI and not within all sectors. For productivity comparisons it matters whether MNEs engage abroad via greenfield investments or cross-border acquisitions.

Helpman et al. (2004) provide a model of heterogeneous firms in an industry that decide whether to serve the foreign market either through exports or to engage in FDI. Firms that want to build a foreign affiliate have to incur set-up costs that are higher than the fixed costs of exporting, but they save on per unit transportation costs. The implied proximity-concentration trade-off between producing closer to the consumer and producing with higher economies of scale leads to a specific productivity ranking of firms in an industry: only the most productive firms decide to invest abroad, while less efficient firms serve the foreign market via exports as illustrated schematically in figure 1. In this context, Helpman et al. (2004) refer to greenfield investments only, where a new firm is set-up abroad, while the alternative entry via cross-border acquisitions of existing firms is neglected (Neary, 2009).[1] More recently, the attention shifted to the composition of FDI with regard to the particular form of market entry. Different reasons arise for firms to choose either greenfield entry or cross-border acquisitions. Apart from strategic considerations – greenfield investments add a new firm to the foreign market, whereas an acquisition can be thought of as a change in ownership (Markusen & Stähler, 2009; Görg, 2000) – one important difference is the acquisition of complementary assets.

This motive is well known in the M&A literature (see, for example, Jovanovic & Braguinsky, 2004), and empirical evidence shows that it is particularly relevant for cross-border acquisitions,

[1] Furthermore, the primary motivation of firms to invest abroad is market access. This horizontal type of FDI refers to a duplication of the domestic production process abroad in order to serve the foreign market locally, thereby substituting exports (in the spirit of Markusen, 1984; Brainard, 1997). Vertical FDI, in contrast, transfers parts of the firm's production process into another country to exploit existing cross-country cost differences, thus resulting in increased intra-firm trade (such as analyzed in Helpman, 1984; Alfaro & Charlton, 2009).

while it plays a minor role for domestic deals (Frey & Hussinger, 2006). This is plausible if one thinks of parts of a firm's stock of knowledge to be market specific. The acquisition of a foreign target firm provides a way to gain access to these valuable assets and knowledge at the cost of the acquisition price. In contrast, MNEs choosing greenfield entry use their own technology both at home and abroad. Given this key difference in the nature of the two entry modes, the characteristics of firms engaging in either one can be expected to vary as well.

The latter distinction is picked up in the theoretical model of Nocke & Yeaple (2007) that analyzes the choice between three foreign entry modes: exporting, cross-border M&A, and greenfield investment.[2] Not only are firms modeled to be heterogeneous with respect to their productivity, but in addition sectors differ regarding the underlying source of the observed productivity differences. In one sector, firms display productivity differences mainly due to an internationally mobile capability, while more market-specific assets drive the heterogeneity of firms in the other industry. Depending on whether immobile or mobile capabilities determine firm heterogeneity within a certain industry, a different subset of firms decide to use a specific foreign entry mode. The known proximity-concentration trade-off still is at work in both types of industries so that more productive firms always prefer greenfield investment over exports. The group of firms that decides to acquire a foreign target firm, however, varies across the two types of industries. The interplay between the firms' capabilities, the importance of either capability in the sector, and the acquisition price that is set in the merger market determines whether the most or least productive firms of all internationally active firms engage in a cross-border acquisition.

The most efficient firms acquire an existing foreign firm whenever the underlying source of the firm heterogeneity is easily transferred to foreign countries. Those firms seek to combine their own exceptional mobile assets with complementary foreign market-specific know-how to be able to exploit their productivity advantage abroad. The predicted productivity ranking implies the known sorting pattern of MNEs, exporters, and domestic firms, whereby those firms choosing greenfield investments are in between the productivity levels of acquirers and exporting firms. The described ranking is sketched in the second line of figure 1. If the relevant determinant of productivity advantages is less mobile across borders, however, the productivity ordering is partly reversed: in this case, firms with the lowest productivity of all internationally active firms acquire an existing foreign firm, while the most efficient firms engage in greenfield investments. For firms with the best immobile, more market-specific capabilities, it does not pay off to costly acquire the knowledge of the local firm as their productivity advantage is strong enough to compensate for its reduced effectiveness in the foreign market. The least productive

[2]Eicher & Kang (2005) also analyze these three entry modes, they focus on country and market characteristics and do not include firm heterogeneity.

firms, in contrast, need to acquire a foreign firm to be able to compete in the foreign market at all. In contrast to Helpman et al. (2004), FDI does not always involve the most productive firms if the entry mode is taken into account. The third line of figure 1 corresponds to this prediction.

Although the literature started to emphasize cross-border M&As and greenfield investments as two distinct modes of FDI recently (Nocke & Yeaple, 2008; Neary, 2009; Stiebale & Trax, 2011), empirical evidence is still rather scarce. Several empirical studies report a productivity advantage of established MNEs over exporters (Greenaway & Kneller, 2007; Tomiura, 2007; Arnold & Hussinger, 2010), with some evidence that large and more productive firms self-select to become MNEs (Girma et al., 2005; Jäckle & Wamser, 2010; Damijan et al., 2007). To the best of my knowledge there is no study that takes into account the two modes of FDI in addition to the firms' exporting decision with an explicit differentiation of mobile and non-mobile industries. Nocke & Yeaple (2008) find firms engaging in greenfield investments to be significantly more productive compared to acquirers in cross-border deals. However, exporting as a third mode of foreign market entry is not considered. In Raff et al. (2008), even more variations of possible entry modes are considered (wholly-owned versus jointly owned affiliates) analyzing a Japanese dataset. Without considering industry differences, the authors also find more productive firms to prefer greenfield investments over cross-border acquisitions.[3]

However, understanding which firms of an industry choose a certain foreign entry mode is important for several reasons. The effects of cross-border investments on the investing and competing firms probably depend on whether the most or less productive firms typically try to acquire a target firm abroad or plan to build up a new firm. Often discussed spillover effects of foreign entry, for example, might be contingent on the investors own productivity level (Keller, 2004; Javorcik, 2004). In addition, as shown by Nocke & Yeaple (2007), theoretical predictions regarding the effects of trade liberalization on average industry productivity and on production reallocations between firms crucially depend on the mapping from the firms' productivity to their internationalization choice. Finally, although cross-border investments are an even rarer firm activity than exporting, their relative impact across economies is huge (compare Bernard et al., 2007): In 2007, the UNCTAD's (2010) World Investment Report counted 7,018 deals and 12,210 greenfield investments worldwide. At the same time, M&As were shown to be a potentially important channel for industry restructuring and asset reallocation after periods of trade liberalizations (Neary, 2007; Bertrand & Zitouna, 2006; Breinlich, 2008). In fact, transaction

[3]There is more empirical work on the choice between greenfield investment and cross-border acquisitions such as Andersson & Svensson (1994). They usually focus on the influence of country and industry characteristics though and do not look at firm productivity.

values involved in cross-border deals are extremely high: the total value of worldwide cross-border M&As amounted to over one trillion US dollars and accounted as such for over half of the value of global FDI flows at their latest peak in the year 2007.

Using a large firm-level panel data set of British firms, I am able to define the two types of foreign investment. The panel structure of the data allows to analyze productivity differences before the actual foreign market entry to separate the selection mechanism from the reverse effects of international activity on the firms' productivity. The distinction of the two industry types is operationalized using the share of intangible assets over non-financial fixed assets. I argue that industries with a high share of intangible assets can be interpreted as sectors where the firms' productivity advantage is based on mobile capabilities, as those intangibles can be combined with local assets in all parts of the firm simultaneously. Industries displaying a lower share are classified as non-mobile. For manufacturing firms, an additional classification is used. Industries with a high share of R&D expenditures relative to industry sales are defined as the sector with relatively mobile technological know-how, while industries with a pronounced share of advertising expenses approximate the sector with less mobile marketing knowledge.

Considering acquirers of foreign firms and firms that build up a new affiliate abroad separately reveals considerable heterogeneity across modes of FDI and between industries. In line with theoretical predictions by Nocke & Yeaple (2007), acquirers in cross-border deals are the most productive firms in sectors with a high share of intangibles, but they are the least productive group of all internationally active firms in the complementary low intangibles industry group. Not all future MNEs are necessarily more productive than exporters if the type of FDI and industry are taken into account. The specific source for the industries' high intangible assets seems to matter less, as cross-border acquirers are the most productive firms both in R&D and advertising-intensive manufacturing industries.

The paper proceeds as follows: in the next section, I present the data and variable definitions, while section 3 discusses the empirical strategy. Section 4 contains the results. Section 5 is devoted to several robustness checks, the last section concludes the paper.

2 Data

The analysis is based on a comprehensive firm-level data set that is constructed combining financial data and ownership information for European firms with a global M&A database that allows for the distinction between the two modes of foreign direct investment.

The financial data is taken from the Amadeus database published by Bureau van Dijk, which provides information on firms' balance sheets, and profit and loss accounts for up to ten years.

The data is collected from company reports that are supplemented by specialized regional information providers. A fundamental feature of the data is the availability of unconsolidated accounts that display balance sheet items separately for the single enterprise in contrast to the whole corporate group. Combining eight consecutive updates of the Amadeus database for the years 2000-2007, I have yearly data on the number of foreign subsidiaries of each firm.[4] I merge the observations from Amadeus with the transaction data from the Zephyr database, an M&A database from the same provider. Zephyr includes data on M&As, IPOs, joint ventures, and private equity transactions and provides information about date and value of a deal, as well as identifiers for the firms involved in the deal.

The data structure of this new combined European firm level data set allows for the necessary differentiation between cross-border M&As and greenfield investments and the reconstruction of the growing international commitment of firms over time. The exact number of cross-border deals is extracted from the Zephyr data. The information for greenfield projects has to be approximated: Subtracting the number of cross-border deals per year and firm from the change in the reported number of foreign subsidiaries between two years given in the Amadeus data, I define greenfield investments as a residual category. I concentrate on investments where the acquirer gains at least a majority interest in the target firm as it is usual in the M&A literature.[5]

The approximation of greenfield investments suffers from two potential inaccuracies. Although the quality of the M&A database is high, for some deals not all necessary information is reported. In those cases, the generated value for greenfield investment would be too high when the resulting affiliate is reported in Amadeus. This should be a minor problem, however, as the two datasets origin from the same data provider, so that all relevant data for the deal should be available if the affiliate is reported in Amadeus.[6] The figures on greenfield investments are downward biased, on the other hand, whenever a firm closes or sells previously acquired firms within one year. If these measurement errors would be too strong, they could blur the classification of the two types of investment. The observed difference in the productivity levels should then be biased if anything towards zero.

The main variable of interest is the firms' efficiency. A frequently used measure of a firm's productivity level is the total factor productivity (TFP) calculated as the residual of a production

[4]Each update of Amadeus provides information on subsidiaries for one point in time only.

[5]Most deals are majority acquisitions or even full acquisitions. The remaining small part of deals results from share buyback activities involving increases in the stake hold of only few percentage points.

[6]Comparing aggregate statistics derived from the Zephyr database with those from Thompson financial data as used in Brakman et al. (2007), the coverage of transactions with a deal value above 10 million US$ appears to be very similar.

function estimation. I implement Olley & Pakes' (1996) estimation algorithm that uses investments to control for unobserved productivity shocks that induce a simultaneity problem in the TFP estimation and that also controls for firm exit.[7] I calculate TFP for all observations with sales, labor, and capital figures available. Alternative productivity measures are discussed in the robustness section.

Next, I define exporters in a comparable way to cross-border acquisition and greenfield investment measures. Thinking about FDI, a crucial distinction is between the stock or flow of FDI. The former is the amount already invested abroad, while the latter refers to the change in the stock of FDI. Cross-border M&As and greenfield investments can be interpreted as flow variables as they reflect additional investment abroad, whereas the number of foreign affiliates corresponds to the stock of FDI. The best approach to generate a comparable flow measure of exports would be to look at exports to a new market or region. As this information is not available in the dataset, I generate a variable that is equal to one if a firm increases significantly its export turnover (export turnover grows more than 50%).

For the estimation sample, British firms are selected, as the data availability is particularly high and the United Kingdom is one of the countries worldwide with the most acquirers in cross-border deals (Brakman et al., 2007). Only firms for which unconsolidated balance sheet data are available are included. Firms that are active in the primary sector, holding companies (NACE code 7415), and firms from the public sector (NACE 75, 91) are deleted. I exclude financial companies (NACE 65-67) as the definition of output or sales and hence any measure of total factor productivity is not comparable to other firms. Inspecting the growth rates of variables like firm size and number of employees, I delete large outliers at both ends of the distribution as they could indicate an unreported merger. After applying standard cleaning procedures,[8] I am left with 249,014 firm-year observations.

3 Estimation

There are two commonly used approaches to measure the productivity differences between firms. One strategy is to test for differences in the productivity distributions between groups of firms in the spirit of Delgado et al. (2002) and Girma et al. (2005), the other consists of regressing a productivity measure on internationalization dummies as in Bernard & Jensen (1999) and Head

[7] The alternative estimation strategy using material inputs instead of investments as suggested in Levinsohn & Petrin (2003) is not an option as this variable is not available for the UK.

[8] Deletion of observations with implausible values such as negative input factors or intangible assets ratios above one, and with growth rates larger than the highest and smaller than the first 200-quantile.

& Ries (2003). Following the latter approach, I estimate the following equation separately for each industry:

$$\begin{aligned} ln(\mathrm{TFP}_{it}) = \alpha_0 + \alpha_X future X_{it} + \alpha_{CB} future CB_{it} + \alpha_{GI} future GI_{it} \\ + \beta_X X_{it} + \beta_{CB} CB_{it} + \beta_{GI} GI_{it} + \boldsymbol{\beta C_{it}} + \gamma_j + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{1}$$

where X refers to exporters, CB to acquirers in a cross-border deal and GI to firms engaged in greenfield investment. Theses variables define firms who have already used the respective entry mode within the last three years. In combination with the prefix 'future', the variables refer to firms that currently do not but that are going to use the specific entry mode within the next three years. Including these two sets of variables allows to separate the productivity differential before the actual foreign market entry from potential productivity effects after the firm has entered the foreign market. The estimated coefficients α_k of the internationalization dummies reflect the productivity advantage of the group of firms that is going to choose the respective internationalization strategy compared to firms that will not use the respective entry mode given other international activities. To see whether firms of group k are more or less productive than firms in group l, two-sided t-tests of the following null hypothesis are performed:

$$H_0 : \alpha_l - \alpha_k = 0, \tag{2}$$

where α_k and α_l are the estimated coefficients and $k, l \in \{X, CB, GI\}$.

C_{it} is a set of control variables. The log of the number of employees as well as its square and the firms' capital stock are included as measures of firm size, the log average wage accounts for the composition of the labor force, and the age of a firm and its square are included to reflect learning effects. In addition, I control for foreign majority shareholders as foreign owned firms usually have a productivity advantage over domestically owned firms (Harris & Robinson, 2003); a further dummy identifies public companies (Harhoff et al., 1998). γ_j refers to a set of industry dummies at the two-digit NACE level, as productivity comparisons are meaningful only within industries, and they capture industry characteristics that could influence the entry mode choice. γ_t stands for a set of time dummies to account for macroeconomic circumstances. Given the panel structure of the model, standard errors are clustered at the firm level to correct for intra-group correlated standard errors.

The chosen approach is clearly descriptive in nature and does not claim a causal interpretation. In the literature that compares exporters with non-exporters, several estimation methods for the identification of productivity as a causal factor have been applied that could be extended in

principle to include MNEs.[9] The main difficulty of such alternative approaches like, for instance, a multinomial choice model, lies in the construction of mutually exclusive categories of firms according to their internationalization status. Considering all possible combinations, I would have to build six categories when introducing the two types of FDI.[10] The number of observations in some industries for some of these categories would be too low to achieve stable estimates. In addition, another advantage of the chosen regression framework is the possibility to control for all potential combinations of past international experience and the various internationalization patterns. Thus, I can analyze the selection of firms into the respective internationalization modes without restricting the analysis to future international and current domestic firms. The results of Andersson & Svensson (1994), for example, indicate that the probability to choose a certain FDI mode might depend on the existing international experience of the firm. A restricted sample would probably be highly selective and additionally reduce the number of observations of future cross-border acquisitions and greenfield investments drastically.

The next step consists in finding an appropriate industry classification that defines industries with mobile and non-mobile capabilities. Nocke & Yeaple (2007) themselves provide concrete examples for the concept of mobile and immobile capabilities that determine the different selection patterns across industries. Marketing expertise is of less value abroad as market conditions differ and existing relationships to market participants provide an advantage in the home market only. Such knowledge thus can be interpreted as immobile across countries. A firm's production technology, on the other hand, can be transferred relatively easily across borders without losing its effectiveness. The operationalization of these capabilities is not straightforward, though.

The balance sheet data at hand is not detailed enough to include marketing expenditure or a similar measure for the importance of immobile capabilities. I also do not have a direct measure of firms' R&D efforts or R&D output to approximate technology-intensive industries. Searching for industry data from other sources, it appears to be difficult to find data at the appropriately detailed level for all industries.

Therefore, I suggest a different measure for mobile capabilities that is directly observable in the data, which is the share of intangible assets relative to the firm's non-financial fixed assets. At first sight, this does not seem to be a direct implementation of the theoretical distinction. Nocke

[9] An example from the exporting literature is Bernard & Jensen (2004), who derive an estimable equation of the export decision including past export status and firm fixed effects in order to account for entry costs of exporting and unobserved heterogeneity.

[10] The categories would be: domestic firms, exporters only, exporters and cross-border acquirers, exporters and firms engaged abroad via greenfield investments, firms without exports, but with both types of FDI, and finally firms that choose all three modes of foreign market entry.

& Yeaple (2007) clearly describe that intangible assets determine the heterogeneity between firms, but they want to stress the different types of intangible assets. According to international accounting standards patents, licenses, and computer software are listed as intangible assets, but also customer lists and supplier relationships. However, as the most important feature that distinguishes the firms' different assets is whether they can easily be transfered to another firm, intangible assets might capture this distinction quite well as they form exactly that part of firms' assets that can be employed simultaneously in more than one location. Combined with the foreign market-specific assets of the target firm, the described complementarities can be exploited.

Hence, I rank the two-digit NACE industries according to their mean intangible assets ratio. The top quartile of all industries is labeled 'High intangibles industry'. The resulting industry should correspond to the sector with mobile capabilities. The complementary category 'Low intangibles industry' subsumes the rest of all industries, as a proxy for the sector in which non-mobile capabilities are the relevant source of heterogeneity in the firms' productivity. Manufacturing of tobacco products, and research and development (NACE 16 and 73) are examples from the manufacturing and service sector, respectively, for the former. Manufacturing of plastic products or real estate activities (NACE 21 and 70), for instance, belong to the low-intangibles group. The list of industries in the two categories is given in table 1. Alternative industry classifications are considered as robustness checks in section 5.

4 Results

Before looking at the results of the regression analysis, some descriptive facts are presented. Table 2 displays the share of firms with different internationalization statuses. Note that some firms may be included in more than one category. In the dataset, 11.6% of all British firms in the sample export. This is higher compared to numbers found for the U.S. (4% of all firms, compare Bernard et al., 2007). This reflects the coverage of the dataset, which is very comprehensive for larger firms, while the smallest firms that are less likely to export are somewhat underrepresented. The shares considering manufacturing firms only or excluding small firms are even higher (37.4%) and similar to other studies for the U.K., illustrating the importance of data selection (Girma et al., 2004, for example, report a share of 35%). The share of MNEs is considerably smaller with only 1.9% of all firms and less than 5% even for large firms in the manufacturing industry. Finally, the shares of cross-border acquirers and firms that engage in greenfield investment are shown. These shares are less than one percent of all firms with even less acquirers than greenfield investors.

Table 3 provides unconditional means of some firm characteristics in the estimation sample. Domestic firms are smaller than exporters and those in turn are smaller than MNEs, both in

terms of sales and employment. The difference between the two types of FDI firms is not very pronounced. On average, exporters are as productive as cross-border acquirers, and both are outperformed by firms engaged abroad via greenfield investments. Interestingly, firms that have acquired a foreign target display the highest average share of intangible investments, possibly indicating the mentioned complementary-asset seeking motive.

The estimation results are presented in table 4. The estimated coefficients of equation 1 are shown in the upper panel separately for the low and high intangibles sector, while the statistics of the tests on equality of the coefficients are displayed below. In the regression for low intangibles industries, future exporting firms display a medium productivity advantage of 7,2%. For greenfield investors, the highest coefficient shows up (13,1%). The cross-border acquirer coefficient is close to zero and not significant at any reasonable level. The productivity differences between groups are not statistically significant, though, due to the high standard error of the cross-border dummy, for which the number of ones is low. For the high intangibles sample, contrasting results can be observed. Here, the group of future cross-border acquirers has the highest and the only statistically significant coefficient (44,3%), while the other two entry modes are not related to a notable productivity advantage. The difference between exporters and greenfield investors is again not significantly different from zero, but the null hypotheses of equality of coefficients for the comparisons with cross-border acquirers can be rejected at the 1% level. The results are in line with the predictions of Nocke & Yeaple (2007), as the high intangibles sector corresponds to the industry in which the firms' heterogeneity is based on mobile capabilities, where the most efficient firms seek to aquire complementary assets abroad. The heterogeneity that shows up in the results is hidden in studies ignoring industry differences and the composition of FDI.

Figure 2 visualizes the productivity differences. The upper graph shows the cumulative density functions of the firms' productivity levels separately for each internationalization mode in the low intangibles sector, the second graph refers to the high intangibles industry. Here, I do not control for simultaneous use of more than one entry mode. Without testing formally for stochastic dominance, inspecting the location of the productivity distributions of the various entry modes gives a more complete picture of the productivity differences as a ranking of the complete distributions is established. The productivity distributions of exporters and greenfield investors is located clearly to the right of the domestic firms' line in both pictures, while the productivity distribution of the two modes is very close to each other. The distribution for cross-border acquirers in the low intangible industries is close to the distribution of exporters and greenfield investors and some quantiles are almost the same as the corresponding values for domestic firms. This finding illustrates why no significant productivity advantage of cross-border acquirers could be found in the corresponding regression analysis. In the high intangibles sec-

tor, in contrast, the productivity distribution of cross-border acquirers clearly dominates all other distributions. In addition to the mean, every quantile of the cross-border acquirers' productivity distribution is the largest compared to the rest of the firms in the sample. The high coefficient in the regression approach seems not to arise due to influential observations but rather reflects systematically higher productivity levels of cross-border acquirers in the mobile capabilities industry.

An important issue for the discussion is whether the results are sensitive towards the specific sample or measurement. For this discussion it appears to be helpful to provide comparable results with previous empirical work.

Table 5 therefore shows estimation results if the heterogeneity of FDI modes and industries is neglected. Future MNEs are defined as firms that are going to acquire an additional affiliate in the upcoming three years. The results are similar to the existing literature, as future exporters are more productive than domestic firms, and future MNEs display even higher productivity levels (compare Arnold & Hussinger, 2010; Girma et al., 2004, for example). The difference between the estimated coefficients is significant at the 10% level. The known result that the most productive firms become MNEs thus holds on average, but hides considerable heterogeneity in the relation between a firm's productivity and its mode of foreign entry.

5 Robustness checks

In the estimations presented so far, a vector of control variables was always included to filter out the pure productivity differences. To show that none of the included firm characteristics has a strong enough influence to wipe out the observed ranking, I estimate the raw productivity differences between the groups. Therefore, only the post-entry dummies together with time and industry dummies, but no controls for further firm characteristics are included in table 6. The estimated coefficients turn out to be larger in size, but the productivity ranking itself does not change. All firms active in international markets turn out to be significantly more productive compared to their domestic counterparts, but partly only due to their size, skill structure, and age. The productivity ranking of the groups of international firms using different entry modes is not affected though.

Further, as the theoretical model strictly speaking refers to domestically owned firms only, table 7 displays the results excluding firms with a majority foreign shareholder. The estimations are again quite similar to the first set of results. While foreign owned firms are known to be more productive, this advantage seems not to be systematically related to the sorting of firms into different internationalization strategies.

Apart from the change in the estimation sample, I consider some changes in the variable definitions. As described in the data section, the Olley & Pakes method used to construct a consistent TFP measure takes care of some of the major estimation problems, nevertheless it critically hinges on functional form restrictions and instrument variables. Therefore, I also use labor productivity (total sales per employee) as an alternative productivity measure (table 8), the residuals from a simple OLS estimation of a Cobb-Douglas type production function (table 9), and estimates including firm fixed effects (table 10).[11] For these variations, I do not include control variables as the results would be identical conditioning on labor and capital input. The correlation between the various measures is always higher than 0.9, thus causing no significant change in the described results. The only exception is the latter version, where cross-border acquirers have a higher coefficient than exporters in the low intangible industry, however, the difference is not statistically significant.

For reasons of comparability, in the baseline specification the exporter variable is equal to one if the share of turnover resulting from export activities increased significantly. Table 11 recalculates the results for the usual stock definition. That is, the exporter dummy equals one for firms that are going to export and zero otherwise. The coefficients and test statistics again almost do not change.

The next variations refer to alternatives to the chosen industry classification. To check the sensitivity of the results towards the grouping of the industries (top-quartile), I perform regressions that include all industries and I interact all foreign entry dummy variables with the mean industry share of intangibles.

$$\begin{aligned} ln(\mathrm{TFP}_{it}) &= \beta_0 + \beta_X X_{it} + \beta_{CB} CB_{it} + \beta_{GI} GI_{it} + \beta_{m_X} X_{it} * m_j \\ &+ \beta_{m_{CB}} CB_{it} * m_j + \beta_{m_{GI}} GI_{it} * m_j + \boldsymbol{\beta C_{it}} + \gamma_j + \gamma_t + \varepsilon_{it} \end{aligned} \tag{3}$$

where m_j is the mean share of intangible assets relative to non-financial fixed assets in a two-digit NACE industry. In this estimation, the interaction between cross-border acquisitions and the mean ratio of intangible assets should have a positive coefficient, while the interaction terms with greenfield investments and exporters are expected to be insignificant. Table 12 gives the respective estimates. The coefficients on the pre-entry dummies are positive and significant for future exporters and greenfield investors, while cross-border acquisitions are related to a lower productivity. Looking at the interaction terms, however, the only positive, large, and significant effect is found for cross-border acquirers in line with expectations. To interpret the

[11] Another measure would be value added per employee; unfortunately, value added is rarely reported for British firms.

results in a meaningful way, the lowest and highest values for the mean share of intangibles have to be considered to get the possible range of the effect. The lowest intangibles ratio is 1.3%, while the sector with the highest value reaches 11.2%. This results in a combined effect between -0.245 and 0.578, implying cross-border acquirers to be the least productive firms in low intangibles industries, but they are the most productive firms in industries with high intangibles. This alternative specification thus again confirms the theoretical predictions.

As a further robustness check, I consider manufacturing firms separately from the service industries. As for many services a more direct customer-producer interaction is necessary, the relevant knowledge and technology in this sector might be less mobile across borders than in manufacturing industries. Thus I expect the results for the manufacturing to be similar to those in the mobile industry, whereas the service sector should display similar patterns as the non-mobile sector. Table 13 gives the results for this alternative classification. The results are in line with expectations, as in the manufacturing sector, the coefficients resemble the high intangibles industry results except that exporters display a significant productivity advantage in this case. The estimates of the service industries correspond to the industry where less mobile capabilities dominate. None of the t-tests on the pairwise equality of the coefficients can be rejected, though.

Finally, I also use data on R&D and advertising intensity to explicitly take into account the suggestions by Nocke & Yeaple (2007). I use the data from Peneder (2002), who presents figures for industry R&D and advertising expenditures over sales for the US economy at the three-digit NACE level, based on the assumption that the US economy serves as a useful point of reference for its technological leadership. This comes at the cost of restricting the sample to the manufacturing sector only. The results for industries classified into those with low and high R&D and advertising ratios are shown in table 14 and 15, respectively.[12] The acquirers display the largest and significant coefficient both in the 'High R&D intensity' and 'High advertising intensity' estimation, while the respective coefficient is rather close to zero and not significant at any reasonable level in the remaining columns. Thus, at least for manufacturing industries, the distinction of the underlying type of intangible asset seems to be less relevant. The chosen classification referring to the importance of intangible assets within an industry seems to be robust towards a finer differentiation. As intangible assets can be transfered and employed at different firms at the same time, they seem to be a good operationalization of the concept of mobile capabilities.

[12] A simultaneous classification into high advertising/low R&D and high R&D/low advertising is not possible, as the low number of ones for cross-border deals does not lead to any significant results.

6 Conclusion

In this paper, the empirical literature on the determinants of international activity at the firm level is extended towards different modes of FDI. While several empirical studies confirm a productivity ranking based on Helpman et al. (2004), this paper shows that these results hold only on average for all types of FDI and over all industries. In line with Nocke & Yeaple (2007), it matters whether MNEs engage abroad via greenfield investments or cross-border acquisitions. Splitting MNEs into acquirers of foreign firms and firms that build a new firm abroad reveals that in the U.K., acquirers in a cross-border deal are the most productive firms in industries where intangible assets are high relative to non-financial fixed assets, but they are the least productive group of all international active firms in the complementary low intangibles industry group. Exporters and firms engaging in greenfield investments display a productivity advantage over domestic firms of similar size in both industries. Whether the higher intangibles stem from higher R&D efforts or from higher marketing expenses seems not to be of primary importance, at least for manufacturing industries. It is shown that these results are not an artifact of the specific dataset as results comparable to the existing literature on MNEs can be produced. It should be taken into account that the motives for firms choosing different internationalization forms potentially differ across industries and thus the effects of trade liberalization might vary across industries as well.

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Figure 1
SCHEMA OF THE PRODUCTIVITY RANKING.

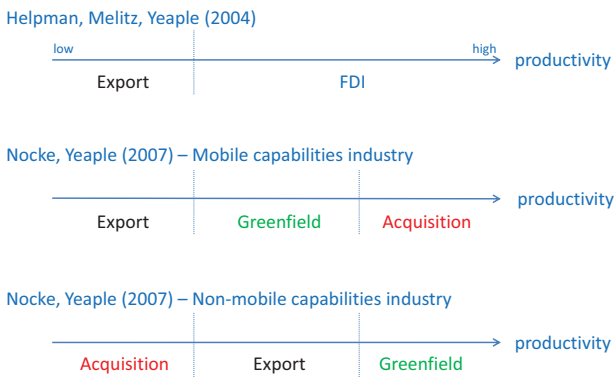

Table 1
Examples for the industry classification – NACE two-digit codes.

	Low intangibles industries
17	Manuf. of textiles
21	Manuf. of pulp, paper and paper products
25	Manuf. of rubber and plastic products
51	Wholesale trade and commission trade
60	Land transport; transport via pipelines
70	Real estate activities
	High intangibles industries
16	Manuf. of tobacco products
22	Publishing, printing and reproduction of recorded media
24	Manuf. of chemicals, chemical products and man-made fibres
33	Manuf. of medical, precision and optical instruments, watches and clocks
52	Retail trade
73	Research and Development

The complete list of NACE codes of the high intangibles category: 16, 22, 23, 24, 90, 33, 34, 41, 52, 55, 73. The remaining industries fall in the low intangibles category.

Table 2
Share of firms in the estimation sample according to their internationalization status in 2006 (in %).

Exporters	
All firms	11.6
Manufacturing firms	32.6
Firms > 10 employees	17.2
Manufacturing firms > 10 employees	37.4
MNEs	
All firms	1.9
Manufacturing firms	4.1
Firms > 10 employees	2.7
Manufacturing firms > 10 employees	4.4
Cross-border acquirers	
All firms	0.09
Manufacturing firms	0.11
Firms with more than 10 employees	0.12
Manufacturing firms > 10 employees	0.12
Greenfield investors	
All firms	0.7
Manufacturing firms	1.6
Firms with more than 10 employees	1.0
Manufacturing firms > 10 employees	1.7

Table 3
Descriptive statistics of the estimation sample.

	Domestic firms	Exporters	Cross-border acquirers	greenfield investors
United Kingdom				
Log sales	7.867	9.334	10.369	10.323
Log employment	3.045	3.985	5.052	4.861
Log TFP	0.826	1.475	1.580	1.701
Share of intangibles	0.051	0.075	0.166	0.106
N (firm-year observations)	174,275	60,546	548	3,733

Unconditional means. Calculations are based on the period of entering the respective status and include up to three years after entrance via the respective internationalization mode. TFP: Olley & Pakes (1996) algorithm. Share of intangibles: intangible assets over non-financial fixed assets.

Table 4
HETEROGENEITY ACROSS MODES OF FDI AND INDUSTRIES – CLASSIFICATION: INDUSTRY SHARE OF INTANGIBLE ASSETS.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.072***	-0.003
	(0.012)	(0.032)
Future cross-border acquirer	0.003	0.443***
	(0.073)	(0.118)
Future Greenfield investor	0.131***	0.001
	(0.025)	(0.044)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.069	-0.446***
	(0.075)	(0.121)
Future exporter = Future greenfield	-0.059**	-0.004
	(0.027)	(0.056)
Future acquirer = Future greenfield	-0.128	0.442***
	(0.079)	(0.123)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.467	0.553

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sectors are classified according to their mean share of intangible assets over non-financial fixed assets. High intangibles industries are the top quartile of all industries ranked by their respective mean share.

Figure 2

Cumulative distribution functions of the firms' productivity by foreign entry mode and industry.

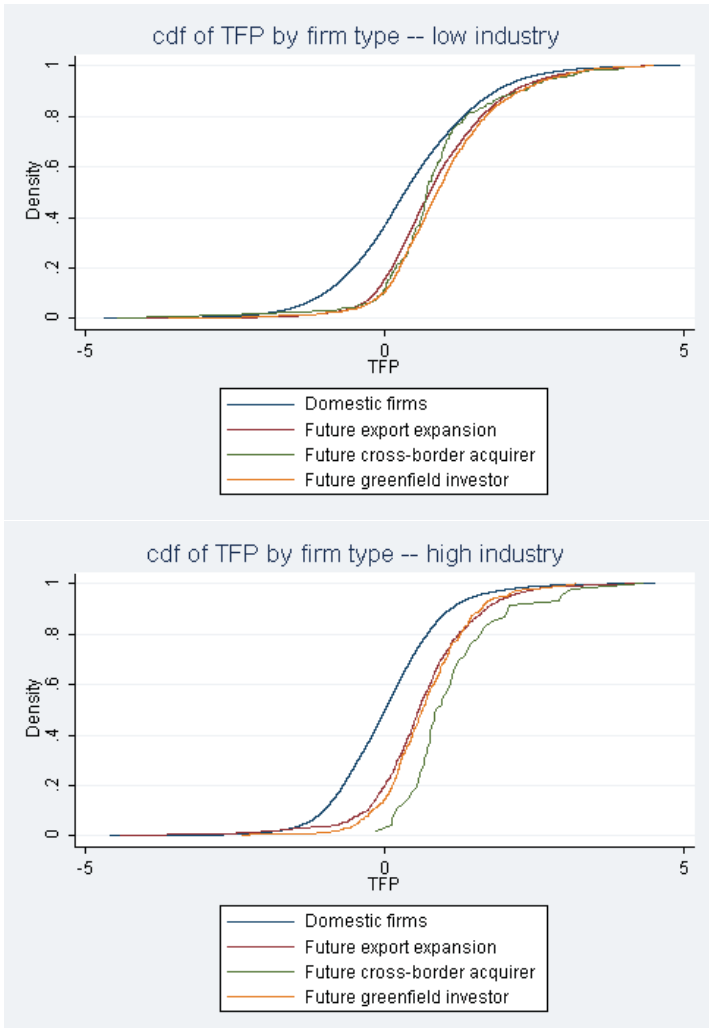

Table 5
IGNORING HETEROGENEITY.

	β (SE)
Estimated coefficients	
Future exporting firm	0.063***
	(0.011)
Future MNE	0.107***
	(0.022)
Test of equality of coefficients	
Future exporter = Future MNE	-0.044*
	(0.025)
Past international activity	Yes
Control variables	Yes
Industry and time effects	Yes
N	249,014
adj.R	0.478

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter and MNE dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-FDI dummy coefficient.

Table 6

Considering heterogeneity across modes of FDI and industries – Only controlling for year and industry.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.292***	0.106***
	(0.013)	(0.036)
Future cross-border acquirer	0.287***	0.671***
	(0.085)	(0.147)
Future Greenfield investor	0.459***	0.291***
	(0.028)	(0.053)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.005	-0.565***
	(0.086)	(0.150)
Future exporter = Future greenfield	-0.167***	-0.185***
	(0.031)	(0.066)
Future acquirer = Future greenfield	-0.172*	0.380**
	(0.090)	(0.158)
Past international activity	Yes	Yes
Control variables	No	No
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.184	0.261

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient.

Table 7
Considering heterogeneity across modes of FDI and industries – Only domestic firms.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.073***	-0.023
	(0.013)	(0.040)
Future cross-border acquirer	0.010	0.380***
	(0.076)	(0.115)
Future Greenfield investor	0.142***	0.010
	(0.028)	(0.051)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.062	-0.403***
	(0.078)	(0.122)
Future exporter = Future greenfield	-0.069**	-0.033
	(0.031)	(0.067)
Future acquirer = Future greenfield	-0.132	0.370***
	(0.083)	(0.123)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	181,298	31,278
adj.R-squared	0.472	0.545

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sample excluding firms with a foreign majority shareholder.

Table 8
HETEROGENEITY ACROSS MODES OF FDI AND INDUSTRIES – LABOR PRODUCTIVITY.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.240***	0.093**
	(0.013)	(0.037)
Future cross-border acquirer	0.161*	0.581***
	(0.083)	(0.153)
Future Greenfield investor	0.313***	0.118**
	(0.027)	(0.051)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.078	-0.488***
	(0.084)	(0.155)
Future exporter = Future greenfield	-0.074**	-0.025
	(0.031)	(0.064)
Future acquirer = Future greenfield	-0.152*	0.463***
	(0.089)	(0.162)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.174	0.259

Coefficients from an OLS regression with log labor productivity as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sectors are classified according to their mean share of intangible assets over non-financial fixed assets. High intangibles industries are the top quartile of all industries ranked by their respective mean share.

Table 9
HETEROGENEITY ACROSS MODES OF FDI AND INDUSTRIES – PRODUCTIVITY ESTIMATION WITH OLS.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.214***	0.090**
	(0.013)	(0.038)
Future cross-border acquirer	0.115	0.526***
	(0.080)	(0.160)
Future Greenfield investor	0.246***	0.046
	(0.027)	(0.051)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.099	-0.436***
	(0.081)	(0.162)
Future exporter = Future greenfield	-0.032	0.044
	(0.031)	(0.064)
Future acquirer = Future greenfield	-0.132	0.479***
	(0.171)	(0.277)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.400	0.503

Coefficients from an OLS regression with the residual from a OLS productivity estimation as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sectors are classified according to their mean share of intangible assets over non-financial fixed assets. High intangibles industries are the top quartile of all industries ranked by their respective mean share.

Table 10
Heterogeneity across modes of FDI and industries – Productivity estimation with fixed effects.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.342***	0.126***
	(0.014)	(0.038)
Future cross-border acquirer	0.405***	0.745***
	(0.088)	(0.153)
Future Greenfield investor	0.590***	0.440***
	(0.029)	(0.059)
Test of equality of coefficients		
Future exporter = Future Acquirer	-0.064	-0.619***
	(0.089)	(0.156)
Future exporter = Future greenfield	-0.249***	-0.315***
	(0.032)	(0.071)
Future acquirer = Future greenfield	-0.185**	0.304*
	(0.094)	(0.166)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.186	0.252

Coefficients from an OLS regression with the residual from a productivity estimation including fixed effects as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sectors are classified according to their mean share of intangible assets over non-financial fixed assets. High intangibles industries are the top quartile of all industries ranked by their respective mean share.

Table 11
HETEROGENEITY ACROSS MODES OF FDI AND INDUSTRIES – ALTERNATIVE EXPORTER DEFINITION.

	Low intangibles	High intangibles
	β (SE)	β (SE)
Estimated coefficients		
Future exporting firm	0.086***	0.052
	(0.014)	(0.034)
Future cross-border acquirer	-0.004	0.424***
	(0.074)	(0.125)
Future Greenfield investor	0.120***	-0.019
	(0.025)	(0.045)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.090	-0.372***
	(0.075)	(0.130)
Future exporter = Future greenfield	-0.033**	0.071*
	(0.028)	(0.058)
Future acquirer = Future greenfield	-0.124*	0.443
	(0.079)	(0.130)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	212,767	36,247
adj.R-squared	0.468	0.555

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. Exporter dummy equals one if firm starts to export within the next three years. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Sectors are classified according to their mean share of intangible assets over non-financial fixed assets. High intangibles industries are the top quartile of all industries ranked by their respective mean share.

Table 12
Considering heterogeneity across modes of FDI and industries – Interaction with industry share of intangible assets.

	β (SE)
Estimated coefficients	
Future export expanding firm	0.105***
	(0.036)
Future cross-border acquirer	-0.354*
	(0.190)
Future Greenfield investor	0.130**
	(0.063)
Future export expanding firm	-0.817
*mean R&D	(0.678)
Future cross-border acquirer	8.325**
*mean R&D	(3.470)
Future Greenfield investor	-0.377
*mean R&D	(1.070)
Past international activity	Yes
Control variables	Yes
Industry and time effects	Yes
N	249,014
adj.R-squared	0.478

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy. Standard errors in parentheses. Two-sided t-test with null hypotheses pre-internationalization dummy coefficient and interaction term coefficient jointly equal to zero.

Table 13

Table 5: Considering heterogeneity across modes of FDI and industries – Manufacturing and service industries.

	Services	Manufacturing
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.075***	0.039***
	(0.016)	(0.014)
Future cross-border acquirer	0.009	0.176**
	(0.089)	(0.077)
Future Greenfield investor	0.141***	0.035
	(0.030)	(0.028)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.066	-0.137*
	(0.091)	(0.078)
Future exporter = Future greenfield	-0.066*	0.004
	(0.034)	(0.032)
Future acquirer = Future greenfield	-0.133	0.141*
	(0.096)	(0.082)
Past international activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	195,193	53,821
adj.R-squared	0.488	0.417

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Manufacturing industries: two-digit NACE codes 15-37.

Table 14
Heterogeneity across modes of FDI and industries – R&D intensity (manufacturing only).

	Low R&D	High R&D
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.059***	-0.006
	(0.016)	(0.027)
Future cross-border acquirer	0.006	0.318***
	(0.090)	(0.111)
Future Greenfield investor	0.055*	-0.004
	(0.031)	(0.050)
Test of equality of coefficients		
Future exporter = Future Acquirer	0.053	-0.324***
	(0.092)	(0.114)
Future exporter = Future Greenfield	0.003	-0.002
	(0.035)	(0.058)
Future acquirer = Future Greenfield	-0.049	0.321***
	(0.097)	(0.119)
Past intern. activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	37,490	15,940
adj.R-squared	0.434	0.394

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Manufacturing industries: two-digit NACE codes 15-37.

Table 15
Heterogeneity across modes of FDI and industries – Advertising intensity (manufacturing only).

	Low advertising	High advertising
	β (SE)	β (SE)
Estimated coefficients		
Future export expanding firm	0.011	0.135***
	(0.016)	(0.031)
Future cross-border acquirer	0.039	0.452***
	(0.071)	(0.153)
Future Greenfield investor	0.015	0.089*
	(0.033)	(0.050)
Test of equality of coefficients		
Future exporter = Future Acquirer	-0.028	-0.317**
	(0.073)	(0.156)
Future exporter = Future Greenfield	-0.004	0.046
	(0.037)	(0.058)
Future acquirer = Future Greenfield	0.023	0.364**
	(0.081)	(0.158)
Past intern. activity	Yes	Yes
Control variables	Yes	Yes
Industry and time effects	Yes	Yes
N	38,311	15,119
adj.R-squared	0.402	0.470

Coefficients from an OLS regression with Olley & Pakes log TFP as the dependent variable. ***, **, * denote significance levels 1, 5, 10%, respectively. Control variables: log number of employees, log number of employees squared, log average wage, log age, squared log age, foreign majority shareholder dummy, legal form dummy, log capital stock, exporter, post-cross-border deal and post-greenfield investment dummies, and a set of time and two-digit NACE industry dummies. Standard errors in parentheses. Two-sided t-test with null hypothesis pre-exporting dummy coefficient is equal to pre-cross-border dummy coefficient, pre-exporting dummy coefficient is equal to pre-greenfield investment dummy coefficient, and pre-cross-border dummy coefficient is equal to pre-greenfield investment dummy coefficient. Manufacturing industries: two-digit NACE codes 15-37.