THE EFFECT OF FOREIGN DIRECT INVESTMENT ON FIRM LABOR PRODUCTIVITY: DOES THE COUNTRY OF ORIGIN OF THE FDI MATTER?

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Many papers have analyzed the effects of foreign acquisition on firm productivity, articulating its positive impacts. However, an important issue remains: is there a *general* foreign acquisition effect, or is there any heterogeneity in the effects? This paper reports on the analysis of over 3,400 majority foreign acquisitions in Hungary. The main result (which exists in a propensity score matching sample as well) of the difference-in-differences analysis is that only acquirers from higher income countries foster labor productivity significantly – and this effect increases with the income gap between Hungary and the country of origin –, while acquirers from lower income countries do not induce statistically significant effects.

1. INTRODUCTION

Globalization and increasing international integration of economies gained momentum at the end of the 20th century, and have been shaping the world since then. One important aspect of this global phenomenon is the appearance and spread of foreign direct investment (FDI). Since the 1990s, an increasing trend can be seen in worldwide movements of FDI: enterprises started to move across the borders. *Figure 1* shows the importance of foreign-owned enterprises in the Visegrad Four (V4) economies (the Czech Republic, Hungary, Poland and Slovakia).

   Figure 1 shows that based on their numbers, foreign-owned companies could be considered irrelevant in the host economy in the V4 countries. Only 10% of the enterprises are owned by foreigners in Poland, and the share is even smaller in the other three countries. Only 3.5% of the firms are owned by foreigners in Hungary. Although, considering other aspects, the message is different: foreign-owned companies do play a huge role in the V4 economies contrary to their low numbers. In all four countries foreign enterprises employ 25–30% of the employees, create 40–50% of value added, and account for 30–40% of gross
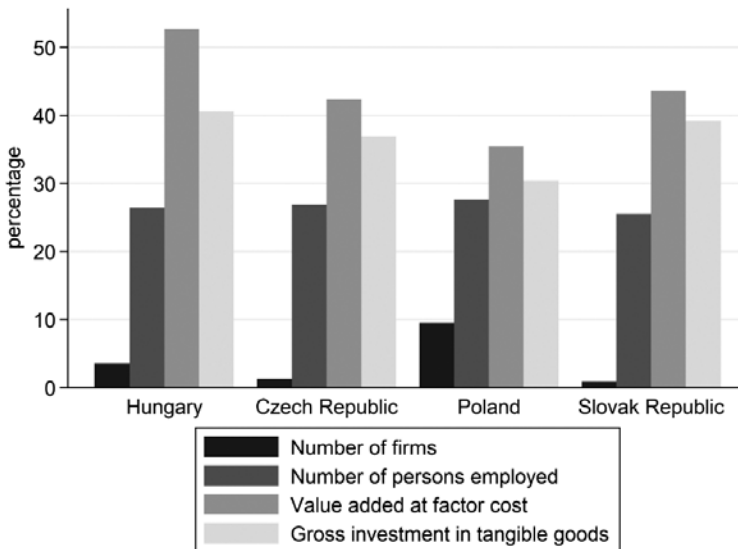

Figure 1. The role of foreign-owned companies in the V4 countries (2014)

Source: calculations of the author based on date from OECD Stat.

Notes: Data is for 2014. Unit of measurement: figures of foreign-owned entities (number of firms, number of persons employed, value added, and gross investment) as a share of the national total (in percentages).

investments. Summing up, foreign-owned companies are relevant factors in the host countries, making their analysis worthwhile.

It is important to consider the differences between foreign firms and domestic ones. An extensive review of the literature reveals that foreign firms are more productive, pay higher wages and employ more workers. While the recent empirical literature is convincing, some relevant issues still remain unexplored. For example, only a few papers examine the heterogeneity of FDI. In this paper the question of whether the country of origin matters is addressed. Is there a general effect of foreign acquisitions on firm-level productivity, or do acquiring firms from high-income countries have a stronger impact, while acquirers from low-income countries smaller effect?

The main hypothesis of this paper is that the country of origin does matter: acquirers from highly developed and high-income countries can transfer superior technologies and advanced managerial practices, so they can improve labor productivity of the acquired firm. While, on the other hand, acquirers from underdeveloped and low-income countries cannot significantly improve the acquired firm's labor productivity. I test this hypothesis using difference-in-differences (DiD) methodology with propensity score matching. Both the full and the matched samples confirm my hypothesis: acquirers from a low-income country do not significantly improve labor productivity, while acquirers from a high-income country have a significant positive effect on the acquired firm's labor productivity. Moreover, the effect of the "high-income acquirer" grows with the income of the country of origin.

The remainder of this paper is organized as follows. Section 2 gives a brief and selective literature review, presents the conclusions of the main papers. Section 3 describes the data in detail and the methodology used to examine the hypothesis. Section 4 presents the results, and Section 5 puts forward conclusions.

2. RELATED LITERATURE

The topic of this paper was analyzed first from a theoretical and macro-empirical point of view: the foreign direct investment and economic growth nexus is investigated by a huge strand of literature, see for example Borensztein et al. (1998), De Mello (1999), Choe (2003), or the surveys of Görg and Greenaway (2004), Faeth (2009), and Benacek et al. (2000) for Central and Eastern Europe. As firm-level data became available, the research issue gained momentum: many researchers started to analyze the differences between foreign and domestic firms in order to develop deeper understanding of the FDI-growth nexus.

Foreign firms perform better: they are more productive and they pay higher wages. The productivity advantages of foreign firms have been the focus of the literature since the 1990s. Early papers show the superiority of foreign firms, but measure only correlation, not causality. Globerman et al. (1994) shows that foreign-owned firms in Canada present higher value added per worker, although this difference vanishes with controlling for other firm characteristics, such as size and capital intensity. Howenstine and Zeile (1994) analyze US companies and find higher labor productivity in the case of foreign-owned companies. However, their results are not robust either, because when controlling for other characteristics, the productivity differences greatly shrink.

Early papers using small sample sizes and limited cross-sectional data are flawed by econometric problems, such as omitted variable bias and selection bias. The literature gained momentum with the appearance of panel data. Griffith (1999) studies the British car industry, and showes that foreign ownership and productivity growth appear hand in hand, but this is rooted in the diverse behavior of foreign firms – they invest more in physical capital and use more intermediate goods. Conyon et al. (2002) also study British firms and show that there is a significant growth in labor productivity after foreign acquisitions of domestic firms. Javorcik (2004) studies spillover effects on Lithuanian firm-level data.

The use of panel data made it possible to control for time-invariant firm characteristics which can also have an impact on productivity. The spread of panel data and panel techniques was undoubtedly a great advance, but other problems still remained. One really acute question was the problem of selection. Many papers, such as Criscuolo and Martin (2009) or Balsvik and Haller (2010), document the cherry-picking behavior of foreign capital. Matching procedures and treating the selection bias were another milestone in the history of the literature. Most of the papers using matching techniques and difference-in-differences analyses find significant foreign acquisition effects on productivity – see for example Petkova (2009) for India, Arnold and Javorcik (2009) for Indonesia, and Girma et al. (2007) for the UK.

Most previous studies make a moderately imprecise assumption, namely the homogeneity of foreign capital. Is it a realistic presumption that all FDI is the same? There are some papers in which heterogeneity by country of origin is not the focal theme, but is somehow touched upon. For example, Schiffbauer et al. (2017), analyzing UK firms, find some evidence that acquirers from the USA have positive effects on total factor productivity, while foreign investment from EU countries does not have a significant impact. Similarly, Earle et al. (2017), working with Hungarian data, provide a thorough analysis on the effects of FDI on wages, and in a brief section they also investigate what happens with labor productivity after a foreign acquisition. They find a significant acquisition effect,

moreover they show some evidence that acquirers from more developed countries have a stronger positive effect on labor productivity.

Chen (2011) uses firm-level data from the USA and checks the acquisition effects of FDI on financial performance. Chen shows that FDI increases profitability of the firms and the effect is larger when FDI comes from an industrial country rather than a developing country. Chari et al. (2012) also investigate US firms and show that FDI from emerging economies significantly increases the profitability of domestic firms, so not only does the traditional view remain that FDI from developed countries brings superior technology to developing markets, but also that FDI from developing countries can also generate positive changes. Kamal (2015) analyzes two kinds of Chinese firms: firms which were acquired by OECD-based firms, and companies which were acquired by HMT (Hong Kong, Macao, and Taiwan) firms. That paper finds that OECD-acquisitions outperform HMT-acquisitions in total factor productivity (TFP) growth, concluding that the country of origin is relevant.

This paper's contribution to the literature is the following: it uses a relatively large sample of Hungarian firms with detailed data on the country of origin and it analyzes the heterogeneity in the effects of foreign acquisition on firm productivity, instead of financial indicators, as is the case in papers such as Chen (2011), Chari et al. (2012) and Kamal (2015). Also, it uses the most up-to-date econometric techniques – difference-in-differences analysis with firm fixed effects, reinforced by kernel matching – to make results as robust as possible.

3. DATA AND METHODOLOGY

3.1. Data source

The main source of the data used here is the annual reports of double-entry bookkeeping firms, collected by the National Tax Administration of Hungary and processed by the Databank of the Centre for Economic and Regional Studies, Hungarian Academy of Sciences. Annual data between 1993 and 2013 was compiled into a 21-year-long panel for analysis. The data about the country of origin[1] of the acquiring firms comes from three different sources: (1) the Ministry of Public Administration and Justice, (2) the Zephyr dataset of a private company, Bureau van Dijk, which specializes in publishing business information and private company data, and (3) CEU Balance data. Merging the data created a unique

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[1]   Country of origin means the nationality of the immediate investor, since, unfortunately, data
    for the ultimate beneficial owner is not available.

dataset containing nationality information for about 3,000 acquired companies. A firm is defined in this paper as foreign-owned if the proportion of foreign ownership is at least 50%. Finally, GDP data comes from the World Bank: the GDP per capita, PPP (constant 2011 international $) indicator was used.

Before the analysis some parts of the sample were dropped. Those firms which were foreign-owned throughout the entire sample period (since they cannot be used for identification in a difference-in-differences framework), or those which had more than two ownership changes, were dropped. So, firms with the following ownership patterns were kept: always domestic (at least 50% of the issued capital is owned by a domestic owner), domestic – foreign (acquisition), and domestic – foreign – domestic (acquisition, followed by a divestment). Only the industry and service sectors were analyzed, not the agricultural sector. The following special sectors (according to Nace Rev. 2) were also dropped from the sample: public administration and defense (O), education (P), human health and social work activities (Q), other service activities (S), activities of households as employers (T), and activities of extraterritorial organizations and bodies (U). Firms with zero employment or with missing estimation data were also dropped.
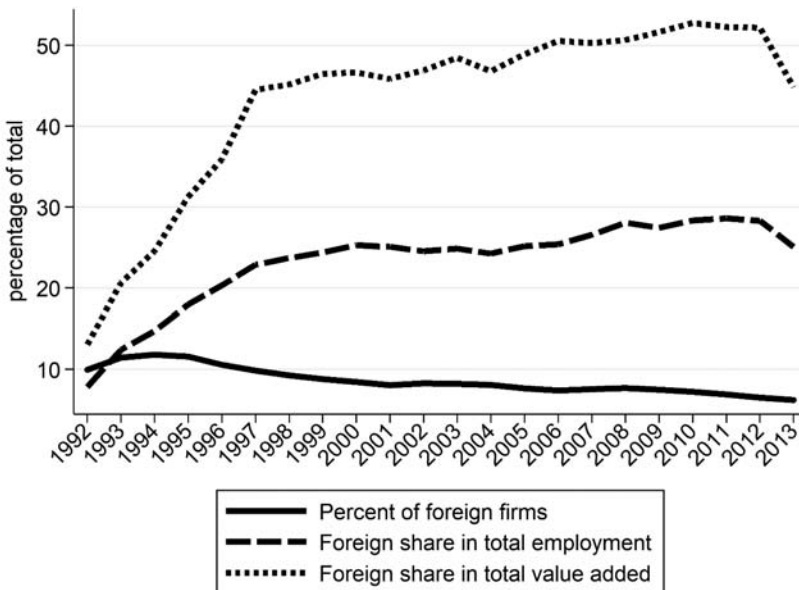

Figure 2. The role of foreign-owned companies in the Hungarian economy

Source: calculations by the author based on the Databank of the Centre for Economic and Regional Studies, Hungarian Academy of Sciences.

The final estimation sample contains 427,987 firms with 2,540,188 firm-years. Detailed information is provided in *Tables 1* and *2* in section 3.4.

3.2. The relevance of FDI according to the data

Is FDI important for the Hungarian economy? Considering foreign-owned firms and their activities, the answer is a definite yes. *Figure 2* shows the weight of foreign-owned companies: the foreign share in the number of firms, in total employment, and in total value added.

   Considering all the double-entry bookkeeping firms in Hungary, it is clear that foreign-owned companies play a dominant role. The proportion of foreign firms has not been so significant, starting at 10% at the beginning of the 1990s, decreasing to 7% by the beginning of the 2010s. On the other hand, this relatively small number of firms currently employs about 25 to 30% of the workforce, and produces about 45 to 50% of the total value added.

3.3. Estimation methods and the main variables

The dependent variable of the estimations is the log of *labor productivity* (LP), which is defined as total sales divided by the total number of employees.[2] The key independent variable is a measure of acquisition, or foreign direct investment (FDI). Finally, it was also necessary to control for time periods, firm fixed effects and different firm characteristics. Considering the following model:

$$\ln\left(LP_{it}\right) = \beta_0 + \beta_1 \cdot FDI_{it-1} + \beta_2 \cdot dfd3_{it} + \boldsymbol{\beta_3} \cdot \boldsymbol{X_{it}} + YI_t + \alpha_i + \varepsilon_{it}, \qquad (1)$$

where *i* indexes firms and *t* indexes years, *FDI* is a dummy variable which takes the value of 1 if the firm is controlled by foreign owners and 0 if not, and β_1 is the foreign effect, the parameter of interest. In most specifications *FDI* is detailed and subsampled based on the country of origin, which is detailed later in this paper. *Dfd3* is a dummy variable which equals 1 if a foreign-owned firm is sold to a domestic owner, so β_2 basically measures the difference between the pre-acquisition and post-divestment labor productivity. *X* is the vector of the following firm characteristics:

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[2]   As a robustness check, another definition of LP was also used: total *value added* divided by the total number of employees. Using this definition of the dependent variable makes the coefficients smaller (and in some cases statistically insignificant), but the main messages still hold both in the full, and the matched samples.

- The logarithm of capital intensity, which is measured as the fraction of the total value of tangible assets and the total number of employees. Capital equips employees with tools to make them productive, so higher capital intensity should result in higher productivity.
- Size measurement dummy variables: small, when the total number of employees is between 1 and 19, medium (this is the reference category), when the total number of employees is between 20 and 99, and large when the total number of employees is over 100. The relationship between the size of a firm and its labor productivity is well documented: the literature shows that there is a significant connection between these two characteristics, see for example Leung et al. (2008).
- Firm age dummy variables from 1, 2, … to 20+. Firm age is measured in years and calculated as the difference between the particular year and the year of foundation. Productivity can be influenced by firm age. On the one hand, as the vintage capital theory – see for example Nelson (1964) – suggests, younger firms can produce with greater efficiency than older ones. On the other hand, productivity may increase with age through learning-by-doing, as Jovanovic and Nyarko (1996) documented.
- Region dummy variables, with the following seven big geographical regions of Hungary: Northern Hungary, Northern Great Plain, Southern Great Plain, Central Hungary, Central Transdanubia, Western Transdanubia, and Southern Transdanubia. A strand of literature emphasize the spatial dimensions of productivity, there can be regions where firms gain productivity advantages due to spillover effects and externalities. See for example the survey of Rosenthal and Strange (2004).

Finally, YI_t represents industry – year interactions to capture industry-specific shocks, α_i are firm fixed effects to capture time-invariant firm-specific characteristics which could also influence labor productivity, and ε_{it} is an error term.

Four different specifications are considered. In the first specification (SPEC1) the effect of majority foreign acquisitions is measured using an *FDI* dummy variable, which equals 1 if the particular firm has foreign owners, and 0 if not. This is a benchmark specification, since this is the one which is estimated in most cases in the literature – of course, with different control variables. According to previous research, we expect a positive and statistically significant *FDI* coefficient here. In the second specification (SPEC2) the null hypothesis is tested as to whether the effect of the acquisition positively depends on the income of the country of origin. Many papers (for example Wagner 2006) document that the most productive firms serve foreign markets via foreign direct investment. These firms also export their superior technologies and management practices, so the acquired firms can absorb this knowledge. It is thus possible to assume that from

a highly productive country better (that is more productive) firms are involved in FDI-activities than from an economy with lower productivity. Since country-level productivity data is not so widely available, I proxy it with GDP per capita. As many papers document, for example Goni and Maloney (2014), countries with higher incomes are involved more in R&D activities. Hence, the higher the income in a country, the better the available technologies and the access to superior production techniques, thus increasing an acquired firm's productivity. Here, instead of a simple *FDI* dummy as in SPEC1, a continuous variable, *GDP per capita distance*, is used, which measures the difference between the GDPs of Hungary and the FDI's country of origin. In the third specification (SPEC3) the heterogeneity in the effects of the acquisition are measured in two distinct sub-samples. Instead of a simple *FDI* dummy as in SPEC1, a *low income FDI* dummy variable is used which equals 1 if the FDI comes from a low income country, that is, the country's GDP per capita is less than Hungary's. A *high income FDI* dummy variable is also used, which equals 1 if the FDI comes from a high in-come country, that is, the country's GDP per capita is greater than Hungary's. In specification four (SPEC4) SPEC2's *GDP distance* variable is decomposed into two variables based on the two dummies of SPEC3. See the definition of the two key variables below:

- $FDI = \begin{cases} 1, \textit{for foreign firms} \\ 0 \, \textit{otherwise} \end{cases}$

- $GDP\,distance = \begin{cases} \ln\left(\dfrac{GDP\ per\ capita\ of\ the\ FDI's\ country\ of\ origin}{GDP\ per\ capita\ of\ Hungary}\right), \textit{for foreign firms} \\ 0 \, \textit{otherwise} \end{cases}$

These two variables are decomposed into subcategories in Specifications 3 to 4. In Specification 3, two kinds of FDI are distinguished: (1) *low income FDI*, which is acquisition from a country poorer than Hungary, namely its GDP per capita is smaller than that of Hungary, and (2) *high income FDI*, which is acquisition from a country which is richer than Hungary, namely its GDP per capita is bigger than that of Hungary.[3] The following equation holds for Specification 3:

$$FDI_{it} = Low\ income\ FDI_{it} + High\ income\ FDI_{it}.$$

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[3] There are a few acquisitions which change category (from high income to low income, of from low income to high income) over time. In these cases, their first position was used.

In Specification 4, there are two distance variables:

$$(1) \quad Low\ income\ GDP\ distance = \begin{cases} GDP\ distance,\ if\ low\ income\ FDI = 1 \\ 0\ otherwise \end{cases}$$

$$(2) \quad High\ income\ GDP\ distance = \begin{cases} GDP\ distance,\ if\ high\ income\ FDI = 1 \\ 0\ otherwise \end{cases}$$

3.4. Descriptive statistics

The full regression sample includes 3,459 firms that were at some time acquired by foreigners and 424,528 firms that have always been domestically owned. *Table 1* shows the number of firms and firm-years.

Table 1. Number of firms and firm-years in the full and matched samples

Category	Full Sample		Matched Sample	
	Number of firms	Number of firm-years	Number of firms	Number of firm-years
Total	427,987	2,540,188	105,736	1,153,463
Always domestic	424,528	2,514,707	104,450	1,139,491
Acquisition	3,459	25,481	1,286	13,972
From a low income country	658	3,689	188	1,721
From a high income country	2,801	21,792	1,098	12,251

Source: compiled by the author.

Notes: a low income country is one where GDP per capita is smaller than that of Hungary; a high income country is one where GDP per capita is larger than that of Hungary.

Table 2 shows the most important firm characteristics of the full sample. Foreign firms are more productive, use more capital intensive production procedures, employ more staff and pay higher wages on average. From this perspective, foreign-owned firms stand apart from their domestic counterparts.

3.5. Matching procedure

Considering the full sample, as *Table 2* shows, foreign-owned and domestic firms are notably different. Foreign-owned firms are more productive, use more capital-intense production procedures, employ more staff and on average pay higher wages. If potential foreign acquirers are looking for firms with more potential and more opportunities, then this so-called cherry-picking behavior creates a selection bias and distorts the results. To control for this potential problem, a

Table 2. Main characteristics of the firms in the full sample

Variable	Domestic firms	Foreign firms	Full sample
Labor productivity	22.28	72.81	22.55
	(125.15)	(485.03)	(129.91)
Capital intensity	6.21	50.54	6.46
	(85.90)	(399.44)	(90.67)
Employment	10.20	116.41	10.78
	(179.32)	(531.02)	(183.26)
Average wage	1.14	2.78	1.15
	(1.54)	(3.19)	(1.55)
Firm age	7.32	10.05	7.34
	(5.15)	(5.45)	(5.16)

Source: compiled by the author.

Notes: Averages and standard deviations (in parentheses) are presented. N = 2,540,188 firm-years. Labor productivity (total sales revenue per employee), capital intensity (total value of tangible assets per employee) and average wage (total wage bill per employee) are in million HUF, employment is in capita, and firm age is in years.

difference-in-differences method was used with propensity score matching,[4] as described in Rosenbaum and Rubin (1983). Constructing a control group (always domestic firms) as similar as possible to the treated group (firms acquired by foreigners) reduced the selection bias, since we are comparing treated firms with similar (based on their propensity score) control firms.

The matching process includes those firms which existed (with non-missing data) for at least one year before and also two years after the treatment period. Subject to these restrictions, the following probit model (2) is used to predict the propensity scores.

$$
\begin{aligned}
\Pr(ACQ_{it}) = \ddot{O}\{\beta_0 + \beta_1 \cdot \ln(LP)_{it-1} + \beta_2 \cdot \ln(avgw)_{it-1} + \beta_3 \cdot \ln(emp)_{it-1} \\
\ln(CapIns)_{it-1} + \boldsymbol{\beta}_5 \cdot \boldsymbol{Dyear}_{it-1} + \boldsymbol{\beta}_6 \cdot \boldsymbol{Dind}_{it-1} + + \boldsymbol{\beta}_7 \cdot \boldsymbol{Dage}_{it-1}\}
\end{aligned}
\tag{2}
$$

where *LP* is the labor productivity, *avgw* is the average wage (equal to total wage bill per total employment), *emp* is the number of employees, *CapIns* is the capital intensity, *Dyear* is a vector of year dummy variables, *Dind* is a vector of industry (21 broad industry categories were constructed) dummy variables and *Dage* is a vector of firm-age dummy variables. The dependent variable, ACQ_{it} is a dummy variable which takes the value of 1 if firm *i* is acquired by foreigners in that particular year, *t* and 0 otherwise. So, the probit model in (2) measures the probability of being acquired by foreigners in year *t*.

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[4]   Matching was implemented in Stata, using the *psmatch2* command of Leuven and Sianesi (2003).

The (2) probit estimation gives the result that firms with higher labor productivity, higher average wages, larger staff and more capital intense production are more likely to be acquired by foreigners. All coefficients are statistically highly significant.[5] In order to check the quality of the matching procedure, as suggested by Imbens and Wooldridge (2009), a calculation was made of the normalized mean differences in the matching variables between the treated and control groups one year before the treatment, and all of the differences are below the threshold of 0.25, so they are acceptable.[6]

After computing the propensity scores using the (2) probit model, common support was enforced by dropping the treated (control) observations with higher (smaller) propensity score than the largest (smallest) control (treated) firm's score. On this common support a propensity score matching was implemented, forcing an exact year and industry match. This means that a foreign acquisition from year t and industry j is matched only with controls (that are always domestic firms) from year t and industry j. Two more restrictions were applied to make the matching procedure stricter: (1) the labor productivity of ($t-1$) of the controls should lie within a 10% bandwidth of that of the matched firm, and (2) the propensity scores of the controls should lie within a 10% bandwidth of that of the matched firm.

The matching procedure permits multiple controls for the treated firms, and assigns weights to controls based on distance, according to propensity scores, from the treated counterparts. Matches were found for 1,286 acquisitions, which is less (about 40%) than the number of acquisitions in the full sample. This decrease in the numbers is due to two factors: first, no restrictions of any kind were applied to the full sample, apart from the requirement of non-missing regression variables, while matching includes firms only with at least three non-missing years; and second, the matching procedure also contains restrictions, such as the common support, the exact industry and year matching, and the distance in propensity scores and labor productivity. So, the matched sample contains 1,286 treated and 104,450 control firms.

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[5]   The coefficients and standard errors are the following: 0.103 (0.027) for the labor productivity, 0.343 (0.051) for the average wage, 0.302 (0.024) for the number of employees, and 0.112 (0.018) for the capital intensity.

[6]   The normalized mean differences are the following: 0.050 for the log labor productivity, 0.093 for the log average wage, 0.061 for the log employment, and 0.018 for the log capital intensity.

4. RESULTS

To check the effects of majority foreign acquisition on labor productivity, the full sample was used first, and equation (1) was estimated with the four different specifications, described in Section 3. *Table 3* shows the results for Specifications 1 to 4.

Table 3. Full sample results, specifications 1 to 4

Variables	SPEC1	SPEC2	SPEC3	SPEC4
Key variables				
FDI	0.171*** (0.023)	–	–	–
GDP distance	–	0.141*** (0.030)	–	–
Low income FDI	–	–	0.119** (0.057)	–
High income FDI	–	–	0.179*** (0.025)	–
Low income GDP distance	–	–	–	–0.055 (0.061)
High income GDP distance	–	–	–	0.221*** (0.032)
Main control variables				
Capital intensity	0.159*** (0.001)	0.159*** (0.001)	0.159*** (0.001)	0.159*** (0.001)
Size: small	0.181*** (0.005)	0.181*** (0.005)	0.181*** (0.005)	0.181*** (0.005)
Size: large	–0.241*** (0.016)	–0.241*** (0.016)	–0.241*** (0.016)	–0.241*** (0.016)
R^2	0.102	0.102	0.102	0.102

Notes: Fixed-effect estimations of Specifications 1 to 4 of equation (1), described in Section 3. N = 2,540,188 firm-years. Standard errors (corrected for firm clustering) are shown in parentheses. *** = significant at 0.01; ** = significant at 0.05. All models include a divestment effect dummy, year-industry interactions, region and firm-age controls.

Considering Specification 1, a significant foreign effect is shown – a foreign acquisition increases labor productivity by about 19%. It can also be seen that this effect grows with the income of the country of origin, as Specification 2 shows. There is a coefficient of 0.141, and the effect is statistically significant: the higher the income in the country of origin the higher the productivity effect.

However, it seems that there is a kind of threshold below which FDI has weaker effect: Specification 3 shows that acquisition has a smaller (and also, statistically weaker) effect on labor productivity when it comes from a country poorer

than Hungary.[7] Low income countries' FDI has a coefficient of 0.119, while the effect of high-income countries' FDI is higher and statistically more significant: a foreign acquisition from a high-income country increases labor productivity by about 20%. Specification 4 shows that if a country is not richer than Hungary then the GDP distance does not matter, as we can see the statistically insignificant coefficient of –0.055. On the other hand, when FDI comes from a high income country, then the GDP distance matters – the bigger the distance, in other words, the higher income the country of origin has, the bigger the effect of acquisition on labor productivity as well, as the coefficient of 0.221 shows.

Considering the control variables, it can be concluded that firms with more capital intense production are characterized by higher labor productivity, and labor productivity shrinks with size and age.

So, as the results of *Table 3* show, acquisitions from low income countries have a smaller effect on the acquired firm's labor productivity, while acquisitions from high income countries have a bigger one.

As explained before, a selection bias could have distorted the results of the full sample, so a matched sample was created to reduce this potential bias. *Table 4* shows the estimation results on the matched sample.

Considering *Tables 3* and *4,* some evidence of selection can be seen, since the coefficients are smaller in *Table 4* than in *Table 3*. This implies that the results of *Table 3* could be distorted by selection bias. However, only a part of the effects is due to selection, since all the key coefficients of *Table 4* remained statistically significant. Considering Specification 1, foreign acquisition increases labor productivity by about 9%, and the effect seems to increase with income (SPEC2) – as it was in the full sample, as well. Distinguishing between acquisitions from low income and high income countries, it can be seen that FDI from low income countries does not increase labor productivity, while FDI from high income countries has a significant effect of about 9%. Moreover, in the case of the FDI from high income countries, the GDP distance matters: the richer the country the bigger the effect, as the coefficient of 0.115 shows[8].

Summing up the results, it is clear that foreign acquisitions increase firm productivity in general. However, this effect is heterogeneous since only acquisitions from high income countries increase labor productivity significantly. Comparing full and matched samples, there is some evidence of selection bias and cherry-picking, but there is a true acquisition effect, as well. Acquisitions from

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[7]   The coefficient becomes statistically insignificant when LP is defined based on total value added.

[8]   The coefficients of GDP distance both in Specification 2 and 4 become statistically insignificant when LP is defined based on the total value added.

Table 4. Matched sample results: Specifications 1 to 4

Variables	SPEC1	SPEC2	SPEC3	SPEC4
Key variables				
FDI	0.085*** (0.025)	–	–	–
GDP distance	–	0.080** (0.037)	–	–
Low income FDI	–	–	0.058 (0.071)	–
High income FDI	–	–	0.089*** (0.027)	–
Low income GDP distance	–	–	–	–0.018 (0.088)
High income GDP distance	–	–	–	0.115*** (0.036)
Main control variables				
Capital intensity	0.167*** (0.007)	0.166*** (0.007)	0.167*** (0.007)	0.167*** (0.007)
Size: small	0.178*** (0.025)	0.179*** (0.025)	0.179*** (0.025)	0.179*** (0.025)
Size: large	–0.170*** (0.039)	–0.168*** (0.039)	–0.170*** (0.039)	–0.169*** (0.039)
R^2	0.153	0.153	0.153	0.153

Notes: Fixed-effect estimations of Specifications 1 to 4 of equation (1), described in Section 3. N = 1,153,450 firm-years. Standard errors (corrected for firm clustering) are shown in parentheses. *** = significant at 0.01; ** = significant at 0.05. All models include a divestment effect dummy, year-industry interactions, region and firm-age controls.

high-income countries have a large and significant effect, but acquirers from low-income countries also increase labor productivity, although the effect is smaller and statistically insignificant.

5. CONCLUSION

Since Hungary's transition to democracy in 1989 and its subsequent involvement in global relationships, foreign direct investment has been a relevant issue. The importance of foreign-owned companies in the Hungarian economy is beyond question. Many papers have shown that the presence of foreign ownership is very advantageous for the host country – foreigners import superior technologies and good management practices, which can also produce spillover effects. The present paper also confirms the positive productivity impact: the average effect of majority foreign acquisition on firm labor productivity is 19% in the full, and 9% in the matched sample.

Moreover, an important aspect of this phenomenon is also answered in this paper: there is heterogeneity in the effects of acquisitions based on the acquirer's country of origin. The analysis of about 3,400 acquisitions revealed that acquisitions from low income countries do not significantly increase labor productivity (the effect is small and statistically less significant). Acquirers from countries which have higher income than Hungary have a positive and statistically significant effect of about 20% on the acquired firms' labor productivity.

In order to manage the selection bias that can occur due to the potential cherry-picking behavior of foreign acquirers, a propensity score-based matching sample was made to execute difference-in-differences analysis on a subsample of similar domestic and acquired firms. Some evidence for selection bias was shown, as the coefficients of the matched sample decreased compared to the full sample, but the main messages still hold: only acquisitions from high-income countries have statistically significant positive effect on firm productivity, and this effect grows with the income of the country of origin.

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