3. FDI, PRODUCTIVITY AND WAGES. NEW EVIDENCE FROM A ROMANIAN MATCHED SAMPLE[1]

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Abstract

Governments in Central and Eastern Europe have created special incentives in order to attract FDI, based on the optimistic idea that foreign firms perform better than local ones. The recent literature sheds some doubt on the sources of productivity and wage premium, suggesting that most of the performance gap is actually due to self-selection. In the present paper we reevaluate the productivity and wage premium of foreign affiliates using a large dataset of Romanian firms, for the period 2000-2008. In order to correct for self- selection and endogeneity, we use a non-parametric econometric approach. Propensity score matching allows us to go beyond a correlation analysis and establish a causal effect of foreign ownership on performance gaps. We find that that around 40% of the productivity gap and 42% of the wage premium is due to self-selection. Once this bias removed, foreign affiliates still present 19% higher productivity and 22% higher wages compared to domestic firms. Results also confirm spillovers effects to domestic firms and show evidence of rent-sharing between foreign affiliates and their employees. We conclude that FDI do indeed have beneficial effects in the Romanian economy, though their magnitude is considerably overestimated.

Keywords: FDI, productivity, wages, selection bias, propensity score matching
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1. Introduction

It has almost become a stylized fact for foreign owned companies to outperform domestic firms in terms of productivity, wages, innovation or profitability (Lipsey, 2004. It is also believed to have the advantage to spill over to domestic firms, therefore generating a multiplier effect in the host economy. This mechanism has entitled governments in emerging countries to promote special incentives in order to attract FDI and catch as much as possible of the associated advantages. However, empirical evidence is less convincing than the theoretical arguments put forward. Even though empirical studies usually find an association between foreign capital and higher productivity and wages, a causal relationship has yet been difficult to prove.

According to the internalization theory (Caves, 1971, Dunning, 1981 foreign affiliates are thought to possess specific assets transferred from their parent companies, difficult to imitate by local competitors and which generate performance gaps. However, a key problem in evaluating these gaps is that the acquisition decision is not independent from factors determining performance indicators, like industry or firm levels characteristics. Foreign investors may cluster in industries with above average productivity or acquire local best performers within a certain industry. Moreover, higher productivity leads to higher wages, thus foreign ownership seems to be only an apparent source of wage premium. Therefore, the endogeneity of the acquisition decision becomes a major source of bias when estimating the causal effect of foreign ownership on performance indicators at plant level. The topic is of great importance for policy makers since a lot of public funds have been used to attract FDI. If foreign ownership itself is not a source of increased performance, distinction between foreign and domestic enterprises has no solid ground in constructing policies and causes unnecessary distortions in the allocation of resources.

The aim of the paper is to reevaluate the performance gaps of foreign affiliates in order to correct for potential self-selection. We concentrate on productivity and wages and advance the hypothesis that the premium attributed to foreign firms might be overestimated. We use a non-parametric matching technique, applied to a large dataset of Romanian firms, for the period 2000-2008. Propensity score matching allows us to go beyond a correlation analysis and establish a causal effect of foreign ownership on firm performance indicators.

The paper finds convincing evidence of self-selection of foreign companies in the Romanian economy. We find that only around 60% of the initial productivity gap and wage premium are due to foreign ownership. Contrary to some previous studies (Konings, 2001, Javorcick and Spatareanu, 2008, once we corrected for self-selection we were able to confirm the presence of positive spillover effects from foreign to domestic firms. Last, results provide some evidence of rent sharing between foreign firms and their workers.

This paper belongs to a recent strand in the literature on foreign ownership and firm performance, dealing with the endogeneity in the takeover decision. The contribution of the paper is threefold. First, the way we address the research question by a matching technique allows us to improve on previous studies by eliminating the selection bias. Second, the rich dataset we use allows us to control for numerous

sources of firm heterogeneity. Third, we do not restrict our analysis to the manufacturing sector, as most previous studies do, but enlarge it to include all sectors of the economy. We consider our contribution to add to the still limited number of studies using plant level data on transition countries, even less including Romania (Hake, 2009, Javorcik and Spatareanu, 2008, Konigs, 2001.,

The structure of the paper is as follows. Section 2 recalls the main contributions of the literature and outlines the theoretical and empirical arguments related to differences in productivity and wages between foreign and domestic firms. Section 3 presents the empirical strategy and describes the dataset used in empirical analysis. Results of the matching procedure are presented in section 4, together with a discussion of main findings. Section 5 outlines the main conclusions and policy implications of our research.

2. Literature review

Most of the studies that treat differences in performance between foreign and local companies focus on developed countries like the UK (Conyon et al., 2002, Girma and Gorg, 2007, Sweeden (Bandick, 2009, Heyman et al., 2007, Karpaty, 2007 or Finland (Huttunen, 2007. There is still little research on former transition countries of CEE. The few studies on FDI using Romanian plant level data (Javorcick and Spatareanu, 2008, Merlevede and Schoors, 2009, Merlevede et al., 2010, Damijan et al., 2003, Konings, 2001 mostly concentrate on the spillovers effects and implicitly assume foreign affiliates to have higher performance.

The recent literature, however, sheds some doubt on the sources of productivity and wage premium, suggesting the existence of the cherry picking phenomenon. Neglecting the selection bias might have caused an overestimation of the performance gap in previous studies. To our knowledge only Damijan et al., 2003, Javorcick and Spatareanu (2008 and Hake (2009 explicitly address the question of selection bias, by adopting two different methodologies: Heckman procedure and matching technique. In the next two sub-sections we will review the main contributions relevant to our research, outlining both the theoretical and empirical arguments that led us to the use of the matching technique. Though we are aware of the strong relationship between productivity and wages, we have divided our literature review in two sections, in order to systematically survey studies dealing with only one of the two indicators.

2.1 FDI and Productivity gap

The positive effect that FDI could have on labor productivity is among the first mentioned when discussing the host country effects of FDI. Starting with the contribution of Aitken and Harison (1999, a consistent body of literature has empirically tested and most often confirmed this hypothesis. The literature identifies several arguments in favor of a superior productivity of foreign affiliates.

The main argument comes from the specific-advantage hypothesis (Dunning, 1981, Caves, 1971. Foreign firms are supposed to benefit from specific assets transferred from their parent company, which would result in higher productivity. Romanian target firms usually have lower technology levels compared to their MNE acquirer, so the

potential for technology transfer is quite important. A second source of performance gap is the different orientation of their activities. Foreign firms have a narrower specialization and the possibility of exploiting economies of scale (Globerman et al., 1994. Moreover, they tend to have an organizational structure that is efficiency oriented, favoring directly productive activities (Dunning, 2008. Higher productivity can also be explained by better capital endowment and higher capital/labour ratios (Bellak, 2004, Girma et al., 2002. It is well documented the tendency of FDI to cluster in industries with high capital intensity, innovation and strong product differentiation (Markusen, 1995. Last, FDI tends to have an employment structure in favor of the skilled, with large shares of professional and technical workers, naturally generating higher productivity levels.

Nevertheless, the concern in the literature is that observable productivity gap could be largely attributable to industry or firm-level differences, and not to foreign ownership. Girma, Greenaway and Wakelin (2002 were the first to question the positive effects of FDI entry into an economy, stating that self-selection might be responsible for the previously found gap in productivity.

A first reference for CEEC is Konigs (2001, who addresses the issue of productivity gap between foreign and domestic firms in Romania, Bulgaria and Poland for the period 1993-1997. His results show that only in Poland foreign firms outperform domestic ones, while in Romania and Bulgaria there is no difference in productivity. While dealing with the endogeneity in input factors by using a difference GMM approach, however he does not explicitly take into account the potential endogeneity of foreign entry. Damijan et al. (2003, on the other hand, address the selection bias by applying a Heckman two-step procedure on a sample of 8 transition countries, in order to evaluate the role of FDI in technology transfer. As opposed to Konings (2001, their results for Romania indicate a significantly higher productivity in foreign affiliates compared to their domestic counterparts.

Applying a more advanced matching technique on a sample of Slovenian companies, Salis (2008 shows that target firms are more productive, have higher export propensity and operate in more concentrated industries. Once he corrects for the endogeneity of foreign entry, he finds the productivity gap to completely disappear. Applying the same matching methodology in the case of Poland, Hagemejer and Tyrowicz (2011 confirm that the observed differential in productivity is almost entirely attributed to self-selection. They find the FDI entry to depend on size, employment, cost structure, capital intensity and industry.

On the other hand, Yasar and Paul (2008 find that foreign firms have 25% higher labor productivity than domestic Turkish firms, after controlling for numerous plant characteristics. They also confirm that foreign firms were larger and more productive before matching. Hake (2009 uses a large sample of firms from 11 CEEC for the period 2000-2007 to account for employment growth. She finds target firms to be cherry picked according to their high labor productivity and capital intensity, their size and age, but also their low export intensity.

2.2 FDI and Wage premium

In line with the productivity gap hypothesis, it is also believed that foreign firms pay higher wages to equivalent workers (Aitken et al., 1996. Like the productivity gap, the

wage premium also appears as a consequence of the internalization theory, since rents generated by the firm specific assets are thought to be shared with their employees, therefore raising average wage (Martins, 2004. Even though the multinational status may weight in favor of the company bargaining power and therefore reduce the rents being shared, the distribution effect is thought to prevail (Girma et al., 2002. Firms may be willing to pay efficiency wages in order to dissuade worker turnover and therefore minimize the risk of technology leakage. Higher wages could also be explained by higher capital and skill intensities that characterize foreign firms (Markusen, 2002, Doms and Jensen, 1998.

According to Bellak (2004, p. 11 the reasons why foreign owned firms pay higher wages derive either from their superior performance or from certain disadvantages . Some of these factors can raise problems of spurious relationship and therefore research should explicitly take into account the risk of selection bias. Even if the overwhelming majority of empirical studies have confirmed wage premium ranging from 10 to 70 percent (Heyman et al., 2007, only few of them have considered self-selection.

The first generation studies showed that controlling for the industry location of FDI reduced significantly the apparent wage premium. Using manufacturing plant level data for Mexico, Venezuela and USA, Aitken et al. (1996 have initially found foreign firms to pay 30% higher wages than domestic ones. After controlling for a possible selection of FDI in industries with above average wages, they concluded that the real wage premium dropped to around 15%. Feenstra and Hanson (1997 have also found that only half of the initial wage premium in Mexico was actually due to foreign presence.

More recent studies control for plant level characteristics and endogeneity in FDI entry and show that the wage premium is almost entirely due to other factors than foreign ownership. Bandick (2009 uses an instrumental variable approach, combined with propensity score matching in order to take into account the endogeneity of the acquisition decision in Sweden. He finds evidence of cherry picking according to higher size, productivity, skill intensity, sales and wages. He also finds foreign acquisitions not to have any effect on wage growth. Heyman et al. (2007, after controlling both for firm and workers' characteristics, confirm that wage premium in Sweden is explained by other factors than foreign ownership. Girma et al. (2002 investigate the sources of productivity and wage gaps in the UK. After controlling for size, industry average wage, firm and industry fixed effects in an instrumental variable framework, they find that the wage premium is entirely explained by the higher productivity associated with foreign ownership.

Martins (2004 uses a detailed Portuguese data set and applies a battery of methodologies, starting with OLS and quantile regressions, continuing with propensity score matching and difference-in-difference estimators. He finds no overall evidence of causal effect of foreign ownership on wages, regardless of the foreign equity share. He suggests two explanations for this result: the lack of like-to-like comparison between foreign and domestic firms and workers unobserved heterogeneity. He argues that in the case of competitive labour markets, the wage premium, if existent,

will most likely be quickly absorbed. Romania, as a former transition country, has yet a non-competitive labour market so we would expect the wage differential to last longer.

3. Data and empirical strategy

3.1 Sample description

The sample we use contains plant level data for the Romanian economy, extracted from the Amadeus database. Amadeus is a pan-European data-bank, provided by Bureau van Dijk Electronic Publishing SA. It contains financial information on 18 billion private and public companies, from 42 European countries. For Romania, data is gathered from the Romanian Chamber of Commerce and Industry. The criteria we used in selecting the firms were their active status and minimum 50 employees in the last available year (2008. Our initial sample contains 3500 medium and large enterprises, with financial information available for the period 2000-2008. Data contains information on tangible and intangible assets, employment, material and labor costs, sales, profits, ownership, etc. Using the NACE 2 digit code, we classified firms into industries, resulting in a total of 18 sectors. Most of the studies use only the manufacturing sector, but data allows us to extend the analysis to the whole economy (as in Hagemejer and Kolasa, 2008. As expected, the largest share is attributed to manufacturing, followed by trade and constructions. We have eliminated sectors like public administration and defense (NACE code O, where legally no foreign enterprise can be possible. We have also eliminated Education (NACE code P, and Other services (NACE code S, because of few observations not allowing the matching procedure[3]. The distribution of firms according to their activity is presented in Table A1 in Appendix. Concerning the spatial distribution, one-third of the firms are located in the capital region (Bucarest-Ilfov while the rest of the regions have a relatively equal distribution, around 10% each. A slight under-representation is found in the South-West region, with only 5% of the sample.

Concerning ownership, AMADEUS provides data on the share and origin of each shareholder[4]. We considered the cumulated share of all foreign shareholders and indentified foreign direct enterprises as having more than 10% foreign equity (UNCTAD. In the 3500 firms sample, we found a serious problem of missing data, especially concerning crucial variables like ownership or NACE code. For around 200 firms, we were able to fill in the missing observations with official data coming from the Ministry of Finance and the Bucharest Stock Exchange. The rest of the firms with

[3] *We have decided to use the large classes of activities according to two-digit NACE code, because the-three digit classes would not have allowed enough firms to perform a good quality matching. We also eliminated observations for PETROM SA, the former state-owned oil company, which is not a representative firm and would have seriously biased our results because of its large size (> 35 000 employees.*

[4] *Amadeus database is updated each year. Since data contains only the last available information on ownership, we gathered information from two successive versions of the Amadeus CD-ROMs in order to complete the ownership series. Due to these limitations, we only considered ownership changes during 2001-2002 and followed their effect on the period 2003-2008.*

missing data were excluded from the sample, which at the end contained 1902 firms. Out of the whole sample, 804 were foreign firms while 1098 were domestic ones (foreign share inferior to 10%. As expected, the regional distribution of FDI quietly follows the development levels, with the highest number of foreign firms in the capital region, followed by the Western region. The lowest FDI intensity is found in the Eastern regions of Romania, also the poorest in tem of income per capita. Descriptive statistics of the sample are presented in Table A2 in Appendix.

3.2 Methodology

The econometric challenge we are facing is to evaluate the causal effect of foreign ownership on labor productivity and wages. The simplest comparison of average indicators for the two groups is particularly misleading. Higher values in the group of foreign firms might be erroneously attributed to foreign presence, if self-selection was present. Most of the studies that test the hypothesis of performance gap use panel regressions (Lipsey and Sjoholm, 2004, Aitken et al., 1996). An OLS approach usually provides a high and significant foreign firm premium, which decreases severely when firm controls are added (Martins, 2004). Besides the inflated coefficient on foreign ownership, this type of approach does not allow the interpretation of the result as a causal effect, since the assumption of independence between firm ownership and the error term is most likely to be violated. Moreover, standard regression assumes that the distribution of regressors is the same across the two groups of firms, which does not seem to be the case if we look at the descriptive statistics for the two groups.

The usual approach in correcting the selection bias is by using instrumental variables. Since most variables that affect foreign acquisition also affect productivity or wages (Girma and Gorg, 2007, this approach is particularly inappropriate in the case of FDI. Recent developments in econometrics allow us to correct the selection bias by a more appropriate technique, propensity score matching (PSM). This method, developed by Rubin and Rosenbaum (1983), is particularly fitted for microeconomic analysis and was initially used in labor economics, to evaluate the effectiveness of training programs. The advantage of PSM compared to other methods that correct for self-selection (like the Heckman procedure) is that it goes beyond a correlation analysis and provides an estimate of the causal effect of foreign ownership on productivity and wage levels. Existing research using PSM to evaluate the effect of foreign ownership on performance gaps in CEEC is limited and very recent (Hagemejer and Tyrowicz, 2011, Hake, 2009).

The difficulty with this type of econometric estimation is that we don't know what would have been the evolution of a foreign firm had not been acquired by a foreign investor, or the evolution of a domestic firm had it been taken over by a foreign investor. The basic idea of PSM is to recreate these evolutions by constructing a domestic counterfactual for each of the foreign firms. We call *FDI* a binary variable, with the following distribution:

$$FDI = \begin{cases} 1, \text{ if } >= 10\% \text{ foreign equity}^5 \\ 0, \text{ if foreign equity} < 10\% \end{cases} \quad (1)$$

[5] *We have used the 10% threshold according to the definition of FDI coming from UNCTAD, but there are authors who have used thresholds ranging from 10-50% foreign presence. The use*

We are interested in creating pairs of twin firms , a foreign and a domestic one, based on the similarity of their observable characteristics. Since an association based on numerous criteria is difficult to perform, the matching is made based on an average score attributed to each firm. The propensity score therefore represents the probability of being acquired by a foreign investor, given the individual characteristics of the firm prior to acquisition and the industry specific fixed effects:

$$\text{Propensity score} = \Pr(FDI=1 \mid X_{t-1}, D_j) \quad (2)$$

X is a vector of firm characteristics in the pre-acquisition period, while D_j represents industry fixed effects. Since the matching is made based on the closest propensity score, the difference in the outcome variable (productivity or wages can be entirely attributed to foreign ownership. Foreign acquisition is therefore equivalent to a treatment applied to the firm. One can evaluate the treatment effect by the changes induced in the outcome variable (in our case labour productivity and average wage, given a change in the treatment variable (Dehejia and Sadek, 2002). We denote by $Y^{treated}$ the outcome variable for foreign firms, while $Y^{untreated}$ is the outcome variable for domestic firms. For each of the pairs, a difference in the outcome variable is computed, then an average for the whole sample. This is called the Average Treatment Effect on the Treated (ATT) and is interpreted as a causal effect of the treatment allocation on the outcome variable:

$$ATT = E(Y^{treated} - Y^{untreated} \mid FDI = 1) = E(Y^{treated} \mid FDI = 1) - E(Y^{untreated} \mid FDI = 1) \quad (3)$$

When using PSM, three concerns have to be addressed: the conditional independence, the common support and the balancing property (Dehejia and Sadek, 2002. The conditional independence states that, given a set of observable characteristics X, unaffected by treatment, the outcome variable should be independent from treatment allocation. The purpose of estimating the propensity score is not to perfectly explain treatment allocation (all the more since our analysis is based only on observable characteristics). In such a case, all foreign firms would have high propensity scores, while all domestic firms would have low propensity scores, and matching would become impossible. Heckman et al. (1997) even suggested that the non-overlapping support, together with the different distributions of the covariates, are more important sources of bias than the selection on non-observables. As the propensity score increases, the number of domestic firms that are good matches to the foreign ones decreases. In order to avoid bad matches due to high within-pair differences, we impose a common support region by dropping foreign firms with a high within-pair difference.

Both Heckman et al. (1997) and Martins (2004) stress the importance of different distributions of the covariates as potential sources of bias. Since the distribution of firm characteristics, even on the region of common support, can be very different between the foreign and domestic group (example size, assets, etc., there is a need to check

of a different threshold would not change the results, since most of the foreign firms are majority owned. We have run the analysis with 20%, 30% and 50% levels of foreign equity and the results are qualitatively the same.

the balancing of the distributions after the matching is completed. A good match will lead to a balanced distribution of covariates between the two groups of firms.

As matching algorithms to construct the counterfactual, we have used the following three ones:

- *The closest neighbour*: each foreign firm is matched to the domestic firm with the closest (*n* closest) propensity score.
- *Radius matching*: All domestic firms that fall within a radius of 0.05, 0.02 and 0.01 difference in probability are used to construct the counterfactual.
- *Kernel matching*: the domestic counterfactual is constructed based on a weighted average of the propensity scores of all domestic firms. Firms with close propensity scores will therefore have high weights, while firms with very different propensity scores will have small weights.

The results and the quality of the matching procedure are presented in the next section, together with the estimated treatment effects.

4. Results

Applying the methodology described in section 3, we first proceed to estimating the predicted probability of receiving foreign investment, given several firm characteristics. We have chosen the covariates based on the studies cited in the literature review (Girma, 2005, Yasar and Paul, 2007, Hagemejer and Tyrowicz, 2008), but also considering the available dataset.

Labour productivity has been confirmed to be a selection factor and a argument for firms to pay higher wages (Bandick, 2009, Girma et al., 2002). Lacking a consistent series of value added, we computed labour productivity as sales per employee, deflated with the corresponding price producer index. High *capital/labour ratio* is a premise for higher productivity and an attraction factor in selecting target firms. According to UNCTAD (2002) foreign firms are most likely to use more capital intensive techniques and therefore have higher assets per employee. We computed this variable as total assets divided by the number of employees. *Profitability* is an indicator of the firms' health status, so we expect it to be positively correlated with FDI propensity. We computed profitability as the ratio of profit to loss before taxes, and sales. *Size* is a variable that systematically appears in the literature to positively influence the predicted probability of becoming FDI. We proxied the firm's size by the number of employees[6]. Since FDI is attracted to sectors where there is already a certain foreign presence, we also included *the industry share of FDI,* proxied by the share of workers in foreign firm in total industry. The export intensity or the age of the firm would have been variables worth taking into account, but the lack of available data prevented us from doing so.

We considered foreign takeovers during 2001-2002 and then evaluated their effect on performance indicators during the following six years, 2003-2008. Results of the

[6] *We have also tested to see if results were different for medium, large and very large enterprises. The introduction of a dummy variable accounting for the company type did not change the results.*

estimations are presented in Table 1. We have presented both Probit and Logit estimates, though there is no argument in favor of one specific model and they both give similar results. We have used the Stata module 'PSMATCH2', developed by Leuven and Sianesi (2003) in order to perform the analysis. According to Cameron and Trivedi (2009) values for pseudo R square ranging between 0.2 and 0.4 are considered highly satisfactory, so we are satisfied with the explanatory power of our model. All the variables are significant.

Table 1

Estimation of the propensity score

Dependent variable FDI=1	**Probit** Model	**Logit** Model
LOG Labour productivity	0.122** (0.05	0. 194** (0.085
LOG Assets per employees	0.195*** (0.043	0. 326*** (0.073
Profitability	-0.409** (0.198 (V	-0. 701** (0.33
Size	0.129*** (0.032	0. 219*** (0.054
Industry share of FDI	0.019* (0.010	0.034* (0.019
Region dummies	Yes	Yes
CENTER Region	-0.402*** (0.11	-0.679*** (0.18
NORTH-EAST Region	-0.683*** (0.133	-1.163*** (0.226
NORTH-WEST Region	-0.339*** (0.12	-0.571*** (0.20
SOUTH Region	-0.452*** (0.119	-0.771*** (0.20
SOUTH-EAST Region	-0.63*** (0.123	-1.085*** (0.21
SOUTH-WEST Region	-0.47*** (0.164	-0.81*** (0.277
WEST Region	-0.13 (0.122	-0.237 (0.202
Industry dummies	Yes	Yes
Observations	4035	4035
Pseudo R^2	0.205	0.204

*Note: Constant included but not reported. In brackets we have reported the standard errors of each estimator. The symbols *, **, *** denote significance levels of 10%, 5% and 1%. Estimations comprise dummy variables for the 8 regions and the 18 industries. For the regional dummies, the reference is the capital region, and for industries it is manufacturing.*

Labor productivity seems to positively influence FDI propensity, in line with other studies which have found target firms to be more productive (Yasar and Paul, 2008, Hake, 2009). Both capital/labour ratio and size have the expected sign and are significant at 1% level, suggesting that acquired firms are larger and have higher

capital intensity. Contrary to what we might expect, profitability has a negative influence for the propensity of receiving FDI. Although it may sound counterintuitive at first sight, this result has been frequently obtained for developing countries (Jurajda and Stancik 2009, Szekeres 2001). Bellak (2004) even argues that profitability is one of the few performance indicators where foreign firms, even after take-over, perform worse than domestic firms. One possible explanation could be the fact that the price and the negotiating power of highly profitable firms are larger, and could therefore dissuade foreign investors. Foreign investors could also be interested in target firms that posses certain strategic assets or market shares, and estimate that by improving their management they could also improve their low profitability. Although significant only at 10% level, foreign presence in the industry is positively associated with new FDI entry, therefore confirming agglomeration effects.

We consider that interpreting the regional dummies might have some interesting implications. Since the dummy excluded was the capital region, all other regions have a negative sign, suggesting less attractiveness for foreign investors. We notice that the West region does not have a significant negative coefficient. This means that it does not have a significantly lower incentive to attract FDI, compared to the capital region. The explanation is that due to the close proximity to EU countries and the supply of skilled workers, the West region offers investors logistic advantages and becomes the second best in terms of location choice. This is also confirmed by descriptive statistics, the West region having a share of 46.7% of foreign firms, significantly higher than the national average and second after the capital[7].

In order to check the validity of the matching procedure, we first need to ensure make sure that the common support is sufficiently large to allow good matches and, second, that the distribution of covariates between the two groups is balanced. Figure A1 in Appendix presents the distribution of the propensity score, according to the two groups of firms: treated and untreated. According to the two distributions, we are comfortable with the large common support. Only among 4% of observations are off support and could not be matched, and their distribution is balanced among the two groups. Observations off support are firms with particular characteristics, for which we could not find a match. Verifying the balancing properties of covariates allows us to estimate the quality of the matching. In order to have good matches, firms inside the same pair should have similar characteristics, acting like twin firms. Mean values for the variables before and after the matching are presented in Table A3 in Appendix. If the two groups had different characteristics before matching, given by a significant difference in means, the differences are no longer significant once matching has been completed. This is an indication of the presence of a significant selection bias. For all of the covariates we accept the null of no difference in means after the matching, ensuring us that the pairs of firms created are good matches.

[7] *We specify that the foreign shares are calculated at sample size. Amadeus database is organized according to a descending order in sales, so our sample comprises the largest firms in the country. Since large firms are most likely to be foreign, the foreign share may be overestimated at population level. As econometric estimations use the variation and not the level, we consider the differences in the sample to reproduce relative differences in overall population.*

Table 2

The average treatment effect of foreign ownership on productivity and wages

		Matching algorithms					
Average Treatement Effect on the Treated	*Kernel Matching*	*Nearest neighbour matching*			*Radius matching*		
(ATT		n=10	n=5	n=1	r =0.05	r =0.02	r =0.01
2008							
Labor productivity	**0.203*** **	**0.188*** **	**0.183*** **	**0.200*** **	**0.204*** **	**0.196*** **	**0.185** **
	(0.035	(0.04	(0.05	(0.073	(0.04	(0.043	(0.042
Average Wage	**0.235*** **	**0.223*** **	**0.212*** **	**0.197*** **	**0.235*** **	**0.232*** **	**0.23*** **
	(0.027	(0.031	(0.035	(0.039	(0.025	(0.027	(0.029
2007							
Labor productivity	**0.161** **	**0.175*** **	**0.169** **	**0.178** **	**0.162*** **	**0.163** **	**0.160** **
	(0.044	(0.053	(0.054	(0.085	(0.047	(0.054	(0.052
Average Wage	**0.292*** **	**0.292*** **	**0.280*** **	**0.290*** **	**0.289*** **	**0.290*** **	**0.284*** **
	(0.037	(0.038	(0.037	(0.048	(0.034	(0.035	(0.035
2006							
Labor productivity	**0.173*** **	**0.158** **	**0.155** **	**0.111**	**0.172*** **	**0.173*** **	**0.135** **
	0.043	(0.054	(0.063	(0.077	(0.045	(0.048	(0.050
Average Wage	**0.322*** **	**0.337*** **	**0.345*** **	**0.363*** **	**0.323*** **	**0.318*** **	**0.284*** **
	0.035	0.038	0.042	0.053	0.037	0.037	0.040
2005							
Labor productivity	**0.208*** **	**0.209*** **	**0 .208*** **	**0.276*** **	**0.208*** **	**0.206*** **	**0.201*** **
	(0.044	(0.051	(0.059	(0.090	(0.047	(0.046	(0.048
Average Wage	**0.359*** **	**0.354*** **	**0.338*** **	**0.38*** **	**0.359*** **	**0.356*** **	**0.337*** **
	(0.037	(0.041	(0.043	(0.063	(0.042	(0.038	(0.044
2004							
Labor productivity	**0.195*** **	**0.19*** **	**0.194** **	**0.155***	**0.192*** **	**0.190*** **	**0.252*** **
	(0.047	(0.057	(0.065	(0.096	(0.051	(0.057	(0.065
Average Wage	**0. 358*** **	**0. 365*** **	**0.355*** **	**0.354*** **	**0.358*** **	**0.364*** **	**0.369*** **
	(0.041	(0.043	(0.048	(0.049	(0.035	(0.043	(0.041
2003							
Labor productivity	**0.234 *** **	**0.243 *** **	**0.289 ** **	**0.403 ** **	**0.231 *** **	**0.284 *** **	**0.216*** **
	(0.047	(0.057	(0.065	(0.096	(0.051	(0.057	(0.065
Average Wage	**0. 411*** **	**0. 399*** **	**0.394 *** **	**0.343*** **	**0.414 *** **	**0.383 *** **	**0.363*** **
	(0.041	(0.043	(0.048	(0.049	(0.035	(0.043	(0.041

*Note: Standard errors are reported in brackets. They have been obtained by bootstrap with 500 replications. Symbols *, **, *** denote significance levels of 10%, 5% and 1%.*

Inside each pair of firms, a difference in the outcome variable is computed. Since the firms are supposed to be statistical twins, the difference in outcome is causally attributed to the only observable difference, the ownership. The average treatment effect on the treated group (ATT) can be interpreted as the productivity gap or wage premium that foreign firms enjoy over domestic ones (Rubin and Rosebaum, 1983. Results are presented in Table 2.

Results indicate that the average treatment effect of foreign ownership on both labor productivity and wage is positive and highly significant. The estimations are robust, all the seven matching algorithms used showing similar values. For 2008, the most recent available year, foreign firms have approximately 19% higher productivity than their domestic counterparts. The productivity gap before matching was around 32%, so matching allowed a correction of the initial value by 40%. This can be interpreted as a selection bias of 40% in the apparent productivity gap, due to factors like capital intensity, lagged labor productivity, agglomeration effects, industry or location.

The effect of foreign ownership on average wage is also positive and highly significant. For 2008, we have obtained values ranging from 0.197 to 0.235, according to the matching algorithm used. Results indicate that foreign firms pay on average 22% higher wages than their domestic twins , results which are consistent with those obtained by Sjoholm and Lipsey (2006. Since the initial wage differential was around 38%, the wage premium drops to less than half once comparing firms with similar characteristics and correcting the endogeneity between productivity and wages. Therefore, the selection bias in the case of average wage is 42% of the initial wage premium.

In order to see if there is an evolution towards closing these gaps, we have computed the average treatment effect for each of the two outcome variables, for six years, ranging from 2003 to 2008. In order to facilitate interpretation, we have made an average of the treatment effect given by the different matching algorithms, which we present in Table 3. The difference between the apparent and corrected gap accounts for the selection bias.

We can see that both gaps were decreasing over time, suggesting a certain convergence between domestic and foreign firms. Concerning labor productivity, there seems to be no spillovers to domestic firms, since the apparent productivity gap remains fairly constant over time, ranging from 32% to 35%. This was also the conclusion reached by previous studies using Romanian plant level data.

Table 3

Synthesis of the average effect of foreign ownership on productivity and wages

		2003	2004	2005	2006	2007	2008
Productivity gap	apparent	35%	32%	34%	34%	32%	32%
	corrected	27%	20%	22%	16%	17%	19%
Wage premium	apparent	55%	53%	53%	49%	44%	38%
	corrected	39%	36%	35%	33%	29%	22%

Note: Figures were obtained as averages of the 7 matching algorithms presented in Table 2.

Konings (2001) had found no spillovers from foreign to domestic firms, though not controlling for selectivity, while Javorcick and Spatareanu (2008) even detected negative vertical spillovers. We improve on these studies by applying the more advanced matching technique, with the advantages presented in section 3.2. As a consequence, once we corrected the selection bias, we can observe that the real productivity gap is smaller and decreasing over time. The decrease in productivity gap

can indicate evidence of spillover effect, domestic firms improving their productivity due to the contact with more productive foreign firms.

The gap between domestic and foreign firms is more pronounced in the wage differences, however the convergence is present both at initial and corrected figures. Starting with a real wage premium of 39% in 2003, foreign firms exhibit in 2008 only a 22% premium over their domestic counterparts. One explanation could be the important increase in average wage in Romania during this period, which had different dynamics in foreign and domestic firms. An important attraction factor for foreign investors in the region was the low labor cost. Thus, once wages levels started to rise, they faced the risk of losing their external competitiveness, so wage increase was inferior to that of domestic firms. Further research needs to be done in this area based on future data availability. Since part of the wage premium could be justified by investment in human capital and creation of new skills by foreign firms, a more detailed analysis including skill intensity would be more relevant.

Since the wage premium is generally higher than the productivity gap, we interpret it as evidence of rent sharing. Foreign firms, due to their specific asset, generate productivity gains, which they share with their workers. We can also observe that the difference between the wage premium and the productivity gap is rather constant over time. However, in 2008 the difference between the two performance gaps drops sharply, suggesting rent sharing to be less significant. A possible explanation could be the increasing bargaining power or foreign firms, which internalize more of the rent generated by their specific assets. A more plausible explanation, however, might be the fact that less rents have been generated, foreign firms being among the first to be affected by the economic crisis, due to their external exposure.

5. Conclusion

This paper provides an empirical reassessment of the productivity gap and wage premium between foreign and domestic firms in the Romanian economy, for the period 2000-2008. Suspecting the presence of the cherry picking phenomenon in the form of self-selection of foreign investors among the local best-performers, we corrected the initial gaps in productivity and wages in order to eliminate endogeneity in the FDI entry. In order to go beyond a correlation analysis and test the causal effect of foreign ownership on productivity and wages, we use a non-parametric econometric technique.

Our results show that there is, indeed, evidence of self-selection of foreign investors, targeted firms being more productive, larger, having higher capital intensity and operating in industries with high initial foreign presence. We found the selection bias to be around 40% of the apparent gap in productivity and wages. Once we corrected for self-selection by applying a matching technique, we found that foreign affiliates present 19% higher productivity than domestic firms. We also confirmed the hypothesis that FDI pays higher wages than domestic firms in all industries. Once we took into account the endogeneity between productivity and wages and eliminated the selection bias, the wage premium dropped from 38% to 22%. Since the wage premium is higher than the productivity gap, foreign firms tend to share with their

employees a part of the rents generated by their specific assets, though this process is decreasing over time.

Results confirm the hypothesis of internalization theory according to which local affiliates internalize the foreign owner's specific advantage and generate productivity gains. The productivity gap, however, is decreasing over time, suggesting evidence of productivity spillovers to local firms. We consider our result to improve on previous studies which failed to find evidence of spillover effect, mainly due to neglecting the selection bias. The convergence can also be depicted for the wage premium, foreign firms having a slower increase in wages due to the need of maintaining their competitiveness.

Overall, the results offer no support for the concerns that foreign acquisitions may harm the target's firm performance and only take advantage of the local assets. We conclude that policy makers should continue to encourage FDI, since not only do they have a net positive effect both on labor productivity and wage levels, but they also generate spillovers to domestic firms, therefore creating a multiplier effect in the host economy.

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Appendix

Table A1

Distribution of firms according to their industry

Industry (NACE Rev. 2	Number of firms	Share in total	Foreign firms	Domestic firms
A. Agriculture	49	2.58	9	40
B. Mining and quarrying	24	1.26	8	16
C. Manufacturing	805	42.38	424	381
D. Electricity, gas, steam	42	2.21	10	32
E. Water supply	37	1.95	13	24
F. Construction	264	13.88	40	224
G. Wholesale and retail trade	396	20.82	155	241
H. Transportation	104	5.47	33	71
I. Accommodation and food services	22	1.16	12	10
J. Information technology	59	3.1	43	16
K. Financial and insurance intermediation	3	0.16	1	2
L. Real estate activities	8	0.42	3	5
M. Professional, scientific and technical activities	43	2.26	28	15
N. Administrative and support services	23	1.21	8	15
O. Public administration and defense	2	0.11	0	2
P. Health and social work	10	0.53	9	1
Q. Art, entertainment and recreation activities	8	0.42	7	1
S. Other services	2	0.11	0	2
Total	1902	100 %	804	1098

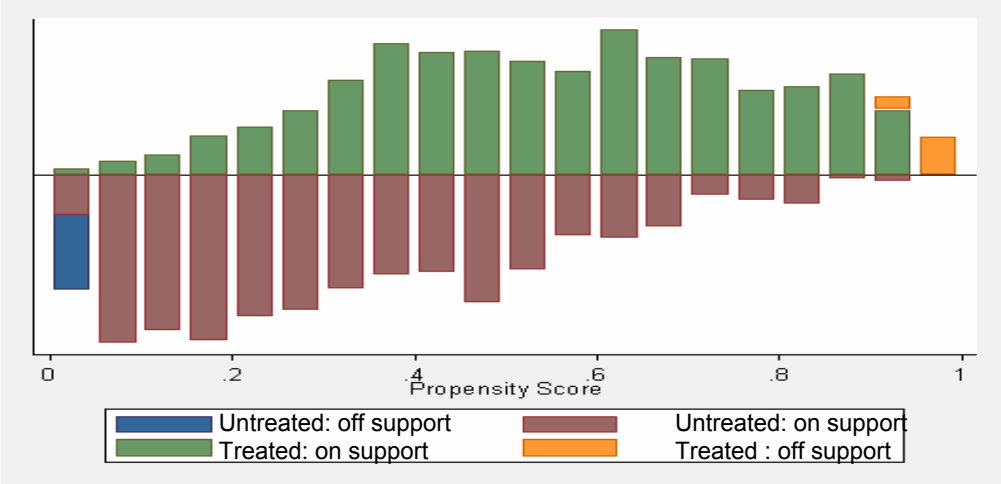
Table A2

Descriptive statistics for the sample

Variables	Total sample		Foreign firms		Domestic firms	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Labour productivity (Sales per employee, th. euros	83.19	161.86	108.48	206.44	64.40	114.91
Assets per employee (th. euros	76.19	253.76	98.46	296.17	59.48	215.23
Profitability (Profits/Sales	0.05	0.22	0.03	0.27	0.06	0.17
Number of employees	574	1501	653	1214	516	1679
Average annual wage (euros	6810	4750	8.58	6.07	5.53	2.87
Total assets (th. euros	45348	218207	50629	135051	41478	262940
Industry foreign share (based on employees	34.26	43.90	83.41	24.64	0.13	0.89

Figure A1

The distribution of the propensity score



Source: author's calculations using PSMATCH2 module in STATA 11.0, based on Amadeus database

Table A3

The balancing property, before and after the matching

Variable	Sample	Mean		Test on mean equality after the matching $p > \|t\|$
		Treated	Control	
Log Labour productivity(t-1	Unmatched	3.96	3.65	0.230
	Matched	3.95	3.89	
Log Assets per employee	Unmatched	3.74	3.28	0.676
	Matched	3.73	3.71	
Profitability	Unmatched	0.056	0.068	0.799
	Matched	0.060	0.062	
Size	Unmatched	5.65	5.46	0.330
	Matched	5.64	5.70	
FDI industry Share	Unmatched	56.05	45.62	0.19
	Matched	55.5	55.72	