THE IMPACT OF MNES ON DOMESTIC FIRMS IN CEECS: A MICRO-ECONOMETRIC APPROACH

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Abstracts
During the past decades, many governments in Central and Eastern European Countries (CEECs) have offered significant incentives in order to attract foreign direct investments (FDI), motivated by expectations on possible spillover benefits. In this paper we try to analyse the effects generated by foreign firms on domestic firms' productivity in Bulgaria, Romania, and Poland. In particular, we try to answer the following research questions: 1) Are there any spillover effects of FDI, and if so, are they positive or negative? 2) Are spillover effects more likely to occur within or across sectors? 3) Are all types of foreign firms able to generate positive spillovers for domestic firms? In order to answer these questions we estimate a firm level database using random effect models. We control for selection bias and endogeneity by adopting the semiparametric estimation method suggested by Olley and Pakes (1996). Finally, we test whether intra and inter-sectoral spillovers depend on host country's social capabilities and absorptive capacity. We found interesting results. On average, spillovers are more likely to accrue to the more productive firms. Less productive firms, in fact, are able to reap some externalities only when they are located in the capital regions. Finally, we found that, on average, high tech foreign firms tend to generate positive externalities for domestic firms only in the less developed countries. Low tech foreign firms generate both vertical and horizontal spillovers, which are exploited mail by more productive firms.

Key words: foreign direct investment, transition countries, spillovers
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1. Introduction

During the past decades, many governments in Central and Eastern European Countries (CEECs) have offered significant incentives in order to attract foreign direct investments (FDI), motivated by expectations on possible spillover benefits. In this paper we try to analyse the effects generated by foreign firms on domestic firms' productivity in Bulgaria, Romania, and Poland. In particular, we try to answer the following research questions: 1) Are there any spillover effects of FDI, and if so, are they positive or negative? 2) Are spillover effects more likely to occur *within* or *across* sectors? 3) Are all types of foreign firms able to generate positive spillovers for domestic firms?

This work relates on a large body of theoretical and empirical literature. From a theoretical point of view, the main hypotheses are, first, that multinational enterprises rely on intangible assets, such as a superior technology in order to be internationally competitive (Markusen, 1995); secondly, multinational enterprises transfer know-how and technology to their foreign affiliates and, thirdly, that technology brought by foreign firms, being partly a public good, spills over the host economy through several channels. The latter are linked to the way how domestic firms react to the entrance of a foreign firm in their own markets. Additional competition pushes for efficiency improvements, which become necessary if firms want to maintain their market shares. Domestic firms may learn from foreign companies about new products, production techniques and organization skills, thus increasing their performance.[1] This transfer of benefits may occur either voluntarily, through input output linkages between domestic and foreign firms, or involuntarily through competition, imitation and training (Blomstrom et al. 2001). Generally speaking, the former tend to encourage vertical flows of *generic knowledge*, leading to *inter-industry spillovers*, while the second involve horizontal flows of *specific knowledge*, yielding to *intra-industry spillovers*. Needless to say, in both cases domestic firms become more productive and efficient, thus fostering local industrial development as suggested by several economists from

[1] Needless to say, foreign firms may also generate negative effects for domestic firms, such as tougher competition in the final markets as well as in the source - i.e. labour – ones. A common belief, however, is that positive effects outweigh negative ones (UNCTAD, 2001).

Hirschman (1954) and Helpman, (1984), to Rodriguez-Clare (1996) and Markusen and Venables (1999).[2] MNEs, instead, will benefit from vertical spillovers since they reach upstream suppliers and downstream clients, and loss from horizontal externalities since they flow to their direct competitors. Therefore, foreign firms will try to minimize outflows of specific knowledge while encouraging outflows of generic knowledge to complementary sectors. Despite this well acknowledged theoretical wisdom, there is little conclusive evidence supporting these claims.

Existing evidence on whether there are spillovers is of three types.[3] First of all, there are case studies and surveys, which offer a variety of qualitative information on specific FDI projects and locations, which however can hardly be generalised. Steward (1976), Crone and Watts (2000), Brand, Hill and Munday (2000), Turok (1993), Driffield and Noor (1999) and Pavlinek and Smith (1998) all carry out this type of analysis. Only the latter concerns CEECs. Although they focus on different countries and economic sectors, they found little or no evidence of backward linkages between MNEs and domestic firms. The second group consists of industry-level studies. Recent examples of this type of studies are Gorg and Strobl (2002) and Altomonte and Resmini (2002). The former focuses on the Irish manufacturing sector while the latter concerns the Polish manufacturing sector. Both conclude that the entry of a new MNE positively affect domestic firms. However, the causal meaning of this correlation is not clear, as discussed also in Aitken and Harrison (1999). Inward FDI may raise host country productivity not only because it generates spillovers, but simply because foreign firms are generally speaking more productive than domestic firms or because they tend to concentrate in the more productive industries and their presence forces less productive domestic firms to exit the market. The third type of studies is micro-level analyses. These studies examine whether the productivity of domestic firms is affected by the presence of foreign firms. Both intra-industry and inter-industry spillovers are considered, while geographical proximity between domestic and foreign firms is not always included into the analysis. Djankov and Hoeckman (2000), Smarzynska Javornic

[2] See Glass et al. (2000) for an in-depth survey of these and other theoretical literature concerning spillovers between domestic and foreign firms.
[3] Gorg and Greenaway (2002), Alfaro and Rodriguez Clare (2003), and UNECE (2001) extensively document empirical evidence on spillovers generated by foreign firms. Only the latter focuses on CEECs.

(2004), Haskel et al. (2002), Peri and Urban (2004), Judaeva et al. (2003), Schoor and van der Tol (2002) and Konings (2001) represent recent examples of this kind of studies. Most of them fail to find evidence on positive spillovers, especially in the case of developing countries. As far as CEECs are concerned, Djankov and Hoeckman (2000) document negative spillovers in the Czech Republic while Schoor and van der Tol (2002) highlight the existence of positive vertical spillovers in Hungary; Konings (2000) found negative spillovers in Bulgaria and Romania and no spillovers in Poland, while Smarzynska Javornic (2004) provides evidence of positive vertical spillovers in Lituania and Judaeva et al. (2003) document positive intra-industry spillovers but negative inter-industry spillovers between foreign firms and domestic firms in Russia. The message coming from these and other studies on spillovers is that the focus, the data and the methods used may affect the results, as suggested by Gorg and Strobl (2001).

Our paper contributes to this literature in several ways. We investigate both *horizontal* and *vertical* effects. The latter have been analysed by considering not only contacts between domestic suppliers of intermediate inputs and their multinational customers, but also contacts between foreign suppliers of intermediate inputs to their domestic clients. The net effect of FDI, therefore, depends on the sign and the magnitude of horizontal, vertical-backward and vertical-forward linkages. We estimate the impact of these three channels for spillovers on the productivity of domestic firms by using a firm level database, which increases the accuracy of the results. We control for selection bias and endogeneity by adopting the semiparametric estimation method suggested by Olley and Pakes (1996). Finally, we test whether intra and inter-sectoral spillovers depend on the one hand on host country's social capabilities and absorptive capacity, and, on the other hand, on the technological content of the production of the foreign affiliates, both in absolute terms and relatively to the domestic firms of the host country.

We arrive at a number of interesting conclusions. We found evidence of positive externalities, which are more likely to be exploited by the most productive domestic firms. This result is in line with previous studies highlighting the importance of absorptive capacity. Less productive firms, however, can partially compensate their

productivity gap and, therefore, reap some spillovers, by locating in the capital regions. Spillovers may occur both within and across sectors. Finally, both high tech and low tech foreign firms are able to generate positive spillovers, though with a different intensity. However, domestic firms can more easily take advantage from spillovers emanating from low tech foreign firms, while high tech MNEs are able to exert a significant impact on domestic firms' performance only in presence of a large technological gap, as it happens in Bulgaria. The Polish experience, instead, suggests that when the technological gap between foreign and domestic firms is very narrow, spillovers are barely significant.

The paper is organized as follows. In the next section we describe our data and the empirical strategy we adopt to answer the above mentioned research questions. In section 3 we describe the results of our estimations. The final section summarizes main results and concludes.

2. Data and methodology

The data used in this study constitute an unbalanced panel with annual information on more than 40,000 domestic manufacturing firms and about 10,000 foreign owned firms located in three transition countries, namely Bulgaria, Poland, and Romania.[4] Although they started with very similar technological levels and managerial skills, their transition towards market economy followed very different patterns and today Poland is a member of the European Union, while Bulgaria and Romania still have the status of candidate countries. The development of transition phase has affected the inflows of FDI (Resmini, 2000), which have responded positively to the structural reforms undertaken in Poland and negatively to the stagnation of the reform process in Bulgaria and Romania. Consequently, Poland has become very soon one of the most important FDI recipients in the area, while Bulgaria and Romania fail in attracting a consistent stock of foreign capitals. Given our research objectives, these and other socio-economic characteristics make the comparison of these three countries interesting.

[4] From a temporal perspective, it covers the period from 1995 to 2003, although for Bulgaria the analysis is restricted to more recent years (1998-2003) due to data availability.

The data come from the Amadeus database published by Bureau Van Djik. In addition to standard financial information it gives details on several qualitative variables, such as ownership characteristics, industry classification and the geographical location within countries. Although it seems to be a common practice to classify a firm as domestic, even in the absence of any information on the nationality of the ownership (Peri and Urban, 2004), we prefer to adopt a more restrictive strategy in order to avoid to overestimate the possible impact of foreign firms on domestic firm performance[5]. Firms with a share of foreign ownership exceeding 10 per cent have been classified as foreign affiliates, following the definition provided by the OECD and the IMF.

Table 1 summarizes the most important facts and figures concerning domestic and foreign firms in the above mentioned countries. In particular, fourth facts are worth of notice.

First of all, the capital regions account for a large proportion of both domestic and foreign firms. It ranges from 17-32 per cent for domestic firms and from 21-52% for foreign firms. Sofia region accounts for the largest percentages in both cases.[6] Secondly, most of FDI undertaken in the above mentioned countries belong to low tech sectors. The share of this kind of FDI ranges from 68% of Poland to 87% of Romania where the distribution of foreign firms between high and low tech sectors is quite similar to that of domestic firms. These asymmetries may create some problems in the estimation of the impact of FDI on domestic firms. On the one hand, spillovers may be limited to the capital regions, given the high concentration of foreign firms located there. On the other hand, the large presence of foreign firms in traditional labour intensive sectors – such as textiles, clothing, footwear, furniture, etc. – may reduce the scope for technology transfer to the foreign affiliates. Consequently, spillovers to domestic firms may be small or non-existing, regardless of ability of domestic firms to reap them.

The examination of the estimated productivity levels, reported at the bottom of Table 1, highlights other interesting features. First of all, Polish firms are the most productive of

[5] This restrictive strategy prevents us from including in the sample other countries, such as Hungary or Czech Republic.

[6] Since the Amadeus dataset is based on balance sheet data, one may argue that this phenomenon might reflect the location of headquarters rather than production plants. However, these results are consistent with other studies on the location of MNEs in the CEECs, based on other database recording production plants, only. See Altomonte and Resmini (2001) and Pusterla and Resmini (2005).

the sample, while the least productive locate in Bulgaria. Therefore, we expect that the technological gap between domestic and foreign firms is larger in Bulgaria than in Poland. Secondly, the capital regions host the most productive firms, regardless of the nationality of the ownership. Thirdly, and more importantly, Table 1 shows that foreign firms are *on average* more productive than domestic firms. However, when we control for the manufacturing sector they belong to, this is not necessarily true. Polish low tech foreign firms are more productive than foreign firms, while the productivity gap between low tech foreign firms and Romania low tech foreign firms is very narrow. We wonder how spillovers might occur in these cases.

In what follows, we will try to understand whether and to what extent these striking features may condition the distribution of spillovers across countries and their exploitation by domestic firms. In doing so, we will cast a new light on the spillovers and FDI topic.

(insert table 1 about here)

2.1 The empirical strategy

Our aim is to detect whether and to what extent foreign firms have affected the performance of domestic firms. Following the most recent literature, we have then constructed an appropriate measure for productivity at firm level.

We measured each domestic firm's total factor productivity (TFP) as the residual of a two-factor Cobb-Douglas production function.[7] Following the approach most commonly used by the recent literature on the topic, we apply the semi parametric estimation technique developed by Olley and Pakes (1996). This technique takes into account the simultaneity bias due to the endogeneity of the firm's input selection, which may arise if a firm responds to unobservable productivity shocks by adjusting its input choice. This would imply a correlation between the inputs and the error term, which biases traditional OLS coefficient estimates. Olley and Pakes suggest as a solution to

[7] Total factor productivity at firm level has been estimated using turnover as a proxy for total output, the stock of tangible fixed assets as a proxy for physical capital and number of employees. We lack industry specific deflators, thus financial data are expressed in thousands of US dollars. This implies that TFP might also capture price and demand shocks (De Loecker, 2005) and that we cannot exclude that MNEs' impact on domestic firms' performance affect prices rather than real productivity. Most of studies focusing on CEECs do not explicitly consider this potential distortion (Tydell and Yudaeva, 2005). We do it in the second step of our empirical analysis, as it is explained later on.

this problem the use of firm's investment decisions as a proxy for unobserved productivity shock[8]. We also estimate TFP using ordinary least squares, in order to assess the magnitude of the simultaneity bias.[9] We estimate the production function for each 2 digit NACE manufacturing sector separately. Due to the small number of observations in some sectors, we are forced to drop manufacturing of refined petroleum products (Nace 23) and recycling (Nace 37)[10].

Once estimated TFP at firm level, we explore the role played by MNEs as a determinant of domestic firms' performance, measured in term of TFP.

In order to achieve this objective, we need to find appropriate measures for foreign firm penetration at both sector and region level. A standard measure of foreign presence that also reflects the likely local nature of spillovers is the number of foreign firms in sector *i*, region *r* at time *t-1* (fdi_{irt-1}). This rough measure of FDI density has been then interacted with factors able to explain both the degree of interdependence of manufacturing sectors, as well as the nature – i.e. source for inputs or destination for output – of such interdependence. Both these characteristics can be inferred from input-output tables, which suggest us that each manufacturing sector is at the same time both a supplier and a customer of several manufacturing sectors, itself included.[11] In order to take into account this complexity, we have considered the following four measures for possible spillovers from multinational firms:

$$B\_SPILL_{it} = \sum_{j \neq i} \alpha_{ij} * fdi_{jrt-1} \quad (1)$$

$$HOR\_SPILL_{it}^{S} = \alpha_{ii} * fdi_{irt-1} \quad (2)$$

$$F\_SPILL_{it} = \sum_{j \neq i} \omega_{ij} * fdi_{jr-1t} \quad (3)$$

$$HOR\_SPILL_{it}^{C} = \omega_{ii} * fdi_{irt-1} \quad (4)$$

[8] Alternatively, Levinsohn and Petrin (2003) suggest that material inputs may be a better proxy for the firm's reaction to productivity shocks.

[9] Results are not shown, but they are available upon requests.

[10] For Romania we have a larger sample, which allows us to estimate TFP for all sectors.

[11] We use Input Output table at two digit level for all countries. However, they refer to different years, namely 1997 for Bulgaria, 2000 for Poland and 1998 in the case of Romania.

B_SPILL_{it} and F_SPILL_{it} measure foreign firm penetration in industries from which industry *i's* domestic firms source (sell) their inputs (output), thus accounting for vertical-backward and vertical-forward spillovers, respectively. α_{ij} (ω_{ij}) is the share of sector *j* output (input) that are supplied (sold) to sector *i*, as indicated by the input-output tables. $HOR\_SPILL^{S}_{it}$ and $HOR\text{-}SPILL^{C}_{it}$, instead, represent the foreign presence in the same sector as the domestic firms, weighted by the share of sector *i* total output (input) supplied (sold) to itself. Therefore, the two variables account for possible horizontal spillovers. While the coefficients taken by the input output tables remain fixed over time, the number of foreign firms operating in each sector changes. Hence, the variables capturing horizontal and vertical spillovers are time-varying sector-specific variables.

As stated in the introduction, horizontal spillovers are likely to involve sector specific technological knowledge, thus it is likely that foreign firms dislike them as they are supposed to benefit domestic competitors. However, since knowledge is a public good, multinational firms can not avoid it spills over domestic firms through imitation, training, demonstration effects as well as input-output linkages.[12] Vertical spillovers, both backward and forward, concern general technical knowledge and may be favoured by foreign firms, which have an incentive in contracting with more efficient upstream and downstream firms. Therefore, while the sign of horizontal spillovers is almost unpredictable, vertical spillovers are likely to show a positive sign.

We control for two important regressors. First of all, we need to account for the relevance of the absorptive capacity of domestic firms. As several previous studies suggested, it is necessary for domestic firms to have enough absorptive capacity in order to be able to capture the spillovers generated by multinational enterprises. In order to account for this important effect, we construct a technology gap variable. It has been defined as the difference between the average TFP of sector *i* in region *r* at time *t*, and the TFP of firm *k* in the same sector, region and year (Jabbour Mucchielli, 2005).[13]

[12] Since we use two digit industries to define sectors, some vertical spillovers may occur within sectors too.

[13] Foreign firms have been excluded from this calculation in order to not introduce any multicollinearity in the estimations.

Then we create a firm specific, time varying dummy variable (GAP_{kt}) taking the value of 1 if firm *k*'s TFP is below the industry average, and 0 otherwise. This dummy variable has been interacted with spillover variables. This allows us to identify separate effects for the less productive firms and the more productive ones, respectively.

Secondly, we include a measure for product market competition. The idea that FDI can create competitive pressure on host country's domestic firms has been discussed both at theoretical and empirical level (Markusen and Venables, 1999; Blomstrom et al., 2001; Haskel et al., 2002; Aitken and Harrison, 1999). Needless to say, these competitive pressures may induce adjustments in domestic firms' performance, especially if it is proxied by a not properly deflated measure of TFP (De Loecker, 2004). Since this is our case, we include in the set of the explanatory variables a measure for firm's pricing power ($MARKUP_{kt}$), computed as operational turnover minus employment costs over operational turnover. Its interpretation is very simple: the greater the difference between revenues and variable costs (proxied by labour costs) the greater power firms have to set prices, the less competitive is the market.[14] This variable should capture the impact of price adjustments to firms' performance. Therefore, we expect it to have a positive sign.

Our baseline specification, therefore, consists in the following two equations:

$$TFP_{kirt} = \alpha_k + \beta_1 B\_SPILL^S_{irt} + \beta_2 HOR\_SPILL^S_{ikt} + \beta_3 GAP_{kt} * B\_SPILL^S_{irt} + \\ + \beta_4 GAP_{kt} * HOR\_SPILL^S_{irt} + \beta_5 MARKUP_{kt} + \alpha_r + \alpha_t + \alpha_i + \varepsilon_{kirt} \qquad (5)$$

$$TFP_{kirt} = \delta_k + \gamma_1 F\_SPILL^C_{irt} + \gamma_2 HOR\_SPILL^C_{ikt} + \gamma_3 GAP_{kt} * B\_SPILL^C_{irt} \\ + \gamma_4 GAP_{kt} * HOR\_SPILL^C_{irt} + \gamma_5 MARKUP_{kt} + \delta_r + \delta_t + \delta_i + \eta_{kirt} \qquad (6)$$

Eq. (5) accounts for spillover effects generated by multinational firms operating in upstream sectors, while eq. (6) captures spillover effects emanating from multinational enterprises operating in downstream sectors. This estimation approach helps us to separately evaluate the magnitude of respectively forward and backward linkages both across but also within sectors. This strategy implies that the net effect of foreign on

[14] This index represents is a proxy for the Lerner index. Therefore, it ranges from zero (perfect competition) to one (monopoly).

domestic firms' productivity can be obtained by jointly evaluating the estimated βs of eq. (5) with the corresponding γs in eq. (6).[15]

Given the panel structure of the dataset, we estimate these equations using random effect models for the three countries separately. These allow us to account for the unobservable heterogeneity and to control for unobserved time invariant factors at firm, sector, and region level which might affect domestic firms' performance.[16] Finally, we include also time dummies in order to take into account the deep transformations which have characterised most of manufacturing sectors during the transition phase.

3. Estimation Results

In this section we present and discuss empirical estimates of spillovers emanating from foreign firms on domestic firms' TFP. We first focus on the estimations of eq. (5) and (6), then discuss whether and to what extent the geographical concentration of FDI in the capital regions is able to condition the general results. Finally, we explore whether and to what extent the concentration of FDI in low tech manufacturing sectors limit the generation of spillovers from foreign to domestic firms.

3.1 The baseline model

Table 2 shows the results of estimating eq. (5) and eq. (6) for Bulgaria, Poland and Romania. Overall, the results confirm, on the one hand, the importance of the absorptive capacity of local firms and, on the other hand, the non-automaticness of spillovers generated by MNEs. Only the more productive firms, in fact, seem to be able to benefit from spillovers emanating from multinational enterprises. Both specific and generic

[15] This estimation strategy is quite different from previous studies, where similar backward and forward measures for spillovers are simultaneously estimated (Smarzynska Javornic, 2004; Schoor and van der Tol, 2002). However, it seems to us the best way to proceed, given the high levels of pairwise correlations among spillover variables (see table A.1 in the appendix)

[16] Needless to say, we estimate fixed effects models, too. Both models provide estimates which are very similar to each other in terms of both the significance and the signs of the estimated coefficients. For that reason, we decide to show random effect results only, though they sometime are not supported by statistics. In particular, the Hausman test indicate that Random effects explain what happens in Poland better than fixed effects, while the opposite occurs for Bulgaria. As far as Romania is concerned, random effect models are acceptable in most of specifications. Results are available from the authors upon request.

knowledge spill over domestic firms, though with different intensity. The estimated coefficients for vertical spillovers are larger than those for horizontal spillovers in all countries. However, foreign firms exert the highest impact on Bulgarian firms and the lowest one on Romanian firms.

Less productive firms, instead, can not benefit from FDI regardless of the country they belong to. The estimated coefficients for the spillover variables are negative and significant at the conventional levels. [17] This indicates that the technological delay is so huge that it prevents this type of domestic firms for reaping any kind of knowledge brought into their respective countries by MNEs. The latter, therefore, has seen as "cathedrals in the desert" by this group of firms.

As far as the other variables are concerned, the coefficients of the capital dummies are positive but significant in the case of Romania only, where, however, its inclusion does not change either the sign or the magnitude of the spillover coefficients. This indicates that the capital regions are not able to affect the location of more productive domestic firms within each country. Their role is completely different, as it will be discussed in the next section. The mark up variable is positive in all specification but significant in the case of Romania only.

(insert table 2 about here)

3.2 Is the location in the capital region an 'atou'?

In order to understand whether and to what extent being located in the capital region represents an advantage in term of capacity to reap spillovers generated by MNEs, we interact the capital dummy with the spillover variables. Results for the relevant variables are shown in table 3.

Generally speaking, less productive domestic firms located outside the capital regions suffer from the presence of MNEs, as indicated by the negative and significant coefficients of the spillover variables. Those located in the capital regions, instead, can

[17] Given the way spillover variables have been built up, the coefficients of the interacted variables indicate by how much the slope coefficients of the less productive firms differ from the slope coefficients of the more productive firms. Since the differential slope coefficients are negative and larger than coefficients of spillover variables for more productive firms, we can conclude that on average less productive firms do not reap any externalities from MNEs.

reduce this negative impact and sometimes benefit from some spillovers, both vertical and horizontal such as in Bulgaria and Romania, or horizonatal only, as in the case of Romania. Overall, these results indicate the location in the capital region allows less productive domestic firms to mitigate the negative impact exerted by MNEs and, in some cases, to reap part of the knowledge brought into the region by the multinational firms. Urbanization externalities, therefore, might partially compensate the lack of technological capabilities of firms.

The evidence for the more productive firms is less clear. Outside the capital regions, we found evidence of both vertical and horizontal spillovers. In Romania, however, the evidence for the transfer of specific knowledge sensibly weakens, since the marginal impact of horizontal spillovers on domestic firms' performance is very close to zero. Differently from what happens in case of the less productive firms, the location around the capital city does not represent an advantage for the more productive firms. Pro-competitive effects clearly emerge in Poland and Bulgaria, while in Romania some vertical spillovers accrue to domestic firms. Overall these results indicates that horizontal spillovers are more likely to occur outside the capital regions, where the concentration of the most productive firms may reduce the scope for reaping externalities generated by MNEs.

(insert tables 3 about here)

3.3. Are all foreign firms able to generate spillovers?

The last topic we want to explore is whether foreign firm characteristics affect the transmission of spillovers on the domestic firms. In particular, we explore whether foreign affiliates with a different technology intensity are able to exert the same impact on domestic firms' performance. To achieve this goal, we consider two types of foreign firms, namely firms operating in high tech sectors and firms operating in traditional labour intensive sectors.[18] Then we recalculate the FDI penetration variable (fdi_{ijt}) in order to take into account this difference. Needless to say, we expect that the more the density of FDI in technologically advanced sectors the higher the probability of generating spillovers.

[18] The classification of manufacturing sectors in low and high tech ones is presented in table A.2 in the appendix.

Table 4 shows the results for the three considered countries. Generally speaking, they confirm our hypothesis. The impact on domestic firms' performance of high tech foreign firms is larger than that exerted by low tech foreign affiliates, as indicated by the magnitude of the estimated coefficients of spillover variables. However, this impact is not necessarily positive.

In Bulgaria, only more productive domestic firms succeed in reaping positive externalities emanating from both high tech and low tech foreign firms. As before, less productive domestic firms are not able to take advantage from the presence of foreign firms, with the exception of some horizontal spillovers emanated by high tech foreign firms.

The empirical evidence in Poland is less clear. We found that horizontal and vertical-spillovers take place between low tech foreign firms and more productive domestic firms.. On the contrary, high tech foreign firms do not seem to be able to benefit Polish firms, with the exception of some horizontal spillovers and vertical backward externalities accruing to less productive domestic firms.

As far as Romania is concerned, we observe that both low tech and high tech foreign firms generate positive spillovers for the more productive domestic firms. Vertical spillovers are more intense than horizontal one in both cases. Less productive firms are instead unable to catch-up their technological delay through spillovers, as indicated by the differential slope coefficients, which are negative, larger and statistically different from those of more productive firms.

Overall these results indicate that low tech foreign firms are more likely to benefit domestic firms in Central and Eastern Europe, provided that they have the necessary level of absorptive capacity. Although they are able to generate both kinds of spillovers, the impact of generic knowledge is more intense than that of specific knowledge. Quite surprisingly, high tech foreign firms exert some positive effects on firms' performance only when the technological gap with the domestic firms is very high. This result is consistent with previous studies, (Peri and Urban, 2004).

(insert Table 4 about here)

4. Summary and Conclusions

In this paper we tried to answer three questions concerning the effects of FDI on domestic firms' performance in three CEECs, namely Bulgaria, Poland and Romania. We provided an answer, though not definite, to all of them.

First of all, we demonstrated that MNEs are able to positively affect domestic firms' performance. However, only more productive domestic firms can reap these benefits. It is a reassuring result which confirms the importance of the absorptive capacity as a determinant of productivity spillovers. Secondly, we found evidence of both horizontal and vertical-backward and vertical-forward spillovers generated by both high and low tech foreign firms. Generally speaking, spillovers emanating from high tech foreign firms are stronger than those generated by low tech multinational enterprises.

These general results, however, uncover a very mixed picture not only across countries, but also within countries, when we control for the location within or outside the capital regions.

In particular, we found that flows of specific knowledge are more diffuse outside the capital regions, though they accrue to the more productive firms only. In the capital regions, pro-competitive effects are more likely to occur, and unfortunately they are barely compensated by flows of generic knowledge across complementary sectors. Less productive firms located in Warsaw and Sofia regions are able to reap both horizontal and vertical spillovers, while Romania firms located around Bucharest benefit from flows of specific knowledge only. Overall, these results indicate that urbanization externalities, making firms more effective, might mitigate the technology gap thus allowing less efficient firms to take advantage from the presence of foreign firms. This is a novelty in the panorama of similar previous studies and deserves further analysis.

As far as foreign firms' heterogeneity is concerned, we found that domestic firms respond differently to externalities emanating from low and high tech foreign firms. Again, the results confirm the inability of less productive firms to reap spillovers regardless of what type of foreign firms we are considering. To this respect, a noticeable exception is represented by Polish and, though to a lesser extent, Bulgarian less productive firms, which are able to benefit from horizontal externalities emanating from high tech foreign firms.

High tech foreign firms, instead, benefit more productive domestic firms in Bulgaria and Romania, but not in Poland. However, while in Bulgaria flows of specific knowledge are more intense than those of generic knowledge, the opposite happens in Romania.

Although the present work uses the same database for three different transition countries, the variety of results obtained makes any generalisation difficult. Overall, our results indicate that the mechanism through which FDI affects domestic firms' total factor productivity is still poorly understood and thus need further researches.

References

Aitken B. and A. Harrison (1999), "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela", *American Economic Review*, vol. 89, n. 3, pp. 605-618.

Alfaro L. and A. Rdoreiguez-Clare (2004), "Multinationals and linkages: an empirical investigation", *Economia*, spring, pp.113-169.

Altomonte C. and L. Resmini (2001), "The geography of foreign direct investment in transition countries: a survey of evidence", in A. Tavidze (ed. by) *Progress in International Economics Research*, Nova Science Publishers, New York., pp. 1-36.

Altomonte, C. and L. Resmini (2002), "Multinational Enterprises as a catalyst for Local Industrial Development. The case of Poland", *Scienze Regionali. The Italian Journal of Regional Science*, vol. 1, n. 2, pp. 29-58.

Blomstrom M., Globerman S. and A. Kokko (2001), "The determinants of host country sprillovers from foreign direct investment: a review and synthesis of the literature", Pain N. (Ed. by), *Inward investment, technological change and growth: the impact of multinational corporations on the UK economy*, Houndmills, New York.

Brand, S., Hill, S. and M. Munday (2000), "Assessing the Impacts of Foreign Manufacturing on Regional Economies: The Case of Wales, Scotland and the West Midlands", *Regional Studies*, vol. 34, n. 4, pp. 343-355.

Crones, M. and D. Watts (2000), "MNE supply linkages and the local SME sector", NIERC working paper n. 57, Belfast.

De Loecker, J. (2005), "Product differentiation, multi-product firms and structural estimation of productivity", KU Leuven, mimeo.

Djankov S. and B. Hoeckman (2000), "Foreign investment and Productivity growth in Czech enterprise", *World Bank Economic Review*, vol. 14, n. 1, pp. 49-64.

Driffield, N. and A. Noor (1999), "Foreign Direct Investment and local input linkages in Malaysia", *Transnational Corporations*, vol. 8, n.3, pp. 1-24.

Glass A., Kosteas V. and K. Saggi (2000), "Linkages, multinationals and industrial development", mimeo.

Gorg H. and D. Greenaway (2002), "Much ado about nothing? Do domestic firms really benefit from foreign investment?", CEPR discussion paper n. 3485.

Gorg H. and E. Strobl (2001), "Multinational companies and productitvity spillovers: a meta-analysis", *The Economic Journal*, vol. 111, pp. 723-739.

Haddad M. and A. Harrison (1993), "Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco", *Journal of Development Economics*, vol. 42, pp. 51-74.

Haskel J., Pereira S. and M. Slaughter (2002), Does inward foreign direct investment boost the productivity of domestic firms?", NBER working paper n. 8724.

Helpman H. (1984), "Multinational corporation and trade structure", *Review of Economic Studies*, vol. 92, n. 3, pp. 451-471.

Hirschman, A. (1958), *The strategy of Economic development*, New Haven, CT, Yale University Press.

Jabbour L. and J.L. Mucchielli (2005), "Foreign affiliates in the French manufacturing industry: source or recipient of technology spillovers?", mimeo.

Konings J. (2001), "The effect of direct foreign investment on domestic firms: evidence from firm level panel data in emerging economies", *Economics of Transition*, vol. 9, n. 3, pp. …

Kugler M. (2005), "Spillovers from Foreign direct investment: within or between industries?", mimeo.

Levinsohn J. and A. Petrin (2003), "Estimating production functions using inputs to control for unobservables", *Review of Economic Studies*, vol. 70, pp. 317-341.

Markusen J. and A. Venables (1999), Foreign direct investment as a catalyst for industrial development", *European Economic Review*, vol. 43, n. 2, pp335-356.

Markusen, J. (1995), "The Boundaries of Multinational Enterprise and the Theory of International Trade, *Journal of Economic Perspectives*, vol. 9, n. 2, pp. 169-189

Olley S. and A. Pakes (1996), "The dynamics of productivity in the telecommunication quipment industry", *Econometrica* vol. 64, n. 6, pp. 1263-1297.

Pavlinek, P. and A. Smith (1998), "Internationalisation and Embeddedness in East-Central European Transition: The Contrasting Geography of Inward Investment in the Czech and Slovak Republics", *Regional Studies*, vol. 32, n. 7, pp. 619-638.

Peri G. and D. Urban (2004), Catching-up to foreign technology? Evidence on the "Veblen-Gerschenkron" effect of foreign investiment", NBER working paper n. 10893.

Pusterla F. and L. Resmini (2005), "Where do foreign firms locate in transition countries? An empirical investigation", Università Bocconi, ISLA working paper n. 20.

Resmini, L. (2000), "The determinants of foreign direct investment into the CEECs: new evidence from sectoral patterns", *The Economics of Transition*, vol. 8, n. 3, pp. 665-689

Rodriguez-Clare, R. (1996), "Multinationals, Linkages, and Economic Development", *American Economic Review*, vol. 86, n. 4, pp. 852-873.

Schoor K. and B. van der Tool (2002), "The productivity effect of foreign ownership on domestic firms in Hungary, working paper . 157, University of Gent.

Smarzynska Javornic B. (2004), "Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages", *American Economic Review*, vol. 94, n. 3, pp. 605-627.

Steward, J. (1976), "Linkages and Foreign Direct Investment", Regional Studies, vol. 10, pp. 245-258.

Torlak E. (2004), "Foreign direct investment, technology transfer, and productivity growth in transition countries. Empirical evidence from panel data", CEGE-Discussion paper n. 26.

Turok, I. (1993), "Inward Investment and Local Linkages: How Deeply Embedded is 'Silicon Glen'?", *Regional Studies*, vol. 27, n. 5, pp. 401-417.

Tydell I. and K. Yudaeva (2005), "The role of FDI in Eastern Europe and New Independent Srtates: new channels for the spillover effect", mimeo.

UN/ECE (2001), "Economic Growth and Foreign Direct Investment in the Transition Economies", chapter 5, *Economic Survey of Europe*, n.1, United Nation, Geneva, pp. 185-225.

UNCTAD, (2001), *World Development Indicator. Promoting Linkages*, chapter IV, pp. 129-215, UNCTAD, Geneva.

Yudaeva K., Kozlov K., Melentieva N. and N. Ponomareva (2003), "Does foreign ownership matter? The Russian experience", *Economics of Transition*, vol. 11, n. 3, pp. 383-409.

Table 1 – Domestic and foreign firms in the transition countries

	Bulgaria		Poland		Romania	
	domestic	foreign	domestic	foreign	domestic	foreign
n of firms	2623	1159	4526	1502	33970	7165
of which:						
in the capital region	827	608	755	322	6098	1771
outside the capital region	1796	551	3771	1180	27872	5394
low tech sectors	1977	979	3304	1027	30236	6206
high tech sectors	646	180	1222	475	3734	959
Estimated Productivity index (averages):						
all sample	2.660	3.342	4.660	4.885	3.163	3.459
in the capital region	2.804	3.646	5.212	5.039	3.529	3.887
outside the capital region	2.584	2.941	4.585	4.849	3.102	3.339
low tech sectors	2.604	3.198	4.882	4.763	3.674	3.749
high tech sectors	2.865	4.129	4.146	5.147	3.099	3.417

Own calculations on AMADEUS database. Productivity indexes have been computed as simple mean of TFP (in log form) of firms belonging to the same country. TFP at firm level has been estimated with Olley and Pakes (1996) semiparametric procedure, as described in the text.

Table 2 - The baseline models: Bulgaria

	Bulgaria		Poland		Romania	
	(1)	(2)	(1)	(2)	(1)	(2)
Supplier sectors						
Horizontal linkages	.027 (.0110)[b]	.028 (.0108)[a]	.011 (.0030)[a]	.011 (.0027)[a]	.005 (.0002)[a]	.005 (.0001)[a]
Backword linkages	.162 (.0218)[a]	.165 (.0209)[a]	.062 (.0098)[a]	.064 (.0067)[a]	.012 (.0004)[a]	.012 (.0004)[a]
tech gap * Hor linkages	-.072 (.0064)[a]	-.072 (.0064)[a]	- .017 (.0016)[a]	- .017 (.0016)[a]	-.010 (.0001)[a]	-.010 (.0001)[a]
tech gap *Back linkages	-.275 (.0099)[a]	-.275 (.0099)[a]	-.091 (.0034)[a]	-.090 (.0034)[a]	-.027 (.0003)[a]	-.027 (.0003)[a]
markup	.588 (.0188)[a]	.591 (.0188)[a]	.000 (.0001)	.000 (.0001)	.172 (.0036)[a]	.173 (.0036)a
capital	-	.066 (.0696)	-	.025 (.0698)	-	.335 (.0154)[a]
sector dummies	yes	yes	yes	yes	yes	yes
region dummies	yes	-	yes	-	yes	-
time dummies	yes	yes	yes	yes	yes	yes
firm dummies	yes	yes	yes	yes	yes	yes
n. of obs	5826	5826	5837	5837	91429	91429
R square	0.76	0.76	0.82	0.82	0.43	0.43
Client sectors						
Horizontal linkages	.034 (.0085)[a]	.035 (.0081)[a]	.011 (.0026)[a]	.012 (.0022)[a]	.004 (.0001)[a]	.005 (.0001)[a]
Forward linkages	.109 (.0151)[a]	.112 (.0144)[a]	.044 (.0080)[a]	.051 (.0060)[a]	.011 (.0004)[a]	.012 (.0004)[a]
tech gap * Hor linkages	-.070 (.0038)[a]	-.070 (.0038)[a]	- .018 (.0013)[a]	- .018 (.0013)[a]	-.009 (.0001)[a]	-.008 (.0001)[a]
tech gap *For linkages	-.161 (.0063)[a]	-.161 (.0063)[a]	-.076 (.0031)[a]	-.076 (.0031)[a]	-.028 (.0003)[a]	-.028 (.0003)[a]
markup	.599 (.0189)[a]	.602 (.0188)[a]	.000 (.0001)	.000 (.0001)	.169 (.0036)[a]	.169 (.0036)[a]
capital	-	.005 (.0768)	-	.051 (.0716)	-	.344 (.0156)[a]
sector dummies	yes	yes	yes	yes	yes	yes
region dummies	yes	-	yes	-	yes	-
time dummies	yes	yes	yes	yes	yes	yes
firm dummies	yes	yes	yes	yes	yes	yes
n. of obs	5826	5826	5837	5837	91429	91429
R square	0.75	0.74	0.81	0.81	0.46	0.46

Standard error in parenthesis; a, b, c denote significance at 1, 5 and 10% level.

Table 3 – The role of the capital city

	Less productive domestic firms		More productive domestic firms	
Bulgaria	capital	Rest of the country	capital	Rest of the country
Supplier sectors				
Horizontal linkages	.151 (.0170)[a]	-.202 (.0156)[a]	- .087 (.0255)[a]	.104 (.0196)[a]
Backward linkages	.153 (.0243)[a]	-.405 (.0218)[a]	.002 (.0293)	.159 (.0325)[a]
n. of obs: 5826				
R square: 0.77				
Client sectors				
Horizontal linkages	.123 (.0115)[a]	-.180 (.0107)[a]	-.060 (.0161)[a]	.084 (.0194)[a]
Forward linkages	.168 (0173)[a]	-.305 (.0160)[a]	-.091 (.0271)[a]	.189 (.0321)[a]
n. of obs: 5826				
R square: 0.77				

	Less productive domestic firm		More productive domestic firm	
Poland	capital	Rest of the country	capital	Rest of the country
Supplier sectors				
Horizontal linkages	.025 (.0033)[a]	-.035 (.0027)[a]	-.015 (.0040)[a]	.022 (.0039)[a]
Backward linkages	.040 (.0072)[a]	-.101 (.0042)[a]	-.019 (.0085)[b]	.071 (.0075)[a]
n. of obs: 5873				
R square: 0.82				
Client sectors				
Horizontal linkages	.022 (.0026)[a]	-.033 (.0022)[a]	-.013 (.0032)[a]	.023 (.0032)[a]
Forward linkages	.050 (.0064)[a]	-.092 (.0038)[a]	-.023 (.0076)[a]	.059 (.0067)[a]
n. of obs: 5873				
R square: 0.82				

	Less productive domestic firm		More productive domestic firm	
Romania	capital	Rest of the country	capital	Rest of the country
Supplier sectors				
Horizontal linkages	.008 (.0002)[a]	-.013 (.0001)[a]	-.004 (.0002)[a]	.008 (.0002)[a]
Backward linkages	-.004 (.0006)[a]	-.026 (.0003)[a]	.007 (.0006)[a]	.011 (.0004)[a]
n. of obs: 91429				
R square: 0.45				
Client sectors				
Horizontal linkages	.006 (.0002)[a]	-.011 (.0001)[a]	-.003 (.0002)[a]	.007 (.0002)[a]
Forward linkages	.006 (.0005)[a]	-.030 (.0003)[a]	.002 (.0005)[a]	.012 (.0005)[a]
n. of obs: 91429				
R square: 0.41				

Standard error in parenthesis; a, b, c denote significance at 1, 5 and 10% level. Other regressors are competition control variable as well as firm, sector and time specific effects, as explained in the text.

Table 4 – High Tech vs. Low Tech foreign firms

	Less productive domestic firm		More productive domestic firm	
Bulgaria	high tech	low tech	high tech	low tech
Supplier sectors				
Horizontal linkages	-1.069 (.1730)[a]	-.078 (.0064)[a]	1.417 (.2780)[a]	.036 (.0111)[a]
Backward linkages	-.389 (.0235)[a]	-.182 (.0165)[a]	.290 (.0493)[a]	.095 (.0249)[a]
n. of obs: 5842				
R square: 0.76				
Client sectors				
Horizontal linkages	-.319 (.0905)[a]	-.070 (.0038)[a]	.337 (.1125)[a]	.034 (.0084)[a]
Forward linkages	-.381 (.0272)[a]	-.122 (.0079)a	.232 (.0637)[a]	.079 (.0154)[a]
n. of obs: 5842				
R square: 0.76				

	Less productive domestic firm		More productive domestic firm	
Poland	high tech	low tech	high tech	low tech
Supplier sectors				
Horizontal linkages	.167 (.0366)[a]	-.031 (.0030)[a]	-.062 (.0520)	.022 (.0052)[a]
Backward linkages	.080 (.0200)[a]	-.220 (.0116)[a]	-.012 (.0316)	.157 (.0222)[a]
n. of obs: 5873				
R square: 0.81				
Client sectors				
Horizontal linkages	-.046 (.0141)[a]	-.032 (.0025)[a]	.034 (.0208)c	.025 (.0046)[a]
Forward linkages	-.071 (.0152)[a]	-.104 (.0075)[a]	.032 (.0220)	.109 (.0158)[a]
n. of obs: 5873				
R square: 0.80				

	Less productive domestic firm		More productive domestic firm	
Romania	high tech	low tech	high tech	low tech
Supplier sectors				
Horizontal linkages	-.028 (.0016)[a]	-.009 (.0001)[a]	.001 (.0018)	.004 (.0002)[a]
Backward linkages	-.089 (.0015)[a]	-.018 (.0003)[a]	.037 (.0020)[a]	.007 (.0004)[a]
n. of obs: 91429				
R square: 0.45				
Client sectors				
Horizontal linkages	-.034 (.0019)[a]	-.008 (.0001)[a]	.007 (.0022)a	.004 (.0001)[a]
Forward linkages	-.085 (.0019)[a]	-.020 (.0003)[a]	.041 (.0026)[a]	.007 (.0005)[a]
n. of obs: 91429				
R square: 0.47				

Standard error in parenthesis; a, b, c denote significance at 1, 5 and 10% level. Other regressors are competition control variable as well as firm, sector and time specific effects, as explained in the text.

Appendix

Table A.1 Spillover variables: correlation matrix

	HOR_SPILL^S	B_SPILL	HOR_SPILL^C	F_SPILL
HOR_SPILL^S	BG: 1.00 PL: 1.00 RO: 1.00			
B_SPILL^S	BG: .009 PL: .015** RO: - .21**	BG: 1.00 PL: 1.00 RO: 1.00		
HOR_SPILL^C	BG: .97** PL: .99** RO: .97**	BG: .054** PL: .012* RO: - .07**	BG: 1.00 PL: 1.00 RO: 1.00	
F_SPILL	BG: - .19** PL: - .054** RO: - .13**	BG: .57** PL: .80** RO: .57**	BG: -.25** PL: - .10** RO: - .17**	BG: 1.00 PL: 1.00 RO: 1.00

**, * denote significance at 1and 5% level.

Table A.2. Classification of Manufacturing Industries (Nace Rev. 1 codes in parenthesis*)*

High-Technology Industries	Low-Technology industry
Aircrafts and Spacecrafts (353)	Building and repair of ships and boats (351)
Office, accounting and computing machinery (30)	Rubber and plastic products (25)
Radio, TV and communications equipment (32)	Coke, refined petroleum products and nuclear fuel(23)
Medical, precision and optical instruments (33)	Other non-metallic mineral products (26)
Electrical machinery and apparatus n.e.c. (31)	Basic metals and fabricated metal products (27-28)
Motor Vehicles, trailers and semi-trailers (34)	Manufacturing n.e.c., recycling (36-37)
Chemicals (excluding pharmaceuticals) (24)	Wood, pulp, paper prod., printing and publishing (20-22)
Railroad and transport equipment (352, 353, 354)	Food products, beverages and tobacco (15-16)
Machinery and equipments n.e.c. (29)	Textiles, textile products, leather and footwear (17-19)