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Growing lemons and cherries? Pre- and post-acquisition performance of foreign-acquired firms in new EU member states*

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Abstract

Foreign acquisitions are an increasingly important mode of FDI in the new EU member states (NMS). Using firm-level data and a common estimation framework for seven NMS we study pre-and post-acquisition performance of acquired firms. We find that selection criteria of target firms differ significantly across countries. In some countries the evidence supports the idea of 'cherry picking' with better firms being chosen as targets for acquisition, while in the others 'lemons' with growth potential tend to get selected. Regardless of whether 'cherries' or 'lemons' are targeted, performance of acquired firms improved after the acquisition, whereby the boost in productivity has not been achieved by a reduction in employment, as it even increased, but rather by increased efficiency in the use of labor and especially capital. Additionally, foreign ownership is found to yield biggest rewards to small less productive firms.

JEL: F23, D22

Keywords: cross-border mergers and acquisitions, firm productivity, picking lemons

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1 Introduction

When investing abroad firms choose between greenfield and acquisition. Two main factors speak in favor of acquisition mode; it is the fastest way to build up a strong position in a foreign market and it enables foreign investors to come in possession of acquired firm's strategic assets (UNCTAD, 2000; Dunning and Lundan, 2008). Over the period of 1990-2009, the share of cross-border mergers and acquisitions (M&As) in the total value of world foreign direct investment (FDI) inflows was 43.8%; in the EU-15 the respective share was much higher (60.7%), while in ten new EU member states (NMS) from Central and Eastern Europe it was much lower, i.e. 17.4%. As NMS converge towards the EU's core economies and become ever more financially integrated, they are set to experience further increases in the share of M&As in total FDI. M&As in new EU member states are concentrated in a handful of industries. In the tertiary sector, finance (15.6% of total), transport and communications (15.6%) and business services (10.8%) prevail, while the most important sectors in manufacturing are chemicals and chemical products (8.8%), food, beverages and tobacco (6.3%), electrical and electronic equipment (4.2%), metals and metal products (3.4%), and motor vehicles and transport equipment (2.5%) etc.¹ Benefits of inward FDI for host economies are widely recognised, but a popular view is that these benefits are mostly linked to greenfield FDI, while acquisitions are ordinarily a cause for concern over their possible short-run risks, such as that they do not add productive capacity, lead to potential employee layoffs, downgrading or closure of some production or functional activities, swapping of domestic with foreign suppliers, increasing concentration and domination of the local market, reduced exports or increased imports etc. (UNCTAD, 2000: xxii-xxvi or OECD, 2007: 71-74). It is argued that foreign acquisitions may have a detrimental effect on the targeted firms' performance since foreign MNEs are less rooted in the local economy and are more footloose (Bandick, 2009). Although not unanimous, studies which report a positive impact of foreign acquisition on acquired firms productivity prevail by a wide margin. As far as employment is concerned, results of empirical studies are also mixed but those suggesting decrease of employment after the acquisition seem to prevail. Traditionally, a lot of attention has been devoted to the issue of how does pre-acquisition efficiency impact investor's decision on the choice of a target. With the latter issue, the literature provides two alternative scenarios as investors can either opt to target firms with above

¹ Calculated from <http://www.unctad.org/Templates/Page.asp?intItemID=5545&lang=1>

average productivity ('cherries') or seek out underperforming but promising firms ('lemons'). Generally the relevant literature seems to support the 'cherry picking' hypothesis but recently the opposite view has also received some backing.

In this paper we study the performance of firms around an ownership change by comparing the newly foreign-acquired firms with firms that remained fully domestically owned. We focus on both the pre-acquisition and post-acquisition period in order to gain insight into both the target selection mechanism as well as the new-owner's impact on firm performance, i.e. productivity shortly after the change in ownership. Given that the choice of target is not exogenous to the changes that owners implement in the newly acquired firms, we control for target selection and also employ firm fixed effects to control for other idiosyncratic time-invariant characteristics of the targeted firms. Using firm-level financial data and information on acquisition activity for a sample of firms from seven NMS (Bulgaria, Estonia, Czech Republic, Poland, Romania, Slovenia and Slovakia) in the period between 1997 and 2009, we find that productivity of acquired firms improved after the acquisition, that the productivity increase has not been achieved by reducing employment but primarily by increased efficiency in the use of both capital and labor, that foreign ownership yields biggest rewards to small less productive firms, and that criteria for target selection differ significantly across firm strata, i.e. there is substantial heterogeneity between sampled countries and other stratifications of the sample. In some instances, evidence tends to support the idea of 'cherry picking' with better firms being chosen as targets for acquisition while in the others less productive firms are on average more likely to be chosen as targets for acquisitions.

Based on relevant theoretical concepts and existing empirical findings, and by applying up-to-date methodological approach, the contributions of the paper are the following: (i) it is the first attempt to systematically assess the impact of cross-border acquisitions on acquired firms from NMS (pooled and by individual countries); (ii) explore the heterogeneity of the estimates in terms of productivity and size quartiles, and (iii) assessment of post-acquisition performance separately for manufacturing and services firms.

The paper is structured as follows. In section two we look at the relevant theoretical concepts and empirical findings of existing literature. In section three, data and sample characteristics are presented, section four describes the identification strategy, while section five discusses the results. Section six

concludes.

2 Literature review

Theoretical argument in favour of superior performance of foreign-owned firms is based on Dunning's OLI (ownership-location-internalisation advantages) paradigm (Dunning, 1988; Dunning and Lundan, 2008) of international production. The combination of foreign investor's ownership specific advantages, the ability to transfer these advantages to a foreign affiliate at a very low marginal cost (internalization), and of location specific advantages of a host country result in the superior performance of foreign-owned as compared to domestic firms. These determinants of foreign-owned firms' efficiency advantage have also been formalized by Markusen (1984, 1995, 2002), Helpman (1984), Helpman and Krugman (1985), Markusen and Venables (1997, 1998), Helpman, Melitz and Yeaple (2004).

Indeed, there is ample empirical evidence of superior performance of foreign-owned as compared to domestic firms. OECD (2007), Bellak (2004b), Damijan, Rojec, Majcen and Knell (2008), and Schiffbauer, Siedschlag and Ruane (2009) all provide surveys of studies comparing the performance of foreign-owned and domestic firms, and find that the vast majority of these studies confirm the superior performance of foreign-owned firms not only in terms of productivity levels and growth, but also in terms of wages, export propensity, R&D and technology, profitability etc. Superior performance of foreign-owned over domestic firms, however, is not the consequence of foreign ownership as such but of a number of other characteristics which are typical for multinational enterprises (MNEs), such as multinationality (Schiffbauer, Siedschlag and Ruane, 2009; Pfaffermayr and Bellak, 2000), industry-specific factors (MNEs tend to invest in better performing industries), size (economies of scale on the firm level) and parent country specific factors (see Bellak, 2004a, 2004b; Lipsey, 2006; Globerman, Ries and Vertinsky, 1994; Graham and Krugman, 1995; Bernard and Sjöholm, 2003). All these point to the importance of various aspects of foreign-owned firms' heterogeneity (size, quality of human resources, position in foreign parent company's international production network etc.) in analyzing their performance as such and in comparison with domestic firms (Damijan, Rojec, Majcen and Knell, 2008; White and Poynter 1984, Bartlet and Ghoshal 1989, Birkinshaw, Hood and Jonsson, 1998).

Traditional FDI theory, including the OLI paradigm does not distinguish between greenfield FDI and

acquisitions. Implicitly, it predicts that firms acquired by MNEs tend to gain or at least not lose from resource transfers from the parent company and therefore will perform well compared to domestic companies (Gioia and Thomsen, 2004). There is, however, new theoretical research which relates specifically to cross-border acquisitions. Theoretical models of Neary (2007), Breinlich (2006) and Helpman, Melitz and Yeaple (2004) all predict that it is the most productive firms which go for foreign acquisitions, which implies greater scope for the possible positive impact on the acquired firms. In contrast to that, the model of Nocke and Yeaple (2007) says that it is either the most or the least productive firms which acquire foreign targets. Foreign acquirers operating in R&D-intensive industries represent the most productive firms in the corresponding industries in their home country while foreign acquirers operating in marketing-intensive industries represent the least productive firms. To the extent that it is the least productive firms which acquire foreign firms this limits the positive impact of foreign acquisitions on the acquired firms.

Productivity trends after the acquisition is the main indicator of how successful acquisition has been for the acquired company. Although the empirical findings are not unanimous, studies which report a positive impact of foreign acquisition on acquired firms productivity far prevail. They include Conyon, Girma, Thompson and Wright (2002) for UK, Lichtenberg and Siegel (1987) for US, Arnold and Smarzynska Javorcik (2005) for Indonesian manufacturing firms, Ilmakunnas and Maliranta (2004) for Finish manufacturing firms and Fukao, Ito, Kwon and Takizawa (2006) for Japan. On the negative side, Salis (2008) finds no effect on productivity as a result of foreign acquisition in Slovenian manufacturing firms, Modén (1998) claims mixed results for Swedish manufacturing firms, Zhu, Jog and Otchere (2011) report better post-acquisition operating performance in the case of domestic than cross-border partial acquisitions in emerging markets, Harris and Robinson (2003) claim that acquired UK manufacturing firms do not reap any benefit from foreign acquisitions, while Barba Navaretti and Venables (2004) have rejected a causal link between cross-border acquisitions and post-acquisition performance of acquired firms.

Most empirical studies report a positive impact of cross-border acquisitions on acquired companies' productivity, conditional on some specific factors. These factors include time since acquisition, various aspects of acquiring and acquired firms' proximity and industry specific factors. Time since the acquisition is probably the most frequently analysed factor. Due to rather intensive post-acquisition restructuring

in a short period following acquisitions, the impact on acquired firm productivity is expected to be negative in the short-run but tends to improve more significantly afterwards (Maksimovic, Phillips and Prabhala, 2011; Yamada and Taguchi, 2010; UNCTAD, 2000; Gioia and Thomsen, 2004; Karpaty, 2007). Schiffbauer, Siedschlag and Ruane (2009) point to the importance of introducing industry differences in the analysis. Their results for cross-border acquisitions of UK manufacturing firms acquired in 1999-2008 suggest that effects of foreign acquisitions vary across industries, leading to higher productivity in ICT manufacturing industries but not in ICT service industries. This is consistent with the theoretical predictions of Nocke and Yeaple (2007), i.e. positive results for R&D intensive industries and negative results for marketing-intensive industries.

Impact of foreign acquisitions on employment is a proxy for post-acquisition trends in acquired firms' extent of activity. Results of empirical studies are mixed but those suggesting a fall in employment seem to prevail. This is explained by the change of control through acquisition which offers an opportunity for renegotiating labour contracts that have previously constituted obstacles for layoffs. According to Lehto and Böckerman (2008), cross-border acquisitions in Finland lead to downsizing in manufacturing employment while the effects on employment in non-manufacturing are much weaker. Girma and Görg (2004) claim that incidence of foreign acquisitions reduces employment growth, in particular for unskilled labour in the UK electronics industry, while there is no significant effect for the UK food sector. Chari, Chen and Dominguez (2009) find that U.S. firms acquired by investors from emerging markets experience decline of sales and employment but increase of profitability. On the contrary, Arnold and Smarzynska Javorcik (2005) report an employment increase in firms acquired by foreign investors in Indonesia. Some other studies report positive results of foreign acquisitions on the acquired firms employment, conditionally on certain factors or only for certain categories of acquisitions. Thus, Lipsey and O'Connor (1982) report of post-acquisition employment growth in short-term after the acquisition of Swedish firms. However, over the longer run the acquired firms did not show the same relative employment gains. In the case of acquired Swedish manufacturing plants, Bandick and Görg (2009) find robust positive employment growth effects only for exporters, and only if the takeover is vertical, not horizontal.

One of the issues which has attracted quite some attention in the literature is the pre-acquisition performance of the acquired firms, i.e. is post-acquisition performance of firms acquired by strategic

foreign investors better than that of domestic firms because they acquire better/the best firms (the so called 'cherry-picking' effect). The overall conclusion of OECD's (2007: 78) literature review of the issue of 'cherry picking' is that many studies indeed confirm it, but it still explains only a part of the discrepancy. The studies which confirm the 'cherry picking' effect include Zhu, Jog and Otchere (2011) for emerging markets, Guadalupe, Kuzmina and Thomas (2011) for Spanish manufacturing firms, Harris and Robinson (2003) for UK. On the other hand studies of Castellani and Zanfei (2004) for Italy, Fukao, Ito, Kwon and Takizawa (2006) for Japan, Karpaty (2007) for Sweden, Gioia and Thomsen (2004) for Denmark, Lipsey and O'Connor (1982) for Sweden, Bansvik and Haller (2009) for Norway, Bloningen, Fontagne, Sly and Toubal (2012) for France offer a more ambiguous view on the sign of the pre-acquisition productivity difference. In empirical studies the issue of pre-acquisition performance of acquired firms is usually dealt with by isolating the exact impact of a foreign takeover by following the target firm before, during and after the takeover.

Based on the above theoretical and empirical literature and within the constraints of data availability we will test the following propositions: (i) productivity of firms acquired in cross-border acquisitions tends to increase after the acquisitions, while the impact on employment is uncertain; (ii) part of the increase in productivity may be due to 'cherry picking', i.e. selecting of best performing firms by foreign investors. However, the opposite mechanism may also be at work, i.e. foreign investors may select under performing firms ('lemons') with promising growth potential; (iii) trends in post-acquisition productivity growth may also be conditional on a number of additional factors, such as time elapsed since the acquisition with extensive post-acquisition restructuring takes place in a short period following acquisitions, industry specific characteristics, acquired firms' heterogeneity in terms of productivity level and size.

3 Data and sample characteristics

The paper focuses on analyzing the effect of cross-border acquisitions on firm efficiency in NMS. For this purpose we use data on seven NMS: Bulgaria, Estonia, Czech Republic, Poland, Romania, Slovenia and Slovakia in the period between 1997 and 2009.² The period considered contains foreign acquisitions

²Initially, the sample of countries also included Bosnia and Herzegovina, Croatia, Hungary, Lithuania, Latvia, Montenegro, Serbia, Macedonia and the Ukraine. Unfortunately, the quality of the data either due to lacking accounting information or insufficient data on cross-border merger and acquisition activity for these countries did not allow us to

within the mass privatization schemes, which were still very numerous in the late 1990s, as well as the post-privatization era where most of the acquisition targets were already privately-owned. From the point of view of the post-acquisition restructuring and performance of acquired companies this does not make any difference.

We use the Amadeus database (Bureau Van Dijk) to obtain accounting information on individual firms between 1997 and 2009. Data cleaning reduces the sample size in the Amadeus database by anywhere from 60.4% (Estonia) to 76.3% (Poland)³. Given the relatively poor coverage of the data collected in the Amadeus database, we opted to use the population of Slovenian firms from the AJPES (The Agency of the Republic of Slovenia for Public Legal Records and Related Services) database from 2000 to 2008, which provides information on firm accounting data and was merged with information on foreign ownership. Information on cross-border merger and acquisition activity comes from the Zephyr database (Bureau Van Dijk) which provides information on when a particular deal took place, what type of investment it was (M&A, IPO, private equity and venture capital deal, etc), the share of ownership before and after the deal, nationality of the buyer, etc. The two databases were merged by using the unique firm identifier and in cases where that was missing, we also matched firms based on the targeted firms' names where there was no ambiguity. All monetary values provided are in thousand euros and year 2000 prices. Table 1 provides a brief description of the data for the 7 countries that remained viable after the data issues were resolved.

[Insert Table 1 about here]

Table 1 reveals that there is a markable difference in the characteristics of the samples gathered for the 7 CEEC countries. Where for Romania and Slovenia and conditionally Estonia sample sizes are relatively large and small firms in terms of size dominate the samples, this is not the case for the remainder of the countries, where the median size of a firm is somewhat larger. This is most evident in case of Slovakia and Poland, where the sample sizes are comparatively small and the median employment is much larger than in Romania, Slovenia and Estonia. The representativeness of the sample is obviously a key issue

perform the required econometric tests.

³The criteria for data cleaning were that a firm had to have at least one period with nonmissing information on employment, turnover, tangible assets, depreciation and information on the industry code. Firms with one or more of the above variables missing in all years of the sample were dropped from the sample.

and will be controlled for by employing population weights in the regressions. Population weights for different size classes of firms and industries were obtained from Eurostat.

[Insert Table 2 about here]

A comparison of how the samples compare with the population data in terms of the number of firms included in each size class (Table 2) reveals that in all cases (apart from Slovenia) micro firms are underrepresented compared with larger firms. The issue is particularly obvious for the Czech Republic, Poland, Slovakia and in part Bulgaria. On the other hand, with the exception of Estonia and Romania, the largest size class (firms with more than 250 employees) has the highest share of firms included in the sample. The smallest relative sample size was achieved for Slovakian data. The issue of sample representativeness, specifically the underrepresentation of small firms or overrepresentation of larger and large firms will be reflected in the way the results are interpreted.

4 Methodology and econometric issues

Our aim is to test the effects of cross-border acquisitions on firm performance. In order to distinguish between pre- and post-acquisition differences between foreign owned and domestic firms, we explore the productivity differences between firms acquired by foreign nationals and fully domestically owned firms from three years before the acquisition took place until up to three years after the event. By analyzing the productivity premia around the year when an acquisition was completed, we can determine how productive acquisition targets were relative to domestically-owned firms both before and after the actual acquisition. By knowing the productivity gradients of targeted firms relative to firms that were not directly effected by foreign investment we can determine the impact of foreign acquisition on the acquired firms. We proceed by separately estimating these premia for each time period between three years prior and three years after the acquisition was completed. This allows for more flexibility in the regression coefficients ...

Where pre-acquisition productivity premia would indicate the acquiring firms are "cherry picking" the best possible targets, post-acquisition premia would point to a positive impact of foreign ownership

on productivity. The acquisition premia are computed from a regression of log labor productivity on the acquisition indicator variable and a set of control variables:

$$\ln(y)_{it-\tau} = \alpha + \beta FDI_{it} + \gamma controls_{it-\tau} + \varepsilon_{it} \quad (1)$$

where $\ln(y)_{it-\tau}$ is log value added per employee of firm i at time $t - \tau$, with τ allowed to take on (integer) values between 3 and -3. Productivity is measured in a number of different ways in the relevant literature (sales per employee, value added, variants of total factor productivity), but given data availability in different country sets, we choose to measure productivity with value added per employee in order to maintain a viable sample size. By including different lags and leads of the dependant variable relative to the year of acquisition, we can apply a uniform approach to estimating the pre- and post-acquisition premia of cross-border acquisitions. FDI_{it} is an indicator variable which assumes value 1 in the period when a cross-border acquisition was successfully completed, missing for acquired firm in periods thereafter⁴ and 0 for domestic firms that were not targeted by foreign investors. We exclude firms that were foreign owned throughout the period of observation from our analysis. Commonly when productivity premia is measured a different indicator variable is applied (Wagner et al. 2010), namely, one where its post acquisition value is unity for as long as the firm is foreign owned, compared with 0 for domestic firms. Our specification has two key advantages over the latter. Firstly, when estimating the pre- and post-acquisition premia, the "static" acquisition identifier ensures that the premia are averaged as they are based on a comparison of the entire pre- and post-acquisition periods. Our identifier, on the other hand, only captures the premia relative to the year of initial acquisition and not the average of all years under foreign control. Secondly, the dynamic acquisition identifier also yield itself well to first differencing, as opposed to the static identifier which enables us to employ it in fixed effects estimation.

Control variables include $\ln(k/l)_{it-\tau}$ which represents the log (or lead) capital intensity of firm i at time $t - \tau$ and is measure by fixed assets per employee, $\ln(w)_{it-\tau}$ is the log labor cost per employee, $\ln(l)_{it-\tau}$ is firm i size at time $t - \tau$ as measured by employment in natural logarithms, $(\ln(l)_{it-\tau})^2$ is the squared size term employed to capture any non-linear effects of size on perfomance. ϕ_T and ϕ_n are time

⁴We restrict the sample of acquired firms to those that were locally owned (with the foreign ownership share not exceeding 10%) prior to the observed investment and are majority foreign owned after acquisitions. Robustness checks with minority foreign ownership (10 and 25% cut-offs) did not yield significant differences.

and industry dummies (NACE rev.2 two-digit industries). ε_{it} is the error term.

The acquisition premium, calculated from the estimated coefficient β as

$$premia = 100 * (\exp(\beta) - 1) \quad (2)$$

reveals the percentage difference in value added per employee between acquired and purely domestic firms controlling for other relevant characteristics included in the set of control variables. In order to control for any additional unobserved (time-invariant) firm heterogeneity that is not captured in (1) and which could, if correlated with the included controls, cause bias in the estimated acquisition premia, we also estimate (1) by including fixed effects. The within regressions (fixed effects) estimate a correlation between a change in ownership⁵ and a change of the dependent variable as it captures the within-firm deviations from the longer-term average of the firm.

4.1 Controlling for endogeneity

Primary among the econometric concerns in estimating the effects of acquisitions on firm performance is the issue of endogeneity of the M&A indicator and control variables. Firstly, it is conceivable that the decision on acquisition targets for foreign investment depends on some observable (or unobservable) measure of firm performance that was not included in our specification, but may in turn also be correlated with measures of productivity and/or production inputs we use as dependent variables. Given that there is ample evidence that either more (cherries) or less (lemons) productive firms are targeted for cross-border acquisition, it is safe to assume that productivity and other structural characteristics of firms play an important role in choice of targeted firms. As the choice of target firms is in part determined by the same variables as firm productivity, specifically those omitted from specification (1) the choice of acquisition target is likely endogenous. This, in turn, introduces a bias in our estimation, making our coefficient estimates inconsistent.

In order to account for the first source of endogeneity, we hence provide estimates of a two-stage Heckman target-selection model. In the Heckman procedure, the bias that results from using non-

⁵Note that the differentiated indicator variable ($FDI_{it=0}$) is, owing to its construction, identical to the original and can thus be applied directly in fixed effects estimation.

randomly selected samples is dealt with as an ordinary specification bias arising due to omitted variables problem. Heckman (1979) proposes to use estimated values of the omitted variables (which when omitted from the model give rise to the specification error) as regressors in the basic model. In the first stage, we therefore estimate a selection model, where the probability of being a target of successfull cross-border acquisition is given by

$$P(FDI_{it} = 1 | FDI_{it-1} = 0, x_{it-1}) = \alpha + \beta controls_{it-1} + v_{it} \quad (3)$$

where we also include ROA_{it-1} , the return on assets of firm i at time $t - 1$, to the above set of control variables. Return on assets is meant to be a measure of firm overall profitability just prior to completion of acquisition and wages captures the average skill level of the target firm's employees. v_{it} is the corresponding error term. The set of right-hand variables included here is set to determine the likelihood that a firm will be acquired by a foreign owner.

Secondly, we deal with the endogeneity of the control variables (namely capital per employee $\ln(k/l)_{it-\tau}$ and average labor costs $\ln(w)_{it-\tau}$) by relying on instrumental variable panel estimation. Employing a variant of the Semyonova and Wooldridge (2012) approach⁶, we include the year-by-year inverse Mill's ratio and instrument both acquisition indicator variable, capital per employee, wages and the inverse Mill's ratio. We use up to two-period lags and a full set of time-Mill's ratio interaction terms as instruments in the estimation. Equation 1 is then estimated using two-step least-squares within estimator and generalised method of moments.

In order to avoid possible influence of sample composition effects, we control for entry and exit in and out of our sample by presenting estimates for a cohort of firms that were present throughout the seven periods of observation around the period of completion of acquisition.⁷ The merits of this approach lie in the fact that the productivity dynamics can be tracked for the same cohort of firms, without the influence or entrants and early exiters. The weakness of this approach, on the other hand, is that it introduces sample-selection bias, as it is estimated only on surviving firms, which are arguably the most productive

⁶This is, in turn, based on Wooldridge (1995) estimation algorithm for dealing with sample selection in a panel dataset. The Semyonova-Wooldridge (2012) variant allows for testing dynamic panel-data models with selection control.

⁷In order to maintain the full set of countries in the sample, we choose not to balance the sample for country-level analysis. When balanced some of the country datasets would be to small to allow meaningfull estimation results.

firms. Less productive firms, which exited early, or younger firms, with insufficient history, are left out of such a sample. The estimated impact on productivity may be therefore be overestimated.

Relatedly, as pointed out by Haskel et al. (2007), the issue of sample selection may also impact our estimate of the effect of foreign ownership. Given that we only observe surviving firms, our estimates of the impact of foreign ownership may be biased. Specifically, if foreign ownership does in fact impact firm performance, then it would also affect its survival chances. In industries with high foreign presence we may therefore observe a higher rate of survival as opposed to industries with lower foreign presence. This would indicate that survival bias could underestimate the true relationship between foreign ownership and firm performance measures. On the other hand, slower growing or less productive firms are less likely to survive in industries with heavy foreign presence, which may cause the relationship between foreign ownership and productivity to be overstated. We tested the robustness of our results by estimating a Heckman two-step algorithm with control for firm survival and found no significant qualitative differences.

5 Results

In order to set a benchmark to which other results can be compared we start off by presenting results of estimating equation (1) on the pooled sample (across all countries). In Table 3 we present results of a simple OLS regression of (1) in column 1, results of a Heckman two-step estimation with control for sample selection (column 2) and, finally, results of fixed effects estimation with included Mills' ratio of the first stage Heckman two-stage estimate (column 3).

[Insert Table 3 about here]

The above benchmark estimates reveal that target firms were chosen, at least partly, based on their pre-acquisition productivity, as the firms that were targets of successful foreign takeovers are revealed to have been significantly less productive up to three years prior to the acquisition. Given that acquisition announcements according to the Zephyr database on average took place two to three years before the completion of the acquisition, this would indicate that poor-performing firms were chosen by the foreign investors based on their performance just prior to selection. The inclusion of survival controls in column

2 and survival controls with firm fixed effects in column 3 reinforces those predictions as it is shown that, controlling for size and capital intensity, firms that ended up targets of a takeover were, on average, less productive than their counterparts. This finding seems to indicate that investors were targeting apparent "lemons" with growth potential and not "picking cherries". On the other hand, the evidence of post-acquisition performance uniformly indicates that foreign ownership improves acquired firm's performance. The latter effect is shown to last up to at least the third period after acquisition.

While the results across the pooled sample represent a good starting point for our analysis they obviously hide a great deal of heterogeneity among different subsets of firms. Namely, given the weighting implicit in OLS, results presented in Table 3 reflect the characteristics of firms that are predominant in the sample. In order to mitigate these effects and filter out other distinctive features of the data, we continue by presenting regressions of the sample split by either initial productivity (Table 4) or firms size (Table 5). Results presented in these two tables were estimated using fixed effects estimates with the inclusion of control for selection into foreign ownership, analogous to the pooled sample results presented in Table 3.

[Insert Table 4 about here]

[Insert Table 5 about here]

Results presented in Table 4 are very revealing. While there are no substantive qualitative differences in terms of direction of effects between the four quartiles of initial productivity⁸, there are noticeable contrast between the quartiles in terms of the size of the coefficients. Whereas takeover targets in all four samples turned out to be of less-than-averagely productive before the acquisition, they experienced above average productivity after the acquisitions were completed. This effect was most pronounced for the least productive firms which experienced the biggest productivity boost after the takeover, most productive firms, on the other hand, experienced the smallest gains, which were even insignificantly positive in the fourth quartile. Furthermore, while the gains increase progressively throughout the sample for least productive firms, productivity improvements effectively stop soon after the acquisition for the productivity

⁸This is the productivity of a firm in the first year it appears in the sample. This measure is employed so as to avoid possible endogeneity concerns with the choice of subsamples as well as prevent individual firms from switching subsamples during the period of observation.

leaders. Results with respect to four size classes appear analogous as smallest firms experienced biggest gains from foreign ownership while these effects dissipate completely for larger firms. In summary, foreign ownership yields biggest rewards to small unproductive firms which can under foreign management be transformed into highly productive market agents.

5.1 Manufacturing versus services

There are substantial differences in the way manufacturing and services firms operate, their size, capital intensity and investment as well as productivity dynamics. These differences are likely to also be reflected in the impact acquisitions have on the two types of firms. In order to gain insight into the effect of a foreign acquisition on manufacturing and services firms, we test our specification on the subsamples of manufacturing and services firms separately. The separate estimates for manufacturing and services with two-stage Heckman and fixed effects are presented in Table 6.

[Insert Table 6 about here]

The results suggest that both manufacturing and services firms are subject to a version of "lemon picking" as less productive firms appear to be more likely to have been chosen as targets for cross-border acquisitions. On the other hand, only manufacturing firms experience statistically significant improvements in productivity after the acquisition has been completed. Although not substantial, there are differences in efficiency dynamics between manufacturing and services firms, which is a reflection of differences in the functioning of manufacturing and services firms as well as the composition of the two samples. While manufacturing firms clearly experience an improvement in productivity throughout the observed period, services firms initially experience a significant efficiency loss, later bounce back only to end up with efficiency losses in periods two and three after completion of the acquisition.

5.2 Estimates by country

Given the wide differences observed between the country samples, by-country estimates are necessary to establish whether the effects of a foreign takeover were different across the sampled countries. Pooled estimates with country-specific intercepts, presented in Table 3, allowed for different average productivities

across countries, but did not control for the possibility of country-specific elasticities of the remaining variables. Table 7 therefore presents the baseline estimate of the effects of cross-border acquisitions on labor productivity of the seven NMS. As before, we only present estimates and relevant heteroscedasticity robust standard errors for the coefficient on the acquisition indicator variable.⁹

By-country estimates reveal a further dimension of the within-sample heterogeneity that was concealed in the pooled sample estimates. While firms in most countries, with the exception of Romania and Slovakia experience a productivity boost after the completion of the acquisition, the pre-acquisition effects yield ambiguous results. With Romania's firms being chosen based on their below-average productivity, in case of Slovenia more productive firms were chosen for takeover targets. The rest of the country subsamples yield positive but insignificant pre-acquisition productivity differences for firms acquired by foreign owners relative to domestically-owned firms. None of the country subsamples conforms completely to the pooled estimates, indicating that those estimates were importantly influenced by sample composition.

[Insert Table 7 about here]

5.3 Effect of employment and capital intensity on productivity dynamics

In order to gain better insight into the causes of productivity premia of the recently acquired firms, we analyze whether they can be explained by the co-movement of employment and fixed-capital formation. The fundamental differences in the way foreign-owned and domestic firms operate go beyond measures of efficiency and likely impact the way labor and capital are employed in production. The impact of foreign and domestic ownership may hence go beyond a simple difference in efficiency scale and include different elasticities of efficiency with respect to the included regressors. Crucial differences in the way foreign-owned firms employ capital and labor may exist and ownership may hence serve as an additional source of heterogeneity of factor coefficients in a productivity specification. In order to explore these potential differences between domestic firms and firms that have undergone a foreign acquisition in the way productivity responds to changes in inputs, we introduce a full set of interaction terms with the acquisition indicator variable in (1) (presented in the Appendix).

⁹Given the number of estimations necessary for an overview of the respective country datasets, presentation of complete tables of estimates would add greatly to the length of this paper, without necessarily helping the disposition.

Estimates of the differences in elasticities between domestic firms and those that were targeted by foreign investors are noticeable primarily in the level of productivity as measured by the $FDI_{t=0}$ variable, while there are smaller differences in elasticity of the coefficients, as measured by the interaction terms. Noticably, the coefficient on capital intensity is significantly lower for acquisition targets just before the takeover and immediately after it, which may be a reflection of the takeover process itself rather than a feature brought on by the change in ownership. Secondly, coefficients on the number of employees ($\ln(l_t)$) and its square are significantly different from those for domestic firms in years $t = 2$ and $t = 3$ after the merger. This serves as an indication of the fact that foreign ownership helps improve the effectiveness of the employees compared with domestic firms and that this effect is visible relatively soon after the actual acquisition.

Given that the biggest differences between domestic and foreign-acquired firms was in the impact of capital intensity and employment on the formation of firm productivity at the very end of the observed period (years $t+2$ and $t+3$), this could conceivably have been caused by reducing the number of employees and limiting investments in firm assets. This would have forced the recently acquired firms to use both labor and capital more efficiently. In order to see whether this was the case, we plot the median values of both employment and capital of acquired firms relative to the country-sector-year median of domestically-owned firms in technical time relative to the moment when the acquisition was completed (Figure 1)¹⁰.

[Insert Figure 1 about here]

Fears that owners are downsizing the recently acquired firms are not confirmed by Figure 7. To the contrary, the median acquired firm actually experiences a pronounced reversal in both employment and capital intensity upon being taken over. Before the acquisition employment is falling steeply and capital intensity is also experiencing a steady decline, but both trends are reversed after the completion of the acquisition. Evidently, therefore, the witnessed post-acquisition productivity improvements are not driven simply by downsizing, but are a reflection of much more efficient use of the key production

¹⁰Qualitatively similar results were generated using the mode of the acquired-firms distribution, while simple averages proved to be much noisier due to their dependence on outliers.

factors. Furthermore, it appears that most firm-restructuring and labor downsizing happens before the actual acquisition and not after as it is often assumed.

6 Robustness check

Finally, we provide a further robustness check of the results by accounting for the endogeneity issues present in the estimation of (1). As noted above, several key variables may cause endogeneity/simultaneity issues to bias the estimates and we tackle the issue by employing both panel IV estimation procedure as well as generalised method of moments estimation in order to instrument for the offending variables. In addition, the dynamic (growth) specifications are estimated by using the system-GMM procedure (Blundell, Bond, 2000). Results of instrumental variable and GMM estimation are presented in Table 8.

[Insert Table 8 about here]

The estimates in Table 8 indicate a very similar pattern to the acquisition premia as the one found in the benchmark estimates (Table 3), with initially negative coefficient indicating that less productive firms tend to be chosen by foreign investors, only to later become above average in terms of productivity. The estimated coefficients are far larger than in our benchmark estimation, while also displaying greater variance, but, crucially, they indicate that the same underlying pattern persists.

7 Conclusion

Cross-border acquisition constitute an increasingly important mode of FDI. The objective of the paper is to analyse the pre- and post-acquisition performance of foreign-acquired firms from seven NMS and see to what extent this performance is due to target selection and post-acquisition improvements. Based on the existing theoretical and empirical literature we test the following propositions: (i) productivity of firms acquired in cross-border acquisitions tends to increase after the acquisitions, while the impact on employment is uncertain; (ii) part of the increase in productivity may be due to ‘cherry picking’, i.e. selecting of best performing firms by foreign investors. However, the opposite mechanism may also be at work, i.e. foreign investors may select under performing firms with promising growth potential; (iii)

trends in post-acquisition productivity growth may also be conditional on a number of additional factors, such as time elapsed since the acquisition with extensive post-acquisition restructuring takes place in a short period following acquisitions, industry specific characteristics, acquired firms' heterogeneity in terms of productivity level and size.

We study the performance of plants around an ownership change by comparing the newly foreign-acquired firms with firms that remained fully domestically owned. Given that the choice of target is not exogenous to the changes that owners implement in the newly acquired firms, we control for target selection and also employ firm fixed effects to capture other idiosyncratic time-invariant characteristics of the targeted firms. Using firm-level financial data and information on acquisition activity for a sample of firms from seven NMS (Bulgaria, Estonia, Czech Republic, Poland, Romania, Slovenia and Slovakia) in the period between 1997 and 2009, we find that productivity of acquired firms improved after they were acquired. Crucially, the improvement in productivity was not achieved by lay-offs but mostly by increased efficiency in the use of labor and especially capital. In addition, we show that the ownership change results in a reversal of the previously negative trend in employment and capital intensity, providing an additional source of growth. We also find that foreign ownership generates biggest benefits to small less productive firms, and that criteria for target selection differ significantly across firm strata, i.e. there is substantial heterogeneity between sampled countries and other stratifications of the sample. In some instances, evidence tends to support the idea of "cherry picking" with better firms being chosen as targets for acquisition while in the others less productive firms ("lemons") are on average more likely to be chosen as targets for acquisitions. Finally, there is some evidence to suggest that manufacturing firms benefit more from an acquisition than services firms as they start off with a more substantial productivity lag and experience more evident post-acquisition improvements.

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Tables and figures

Table 1. Sample characteristics for domestic and foreign owned firms (for year 2008)

country	sector	Number of firms	Number of acquisitions	Median employment	Median employment of foreign owned firms	Median labor productivity	Median labor productivity of foreign owned firms
Bulgaria	manuf	11,225	211	16	178	6,750	6,054
	servic	60,159	643	6	32	18,217	19,352
Czech republic	manuf	10,361	130	23	225	15,800	20,629
	servic	56,363	55	3	38	16,852	38,260
Estonia	manuf	3,977	60	9	176	10,200	24,145
	servic	33,982	214	4	30	12,000	32,400
Poland	manuf	3,890	66	70	218	18,777	24,137
	servic	12,174	167	23	65	23,650	36,158
Romania	manuf	35,286	55	6	6	6,000	4,000
	servic	194,067	44	2	3	6,000	4,550
Slovenia	manuf	6,826	161	3	18	12,240	15,456
	servic	44,200	588	1	2	17,327	27,428
Slovak republic	manuf	2,842	23	75	300	21,606	23,992
	servic	12,359	54	15	125	59,043	39,467

Source: Amadeus

Note: All data for 2008, except for number of acquisitions, which is for the period between 2000 and 2008.

Labor productivity is measured by value added per employee in euros (constant prices in year 2000).

Table 2. Sample coverage with respect to population of firms in year 2008 in percentages

size class/country	BUL	CZE	EST	POL	ROM	SLO	SVK
0-9 employees	13.8	1.8	44.6	0.4	29.5	100	0.2
10-19 employees	56.8	19.8	77.6	32.1	66.6	100	7.0
20-49 employees	64.8	26.9	76.5	19.5	77.9	100	4.2
50-249 emp	80.7	27.2	73.8	41.8	54.0	100	8.5
more than 250 emp	85.5	51.9	66.1	47.1	48.4	100	11.7

Source: Amadeus and Eurostat.

Note: Sample coverage in terms of number of firms

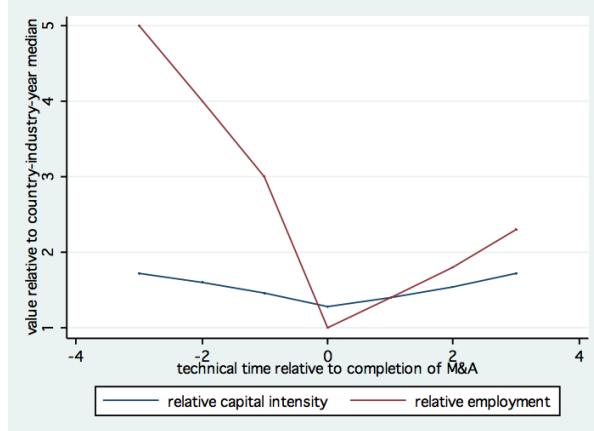
Table 3. Pre- and post-acquisition premia: Pooled regression across countries and industries for 7 NMS (1997-2008)

Lags/leads of productivity levels	Coefficient estimates			Pre- and post-acquisition premia (in %)		
	OLS	two-stage Heckman	FE two-stage Heckman	OLS	two-stage Heckman	FE two-stage Heckman
t-3	-0.143*** (0.059)	-0.218*** (0.051)	-0.167*** (0.040)	-15.4	-22.4	-18.2
t-2	-0.088 (0.057)	-0.162*** (0.049)	-0.183*** (0.039)	-9.2	-17.6	-20.1
t-1	0.063 (0.058)	0.035 (0.048)	0.035 (0.048)	6.5	3.6	3.6
t	0.120** (0.053)	0.078* (0.046)	0.045 (0.031)	12.8	8.1	4.6
t+1	0.140*** (0.053)	0.104** (0.046)	0.073** (0.031)	15.0	11.0	7.7
t+2	0.164*** (0.053)	0.131*** (0.047)	0.067** (0.034)	17.8	14.0	6.9
t+3	0.188*** (0.053)	0.161*** (0.048)	0.074** (0.035)	20.7	17.5	7.7
Growth rates						
(t-1)-(t-3)	0.204*** (0.049)	0.204*** (0.048)	0.070 (0.046)	22.6	22.6	7.3
t-(t-2)	0.242*** (0.043)	0.242*** (0.042)	0.150*** (0.036)	27.4	27.4	16.2
(t+2)-t	0.116*** (0.033)	0.121*** (0.033)	0.101*** (0.031)	12.3	12.9	10.6
(t+3)-(t+1)	0.110*** (0.033)	0.110*** (0.033)	0.078** (0.032)	11.6	11.6	8.1
Observations	95,492	95,492	95,492	/	/	/

Source: Amadeus and own calculations

Note: Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Figure 1: Dynamics of employment and capital intensity of acquired firm relative to country-industry-year median values of domestically owned firms



Note: Median values of employment and capital intensity (in levels) relative to the relevant country-sector-year medians of domestically-owned firms in technical time (where $t=0$ represents the period when the acquisition was completed).

Table 4. **Estimates by productivity quartiles:** Pre- and post-acquisition premia by productivity quartiles

Levels	1.quartile	2.quartile	3.quartile	4.quartile
t-3	-0.554*** (0.105)	-0.255*** (0.074)	-0.155*** (0.072)	-0.126* (0.066)
t-2	-0.192* (0.107)	-0.268*** (0.077)	-0.191*** (0.074)	-0.205*** (0.070)
t-1	-0.024 (0.097)	-0.093 (0.087)	-0.065 (0.086)	0.066** (0.032)
t	-0.076 (0.065)	-0.015 (0.062)	0.117* (0.063)	0.096* (0.049)
t+1	0.072 (0.070)	0.059 (0.051)	0.065 (0.060)	0.083 (0.060)
t+2	0.042 (0.070)	0.174*** (0.061)	0.124* (0.064)	0.030 (0.067)
t+3	0.172*** (0.060)	0.108 (0.077)	0.112 (0.071)	0.027 (0.064)
Growth rates				
(t-1)-(t-3)	0.035 (0.109)	-0.047 (0.091)	0.062 (0.049)	-0.041 (0.030)
t-(t-2)	-0.005 (0.081)	0.084 (0.068)	0.182*** (0.048)	0.068 (0.053)
(t+2)-t	0.137* (0.074)	0.212*** (0.052)	0.072 (0.047)	0.000 (0.065)
(t+3)-(t+1)	-0.071 (0.060)	-0.027 (0.058)	-0.030 (0.041)	-0.088 (0.056)
N	17,992	24,137	26,673	26,690

Source: Amadeus and own calculations

Notes: Results pooled across 7 countries by quartiles of initial-year labor productivity (calculated by year, country and 2-digit industry) estimate of the acquisition indicator variable's impact on labor productivity from three period prior the completion of the merger (acquisition) to three periods after. Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Table 5. **Estimates by size classes:** Effects of cross-border acquisitions on labor productivity by size classes, two-stage Heckman with fixed effects estimates

Levels	Less than 20	20<emp<50	50<emp<250	More than 250
t-3	-0.537*** (0.078)	0.153 (0.185)	-0.139*** (0.054)	-0.169*** (0.078)
t-2	-0.467*** (0.080)	-0.271 (0.170)	-0.066 (0.055)	-0.073 (0.002)
t-1	0.090 (0.062)	0.037 (0.125)	-0.025 (0.061)	-0.009 (0.053)
t	0.226*** (0.069)	0.201* (0.106)	0.067 (0.042)	-0.135*** (0.049)
t+1	0.161*** (0.056)	0.252** (0.106)	0.083* (0.046)	0.026 (0.056)
t+2	0.177*** (0.062)	0.011 (0.119)	0.082* (0.047)	0.064 (0.048)
t+3	0.298*** (0.054)	0.066 (0.172)	0.095* (0.056)	-0.031 (0.058)
Growth rates				
(t-1)-(t-3)	0.151** (0.077)	0.066 (0.172)	0.165* (0.087)	0.093 (0.062)
t-(t-2)	0.389*** (0.060)	0.263 (0.169)	0.171*** (0.047)	-0.054 (0.065)
(t+2)-t	0.178*** (0.057)	0.249** (0.102)	0.071 (0.045)	0.164*** (0.049)
(t+3)-(t+1)	-0.094* (0.048)	-0.052 (0.084)	-0.072 (0.047)	-0.051 (0.059)
Observations	43,224	8,521	13,719	30,028

Source: Amadeus and own calculations

Size classes were defined according to initial firm size as micro firms with less than 20 employees, small firms with more than 20 and at most 50 employees, medium firms with more than 50 and less than 251 employees, and large firms with at least 250 employees.

Note: Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Table 6. **Manufacturing vs services:** Effect of cross-border acquisitions on firm labor productivity (log of value added per employee) from t-3 to t+3. Difference between manufacturing and services firms

Levels	Manufacturing	Services
t-3	-0.186*** (0.063)	0.049 (0.045)
t-2	-0.175*** (0.065)	-0.102** (0.049)
t-1	-0.025 (0.074)	-0.046 (0.050)
t	-0.005 (0.049)	0.016 (0.059)
t+1	0.040 (0.040)	0.023 (0.067)
t+2	0.059 (0.042)	-0.036 (0.061)
t+3	0.012 (0.049)	-0.002 (0.056)
Growth rates		
(t-1)-(t-3)	-0.033 (0.081)	-0.175** (0.070)
t-(t-2)	0.030 (0.053)	-0.028 (0.059)
(t+2)-t	0.087** (0.044)	0.015 (0.062)
(t+3)-(t+1)	0.043 (0.050)	0.042 (0.053)
N	27,624	64,116

Source: Amadeus and own calculations

Notes: Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Table 7. **Estimates by country:** Effect of cross-border acquisitions on abor productivity (log of value added per employee) from t-3 to t+3 with Heckman control for selection into foreign ownership

Levels	BUL	CZE	EST	POL	ROM	SLO	SVK
t-3	0.247 (0.172)	0.247 (0.172)	0.249 (0.221)	0.228 (0.345)	-0.405*** (0.122)	0.170*** (0.050)	0.795 (0.657)
t-2	0.008 (0.258)	0.274 (0.190)	0.263 (0.256)	0.312 (0.368)	-0.383*** (0.137)	0.268*** (0.061)	0.556 (0.587)
t-1	0.033 (0.231)	0.314 (0.214)	0.216 (0.305)	0.390 (0.416)	-0.376* (0.220)	0.247*** (0.080)	0.384 (0.735)
t	0.323** (0.151)	0.388 (0.318)	0.120 (0.511)	0.303*** (0.112)	-0.307 (0.538)	0.698*** (0.195)	0.324 (1.388)
t+1	0.364*** (0.100)	0.345 (0.227)	0.214 (0.382)	0.394*** (0.101)	-0.232 (0.342)	0.381*** (0.079)	0.289 (1.225)
t+2	0.358*** (0.092)	0.332* (0.191)	0.276 (0.385)	0.476*** (0.080)	-0.275 (0.177)	0.305*** (0.065)	-0.128 (0.585)
t+3	0.336*** (0.102)	0.314 (0.333)	0.184 (0.500)	0.554*** (0.106)	-0.318** (0.156)	0.309*** (0.054)	-0.239 (3.365)
Growth rates							
(t-1)-(t-3)	-0.013 (0.118)	0.111** (0.052)	0.138 (0.092)	0.343** (0.158)	-0.138 (0.107)	0.110*** (0.040)	-0.362 (0.334)
t-(t-2)	0.116 (0.099)	0.123 (0.087)	0.092 (0.200)	0.295 (0.198)	-0.069 (0.127)	0.367*** (0.111)	-0.044 (0.235)
(t+2)-t	0.081** (0.040)	0.102*** (0.030)	0.198** (0.087)	0.172*** (0.014)	-0.013 (0.109)	-0.060 (0.038)	0.020 (0.181)
(t+3)-(t+1)	0.053 (0.040)	0.118*** (0.042)	0.048 (0.096)	0.165*** (0.015)	-0.100 (0.105)	0.157*** (0.030)	0.021 (0.309)
Observations	131,279	140,954	104,669	107,197	202,837	44,118	27,520

Source: Amadeus and own calculations

Notes: Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Table 8. Pooled regression across countries and industries for 7 NMS (1997-2008)

Lags/leads of	Coefficient estimates	
	IV fixed effects	GMM fixed effects
t-3	-1.456*** (0.540)	-1.126** (0.446)
t-2	-3.583*** (0.672)	-3.830*** (0.617)
t-1	0.427 (0.058)	0.730*** (0.250)
t	0.624*** (0.221)	0.583** (0.230)
t+1	1.358*** (0.432)	0.325 (0.224)
t+2	13.555*** (0.540)	13.039*** (1.730)
t+3	5.455*** (1.290)	3.248*** (0.783)
Growth rates		
(t-1)-(t-3)	-1.456*** (0.537)	0.056 (0.101)
t-(t-2)	-3.583*** (0.676)	-0.200 (0.129)
(t+2)-t	0.472 (0.287)	-0.042 (0.089)
(t+3)-(t+1)	0.624*** (0.186)	-0.033 (0.085)
Observations	31,328	23,131

Source: Amadeus and own calculations

Notes: Only coefficient estimates of the acquisition variable in eq. (1) presented. Dependent variable is value added per employee. Country, sector and year fixed effects included in the regressions. Robust standard errors in parentheses. Errors clustered at the firm level. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Appendix

Table 9. **Coefficient sensitivity to nationality of ownership** Effect of cross-border acquisition on labor productivity in the pooled sample. Full regression with interaction terms

variables tech time	t=-3	t=-2	t=-1	t=0	t=1	t=2	t=3
FDI _{t=0}	0.433** (0.204)	0.314** (0.150)	0.332 (0.286)	0.212 (0.399)	0.681* (0.406)	-0.547* (0.308)	-0.322 (0.279)
Ln(K/L) _t	0.192*** (0.011)	0.141*** (0.009)	0.188*** (0.011)	0.141*** (0.009)	0.132*** (0.010)	0.113*** (0.013)	0.110*** (0.012)
Ln(L) _t	-0.199*** (0.031)	-0.372*** (0.033)	-0.000** (0.000)	-0.448*** (0.044)	-0.573*** (0.046)	-0.577*** (0.051)	-0.432*** (0.056)
(Ln(L) _t) ²	0.006 (0.006)	0.024*** (0.005)	0.000 (0.000)	0.033*** (0.007)	0.042*** (0.007)	0.035*** (0.009)	0.016* (0.010)
FDI _{t=0} * Ln(K/L) _t	-0.007 (0.020)	-0.001 (0.014)	-0.055** (0.028)	0.013 (0.036)	-0.061* (0.036)	0.027 (0.028)	-0.012 (0.018)
FDI _{t=0} * Ln(L) _t	-0.086 (0.076)	-0.087 (0.075)	-0.008 (0.121)	-0.055 (0.096)	0.004 (0.107)	0.199** (0.090)	0.323*** (0.115)
FDI _{t=0} * (Ln(L) _t) ²	0.006 (0.009)	0.006 (0.009)	0.006 (0.013)	-0.001 (0.012)	-0.002 (0.013)	-0.024** (0.011)	-0.042*** (0.014)
inverse Mill's ratio	-0.375*** (0.061)	-0.512*** (0.048)	-0.126*** (0.018)	-0.005 (0.016)	0.017 (0.015)	0.037** (0.015)	0.032 (0.020)
Constant	6.277*** (0.199)	7.886*** (0.171)	6.104*** (0.094)	7.213*** (0.112)	6.882*** (0.113)	6.413*** (0.118)	5.580*** (0.128)
Observations	26,170	26,170	26,170	26,170	26,170	26,170	26,170
R-squared	0.099	0.114	0.080	0.105	0.133	0.138	0.116
Number of id	9,036	9,036	9,036	9,036	9,036	9,036	9,036

Source: Amadeus and own calculations

Notes: Robust standard errors in parenthesis. Errors clustered at the firm level. Other regressors that were included were size ($\ln(L_{t-1})$), size squared ($\ln(L_{t-1})^2$), *laborcosts*($\ln(w_{t-1})$), industry, country and year dummies. ***, ** and * denote statistical significance at 1, 5 and 10 percent.

Table 10. **Coefficient sensitivity to nationality of ownership** Effect of cross-border acquisition on firm labor productivity pooled sample. Full regression with interaction terms

variables tech time	Growth (t=-3)	Growth (t=-2)	Growth (t=0)	Growth (t=1)
Ln(VA/L _t)	-1.003*** (0.013)	-1.010*** (0.014)	-1.043*** (0.015)	-1.083*** (0.017)
FDI _{t=0}	0.467 (0.290)	0.137 (0.369)	-0.394 (0.304)	-0.155 (0.216)
Ln(K/L _t)	0.027*** (0.008)	0.035*** (0.009)	0.034*** (0.010)	0.022** (0.010)
Ln(L _t)	0.076*** (0.021)	0.091*** (0.030)	0.070 (0.046)	0.209*** (0.051)
(Ln(L _t) ²)	-0.016*** (0.004)	-0.016*** (0.005)	-0.015** (0.007)	-0.032*** (0.007)
FDI _{t=0} * Ln(K/L _t)	-0.060** (0.026)	0.003 (0.035)	0.012 (0.030)	0.004 (0.023)
FDI _{t=0} * Ln(L _t)	-0.054 (0.130)	-0.010 (0.097)	0.189* (0.101)	0.162* (0.097)
FDI _{t=0} * (Ln(L _t) ²)	0.012 (0.015)	-0.002 (0.013)	-0.023** (0.011)	-0.025** (0.011)
inverse Mill's ratio	-0.078*** (0.020)	0.041** (0.017)	0.029* (0.016)	0.047*** (0.018)
Constant	6.049*** (0.114)	6.297*** (0.130)	7.377*** (0.159)	6.829*** (0.163)
Observations	26,170	26,170	26,170	26,170
R-squared	0.612	0.537	0.508	0.495
Number of id	9,036	9,036	9,036	9,036

Source: Amadeus and own calculations

Notes: Robust standard errors in parenthesis. Errors clustered at the firm level. Other regressors that were included were size ($\ln(L_{t-1})$), size squared ($\ln(L_{t-1})^2$), $laborcosts(\ln(w_{t-1}))$, industry, country and year dummies. ***, ** and * denote statistical significance at 1, 5 and 10 percent.