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
JEL codes: F23, P31, P52.

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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 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*. In both cases domestic firms become more productive and efficient, thus fostering local industrial development as suggested by several economists from Hirschman (1954) and

[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).

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 affects 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 concentrate the most 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* spillovers. 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 previously 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 paths and today Poland is a member of the European Union, while Bulgaria and Romania still have the status of candidate countries. The development of the 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.[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. All other firms with a percentage of foreign ownership below 10 per cent have been classified as domestic. 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. Therefore we have excluded from the sample all firms whose ownership could not be properly identified.[6]

Table 1 summarizes the most important facts and figures concerning domestic and foreign firms in the above mentioned countries. Several interesting 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 to 32 per cent for domestic firms and from 21 to 52% for foreign firms. Sofia region accounts for the largest percentages in both cases.[7] 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

[5] Amadeus provides the latest available information on stakeholders' nationalities. Therefore, we have to assume that ownership remains unchanged over the sample period.

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

[7] 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).

scope for technology transfer to the foreign affiliates. Consequently, spillovers to domestic firms may be small or non-existing, regardless of the 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, firms located in Poland are the most productive of the sample, regardless of the ownership, while Bulgaria hosts the least productive ones. 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 and the location within the host country this is not necessarily true. Polish firms located in the capital region and/or belonging to low tech manufacturing sectors are more productive than the corresponding foreign firms, while the productivity gap between low tech foreign firms and Romania's 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.[8] Following the approach most

[8] 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

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 this problem the use of firm's investment decisions as a proxy for unobserved productivity shock[9]. We estimate the production function for each 2 digit NACE manufacturing sector separately.[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, and 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 that each manufacturing sector is at the same time both a supplier (*S*) and a customer (*C*) 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:

$$VERT\_SPILL^{S}_{irt} = \sum_{j \neq i} \alpha_{ij} * fdi_{jrt-1} \quad (1)$$

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

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focusing on CEECs do not explicitly consider this potential distortion (Tydell and Yudaeva, 2005; Torlak, 2004). We do it in the second step of our empirical analysis, as it is explained later on.

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

[10] Two sectors, namely manufacturing of refined petroleum products (NACE 23) and recycling (NACE 37) have been excluded, since the small number of firms operating in these sectors makes it impossible to apply the Olley and Pakes procedure.

[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.

$$VERT\_SPILL^{C}_{irt} = \sum_{j \neq i} \omega_{ij} * fdi_{jrt-1} \quad (3)$$

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

$VERT\_SPILL^{S}_{irt}$ and $VERT\_SPILL^{C}_{irt}$ measure foreign firm penetration in industries from which industry *i's* domestic firms source (sell) their inputs (output), thus accounting for vertical-forward and vertical-backward spillovers within region *r*, respectively.[12] α_{ij} (ω_{ij}) is the share of sector *j* output (input) that is supplied (sold) to sector *i*, as indicated by the input-output tables. $HOR\_SPILL^{S}_{irt}$ and $HOR\text{-}SPILL^{C}_{irt}$, instead, proxy the presence of foreign in the same sector (and region) 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 within each region 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.[13] 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

[12] Figure 1 offers a graphical representation of these relationships.
[13] Since we use two digit industries to define sectors, some vertical spillovers may occur within sectors too. This caveat has to be taken in mind when interpreting our results.

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).[14] 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 domestic firms and the more productive ones, respectively.

Secondly, we include a measure for product market competition. The idea that the degree of competition may affect firms' productivity is not new in the literature, both at theoretical and empirical level (Markusen and Venables, 1999; Blomstrom et al., 2001; Haskel et al., 2002; Sinani and Mayer, 2005). Competition can stimulate firms to use more efficiently the existing technology in order to maintain their market shares. However, it can also be detrimental for firms, if the entry of a new competitor forces incumbent firms to move up their average cost curves. Both these effects can be a direct consequence of the entry of a MNE. Therefore, without a direct control on competition, the coefficients of spillover variables can pick-up both technological spillovers and pro-competitive effects.[15] In order to obtain a measure as close to technological spillovers as possible, we decide to control for the degree of competition faced by firms in their respective product markets. The variable we include in the set of the explanatory variables ($MARKUP_{kt}$), has been computed as operational turnover minus employment and material costs over operational turnover. Its interpretation is very simple: the greater the difference between revenues and variable costs, the greater power firms have to set prices, the less competitive is the market.[16] Given the opposite effects competition can exert on firm productivity, we can not predict its sign.

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

[15] Some scholars (Aitken and Harrison, 1999; Konings, 2001) ascribe to pro-competitive effects their findings of negative spillovers. However, they are not pure technological spillovers – i.e. Pareto improving positive externalities – but a transfer of welfare from the employees – who put more efforts in doing their job in order to keep the firm viable – to the shareholders (Haskel et al. 2002).

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

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

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

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

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 domestic firms' productivity can be obtained by jointly evaluating the estimated βs of eq. (5) with the corresponding γs in eq. (6).[17]

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 unobserved heterogeneity and to control for unobserved time invariant factors at firm, sector, and region level which might affect domestic firms' performance.[18] 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.

[17] This estimation strategy is quite different from previous studies, where similar backward and forward measures for spillovers have been 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 that characterize spillover variables (see table A.1 in the appendix).

[18] 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.

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 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 in all specifications.[19] 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

[19] 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.

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' for domestic firms?

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 do not benefit from the presence of MNEs, as indicated by the negative and significant differential slope coefficients of the spillover variables, which are always negative, significant and larger than those for more productive domestic firms located outside the capital regions.[20] Those located in the capital regions, however, are sometime able to reap part of the knowledge – specific knowledge in Bulgaria and Romania and generic and specific knowledge in Poland – brought into the region by MNEs. Urbanization externalities, therefore, might partially compensate the lack of technological capabilities of firms.

The evidence for the more productive firms is even more clear. Differently from what happens in case of the less productive firms, knowledge spillovers occur both within and outside the capital regions. However, the evidence for the transfer of specific knowledge sensibly weakens in Romania, where the marginal impact of horizontal spillovers on domestic firms' performance is very close to zero and totally disappears in Poland. This result might be explained by fact that in the capital region, foreign firms have no productivity advantage over domestic firms, as it has been shown in table 1.

[20] Table 3 shows differential slope coefficients. The benchmark case is more productive domestic firms (GAP=0) located outside the capital region (capital dummy = 0). Therefore, in order to obtain the final impact MNEs exert on, for example, less productive domestic firms we need to sum up the differential slope coefficients with those of the corresponding benchmark cases.

Therefore, there is no scope for intra-sectoral technological externalities, while pro-competitive effects might be exacerbated.

(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 to 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.[21] 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.

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, high tech foreign firms generate both horizontal and vertical spillovers, but the latter accrue to the more productive domestic firms only, which are also able to benefit from knowledge spillovers emanating from low 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. However, while low tech foreign firms generate both type of knowledge spillovers, high tech foreign firms generate vertical spillovers only. Generally speaking, the latter are more

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

intense than the horizontal one. 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 local firms in Central and Eastern Europe are more likely to benefit from low tech rather than high tech foreign firms, provided that they have the necessary level of absorptive capacity. Although low tech foreign firms 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 seems to be very high, as it occurs in Bulgaria and in Poland for the less productive firms. These results, though counterintuitive, suggest that the so called Veblen-Gerschenkron effect might be at work in these countries.[22]

(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 affected domestic firms' performance, measured by TFP. However, only more productive domestic firms can reap technological externalities emanating from FDI. 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 foreign firms. Flows of specific knowledge are generally speaking less intense than flows of generic knowledge.

[22] According to Veblen (1915) and Gerschenkron (1952), the largest effect of foreign firms on domestic ones is likely to occur where the concentration of FDI is small and the technological advantage of foreign firms is high (Peri and Urban, 2004). Both these conditions occur in Bulgaria and, perhaps, in some of the least developed Polish regions, as table 1 indicates.

These general results uncover a very mixed picture not only across and within countries – when we control for the location in or outside the capital regions – but also among low tech and high tech multinational enterprises.

In particular, we found that, outside the capital regions, the flows of specific knowledge accrue to the more productive firms only, while they are able to benefit both types of domestic firms in the capital regions. These results indicate that urbanization externalities 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. On average, 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 Bulgarian less productive firms, which are able to benefit from horizontal externalities emanating from high tech foreign firms.

We found evidence of knowledge spillovers from high tech foreign firms to 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.

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Figure 1 – Vertical and horizontal linkages between domestic and foreign firms

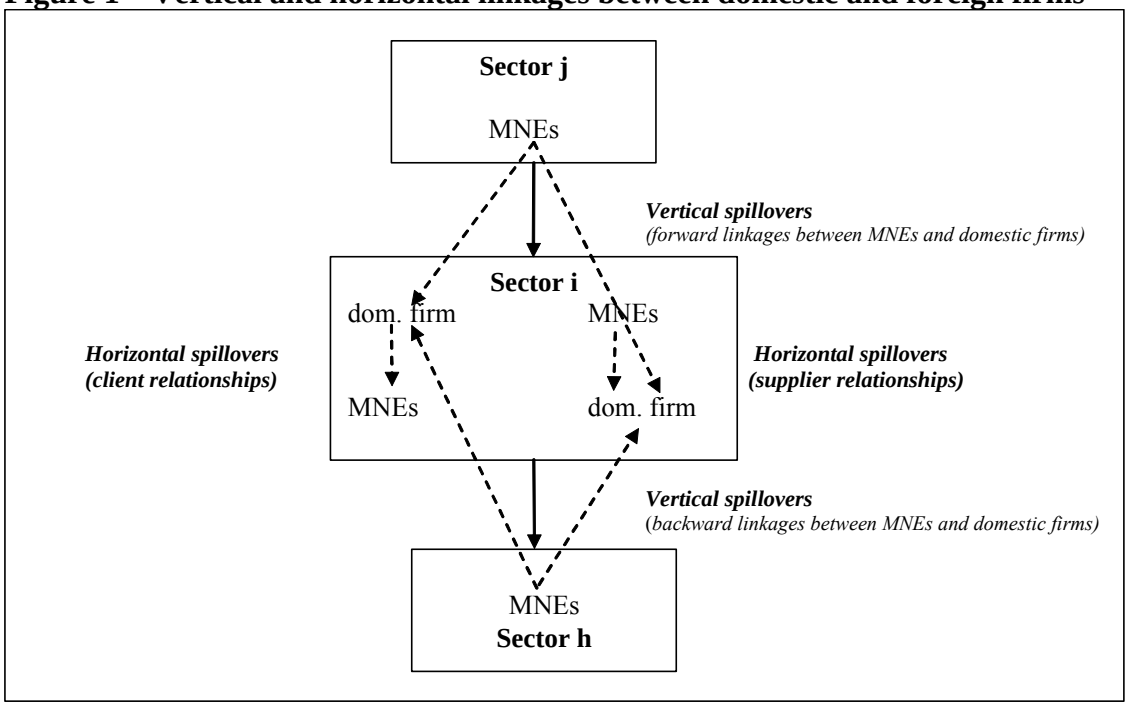

Table 1 – Domestic and foreign firms in the transition countries

	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. TFP at firm level has been estimated with Olley and Pakes (1996) semiparametric procedure, as described in the text.

Table 2 - The baseline model

	Bulgaria		Poland		Romania	
	(1)	(2)	(1)	(2)	(1)	(2)
Supplier sectors						
Horizontal Spillovers	.027 (.0110)[b]	.028 (.0108)[a]	.011 (.0030)[a]	.011 (.0027)[a]	.005 (.0002)[a]	.005 (.0001)[a]
Vertical Spillovers	.162 (.0218)[a]	.165 (.0209)[a]	.062 (.0098)[a]	.064 (.0067)[a]	.012 (.0004)[a]	.012 (.0004)[a]
Gap * Hor Spillovers	-.072 (.0064)[a]	-.072 (.0064)[a]	- .017 (.0016)[a]	- .017 (.0016)[a]	-.010 (.0001)[a]	-.010 (.0001)[a]
Gap * Ver Spillovers	-.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 Spillovers	.034 (.0085)[a]	.035 (.0081)[a]	.011 (.0026)[a]	.012 (.0022)[a]	.004 (.0001)[a]	.005 (.0001)[a]
Vertical Spillovers	.109 (.0151)[a]	.112 (.0144)[a]	.044 (.0080)[a]	.051 (.0060)[a]	.011 (.0004)[a]	.012 (.0004)[a]
Gap * Hor Spillovers	-.070 (.0038)[a]	-.070 (.0038)[a]	- .018 (.0013)[a]	- .018 (.0013)[a]	-.009 (.0001)[a]	-.008 (.0001)[a]
Gap * Ver Spillovers	-.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, respectively.

Table 3 – The role of the capital region

	Less productive domestic firms		More productive domestic firms	
Bulgaria	capital	Rest of the country	capital	Rest of the country
Supplier sectors				
HorizontalSpillovers	.151 (.0170)[a]	-.202 (.0156)[a]	- .087 (.0255)[a]	.104 (.0196)[a]
Vertical Spillovers	.153 (.0243)[a]	-.405 (.0218)[a]	.002 (.0293)	.159 (.0325)[a]
n. of obs: 5826				
R square: 0.77				
Client sectors				
HorizontalSpillovers	.123 (.0115)[a]	-.180 (.0107)[a]	-.060 (.0161)[a]	.084 (.0194)[a]
Vertical Spillovers	.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				
HorizontalSpillovers	.025 (.0033)[a]	-.035 (.0027)[a]	-.015 (.0040)[a]	.022 (.0039)[a]
Vertical Spillovers	.040 (.0072)[a]	-.101 (.0042)[a]	-.019 (.0085)[b]	.071 (.0075)[a]
n. of obs: 5873				
R square: 0.82				
Client sectors				
HorizontalSpillovers	.022 (.0026)[a]	-.033 (.0022)[a]	-.013 (.0032)[a]	.023 (.0032)[a]
Vertical Spillovers	.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				
HorizontalSpillovers	.008 (.0002)[a]	-.013 (.0001)[a]	-.004 (.0002)[a]	.008 (.0002)[a]
Vertical Spillovers	-.004 (.0006)[a]	-.026 (.0003)[a]	.007 (.0006)[a]	.011 (.0004)[a]
n. of obs: 91429				
R square: 0.45				
Client sectors				
HorizontalSpillovers	.006 (.0002)[a]	-.011 (.0001)[a]	-.003 (.0002)[a]	.007 (.0002)[a]
Vertical Spillovers	.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 MARKUP and firm, sector and time specific fixed 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 Spillovers	-1.069 (.1730)[a]	-.078 (.0064)[a]	1.417 (.2780)[a]	.036 (.0111)[a]
Vertical Spillovers	-.389 (.0235)[a]	-.182 (.0165)[a]	.290 (.0493)[a]	.095 (.0249)[a]
n. of obs: 5842				
R square: 0.76				
Client sectors				
Horizontal Spillovers	-.319 (.0905)[a]	-.070 (.0038)[a]	.337 (.1125)[a]	.034 (.0084)[a]
Vertical Spillovers	-.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 Spillovers	.167 (.0366)[a]	-.031 (.0030)[a]	-.062 (.0520)	.022 (.0052)[a]
Vertical Spillovers	.080 (.0200)[a]	-.220 (.0116)[a]	-.012 (.0316)	.157 (.0222)[a]
n. of obs: 5873				
R square: 0.81				
Client sectors				
Horizontal Spillovers	-.046 (.0141)[a]	-.032 (.0025)[a]	.034 (.0208)c	.025 (.0046)[a]
Vertical Spillovers	-.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 Spillovers	-.028 (.0016)[a]	-.009 (.0001)[a]	.001 (.0018)	.004 (.0002)[a]
Vertical Spillovers	-.089 (.0015)[a]	-.018 (.0003)[a]	.037 (.0020)[a]	.007 (.0004)[a]
n. of obs: 91429				
R square: 0.45				
Client sectors				
Horizontal Spillovers	-.034 (.0019)[a]	-.008 (.0001)[a]	.007 (.0022)[a]	.004 (.0001)[a]
Vertical Spillovers	-.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 MARKUP and firm, sector, region and time specific fixed effects, as explained in the text.

Appendix

Table A.1 Spillover variables: correlation matrix

	HOR_SPILL^S	VER_SPILL^S	HOR_SPILL^C	VER_SPILL^C
HOR_SPILL^S	BG: 1.00 PL: 1.00 RO: 1.00			
VER_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	
VER_SPILL^C	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)