THE ROLE OF FDI, R&D ACCUMULATION AND TRADE IN TRANSFERRING TECHNOLOGY TO TRANSITION COUNTRIES:

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Abstract

The paper studies the importance of both direct and indirect means of technology transfer for transition countries and its impact on productivity growth of local firms. Using firm-level data for eight transition countries for the period 1994 - 1998 and employing growth accounting approach, the paper explores the importance of FDI, intra-industry knowledge spillovers from FDI, firm's own R&D accumulation and of international R&D spillovers through trade for firm's TFP growth. Time-invariant firm-specific effects are taken into account using panel data techniques, and potential selection bias for foreign investment decisions is corrected by using a generalized Heckman two-step procedure. After controlling for common economic policy influences and industry effects, our results confirm for five advanced transition countries that technology is being transferred to domestic firms primarily through direct foreign linkages. Evidence on some international R&D spillovers through arm-length trade has been found for four transition countries. Our results also suggest that FDI do not generate positive intra-industry spillovers for domestic firms. Moreover, for three transition countries FDI were found to have significant crowding-out effects for local firms in the same industry.

JEL classifications: D24, F14

Keywords: Foreign direct investments, technology transfer, spillover, transition economies

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1. INTRODUCTION

The recent rise of endogenous growth theory, starting with Romer (1986, 1990), Lucas (1988), Grossman and Helpman (1991), has stressed the importance of knowledge as an endogenous determinant of growth. Gaining access to new knowledge is essential for the transition economies of Eastern Europe to catch-up with the EU. With over 90 per cent of global R&D activity centered in the OECD countries, it becomes all the more important that transition countries can gain access through the direct transfer of technology or spillovers from transnational corporations (TNCs). The channels of international technology transfer and their importance for growth have been studied extensively in the 1990s. These studies identify three principal channels of international R&D spillovers. The first is a direct transfer of technology via international licensing agreements (Eaton and Kortum 1996), though recently these provide less important source as the latest and most valuable technologies are not available on license (World Investment Report 2000). Second is foreign direct investments (FDI) that provides probably the most important and cheapest channel of direct technology transfer as well as indirect, intra-industry knowledge spillovers to developing countries (Blomström and Kokko 1997). Several studies offer empirical evidence on the importance of FDI flows for firm's productivity growth in developing countries (see Aitken and Harrison 1999, Borensztein, De Gregorio and Lee 1998, Blomström and Sjöholm 1999). Third channel of technology transfer is through international trade, in particular imports of intermediate products and capital equipment (see Markusen 1989, Grossman and Helpman 1991, Feenstra, Markusen and Zeile 1992) as well as through learning by exporting into industrial countries (Clerides, Lach and Tybout 1997).

The main objective of this paper is to examine the role that these three channels of technology transfer play in the economic transformation of Eastern Europe. Using panel data for firms in eight transition countries it addresses several important questions. First, does FDI represent a significant channel for transfer of technology to transition countries? Second, does majority ownership facilitate transfer of more complex technology and management skills to local firms? Third, does FDI generate significant externalities for domestic firms? Fourth, do technological spillovers from FDI depend on the absorptive capacity of domestic firms? And fifth, do imports of capital and intermediate goods, and

learning-by-exporting provide an alternative source of technology transfer to domestic firms? The major contribution of this paper is that it addresses the above questions using a unique large firm level data base for individual transition economies and employing common methodology and econometric approach. In order to obtain efficient and non-biased coefficient estimates, the paper explicitly takes into account time-invariant firm-specific effects using panel data techniques. Accordingly, we corrected for potential selection bias for foreign investment decisions using a generalized Heckman two-step procedure.

The paper is organized as follows. Section 2 briefly discusses sources of productivity growth in the global economy. Section 3 describes the basic model being tested and section 4 describes the data being analyzed. Three different tests of technology transfer are then performed in section 5. These tests consider: (1) the importance of direct transfers of technology through FDI to selected local firms; (2) the associated, indirect intra-industry spillovers from FDI to other firms in the economy; and (3) the importance of alternative sources technology for firms without FDI, such as imports of capital and intermediate goods and learning by exporting. Final Section concludes the paper.

2. SOURCES OF TECHNOLOGY TRANSFER IN THE GLOBAL ECONOMY

There are many ways an enterprise can acquire new technology besides its own investments into R&D capital. FDI is potentially the most important international vehicle of technology transfer for firms. This source of productivity growth is particularly important for enterprises in transition economies because of the urgent need to restructure quickly. Foreign ownership often provides local firms with efficient corporate governance, as they, mainly privatized to insiders, do not have incentives to restructure (Blanchard 1997). FDI may also be the cheapest means of technology transfer, as the recipient firm normally does not have to finance the acquisition of new technology. And it tends to transfer newer technology more quickly than licensing agreements and international trade (Mansfield and Romeo 1980). And since it has a more direct effect on the efficiency of firms, it also has the potential to create positive spillover effects to local enterprises.

Technology spillovers can occur between firms that are vertically integrated with the TNC (inter-industry spillovers) or in direct competition with it (intra-industry spillovers). Kokko

(1992) identifies at least four ways that technology might be diffused from foreign investment enterprise (FIE) to other firms in the economy: (1) demonstration - imitation effect, (2) competition effect, (3) foreign linkage effect, and (4) training effect. Not all spillovers are positive as FDI can generate negative externalities when foreign firms with superior technology force domestic firms to exit. Aitken and Harrison (1996, 1999) for Colombia and Venezuela and Haddad and Harrison (1993) for Morocco, found evidence on such negative externalities (often called also *competition effect, crowding-out effect* or *business-stealing effect*) from foreign on domestic firms. Djankov and Hoekman (1998) observed similar negative externalities for the Czech Republic. On the other hand, empirical evidence (Kokko 1994, Borensztein, De Gregorio and Lee 1998, and Kinoshita 2000) demonstrate that FDI can contribute to overall domestic productivity growth only when technology gap between domestic and foreign firms is not too large and when a sufficient absorptive capacity is available in domestic firms.

Technology spillovers from TNCs tend to occur more frequently when the social capabilities of the host country and the absorptive capacity of the firms in the economy are high. While relatively backward countries have a certain advantage in catching-up, it becomes increasingly more difficult for the country to build the necessary social capabilities and absorptive capacities that allow firms to take advantage of the technology spillovers that are available in the economy. For this reason, R&D can be thought of as having two complementary effects on firm's productivity growth (Cohen and Levinthal 1989). First, R&D directly expands firm's technology level by new innovations, which is called *innovation effect*. On the other hand, it increases firm's absorptive capacity - ability to identify, assimilate and exploit outside knowledge, which is usually called *learning* or *absorption effect*.

Enterprises that do not have access to FDI and its potential spillovers can also acquire technology through intra-industry trade and international R&D spillovers. Coe and Helpman (1995) provide evidence on such beneficial effects of international R&D spillovers through international trade on domestic productivity in 21 OECD countries. They also show that these benefits are larger the more open an economy is to trade. In addition, Coe, Helpman and Hoffmaister (1997) demonstrate substantial positive R&D spillovers also from 21 OECD to 77 developing countries. Imports of intermediate products and capital equipment (Feenstra, Markusen and Zeile 1996) and learning by

exporting into industrial countries (Clerides, Lach and Tybout 1997) are two most important vehicles of international knowledge spillovers.

3. ACCOUNTING FOR SOURCES OF TECHNOLOGY TRANSFER

The standard growth accounting approach of Solow (1957) can be used as a way to measure both direct and indirect technology transfer to the transition economies. The objective of this approach is to study the various factors that affect overall productivity, including the growth of technology. This is done by decomposing total factor productivity or TFP growth into factors internal and external to the firm, including R&D investments and human capital, and different sources of international technology transfer, respectively.

Following Basu and Fernald (1995), we consider a firm's *i* production function having a following form:

(1) $$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} N_{it}^{\gamma}$$

where Y_{it} is gross output, K_{it}, L_{it} and N_{it} represent capital stock, labor input and materials, and A_{it} is total factor productivity (TFP) or Solow residual for firm *i* at time *t*. The production function is homogenous of degree *r* in *K*, *L* and *N*, so that $r = \alpha+\beta+\gamma \neq 1$.

To get the firm's TFP growth, we differentiate (1) over time. Under assumption of competitive markets, marginal products of each input are equal to its factor price, hence, (1) can be rewritten:

(2) $$y_{it} = a_{it} + \alpha k_{it} + \beta l_{it} + \gamma n_{it}$$

where $y_{it} = \log (Y_{it+1}/Y_{it})$, $a_{it} = \log (A_{it+1}/A_{it})$, $k_{it} = \log (K_{it+1}/K_{it})$, $l_{it} = \log (L_{it+1}/L_{it})$, and $n_{it} = \log (N_{it+1}/N_{it})$. According to the above accounting, TFP growth (or technological progress) is the difference between the growth of output and weighted sum of growth of inputs, with weights being the individual shares of factors used in production.

Estimating (1) or (2) on aggregate data or firm level data may give us some information on average technology stock or average TFP growth in the economy or across firms. Since the technology parameter is simply the regression residual, i.e. part of variance of output that cannot be accounted for by variance of factor inputs, it says nothing about the factors that influence TFP growth. In reality this residual may capture a number of factors that may

have little in common with technology level or TFP growth. In this specification the technology parameter depends crucially on the goodness of fit of the model. This is especially true in transition economies, in which this estimation approach - due to an inefficient utilization of production factors - may return incorrectly high parameters of technology level or TFP growth. The data for Slovenia indicates that FIEs had in the period 1994-1998 significantly lower parameters of technology level as compared to domestic firms (Damijan and Polanec 2001).

Ideally the model should include those factors that determine the level of technology or its growth. Often this can be difficult since technology embodies skills and knowledge that is not easy to measure. In present model we define the firm's technology level A_{it} as:

$$A_{it} = G_i(RD_{it}, H_{it}, F_i, S_{jt}, X_{it}, M_{it}, d_j, d_t) \tag{3}$$

where RD_{it} and H_{it} capture the sources of technology internal to the firm, and factors F_i through M_{it} capture the sources external to the firm, i.e. international technology spillovers. RD_{it} represents annual R&D expenditures (relative to output), H_{it} indicates accumulated human capital (measured as average labor costs per employee), F_i is dummy for foreign ownership, S_{jt} measures intra-industry R&D spillovers stemming from foreign owned firms (measured as the share of foreign owned firms in industry *j's* domestic sales and exports), X_{it} and M_{it} refer to the export propensity (exports to sales ratio) and import propensity (ratio of imports to the material costs) of the firm, respectively, while d_j and d_t are the sector and time dummies.

The term R&D captures the innovative and absorptive capacity of the firm. This factor reflects both the innovation effect and learning or absorption effect of R&D activity. These two effects are controlled for in the model by considering RD_{it} as innovative effect to the firm and $RD_{it}S_{jt}$ as absorptive capacity, i.e. the ability of the firm to identify, assimilate and exploit knowledge spillovers at the sector level. The stock of human capital (H_{it}) represents the skills of the workforce and increases overall productivity of the firm. Firms employ labor of different skills, which employees acquired through education and training both inside and outside the firm. Human capital is assumed to lie within the firm's scope in this model since it indicates the firm's eagerness to enhance its technology level by engaging high skilled workers. Inter-firm diffusion of labor (job reallocation) is captured by the variable S_{jt}, which represents intra-industry spillovers from foreign to domestic firms. The

model assumes that workers trained by foreign firms migrate to domestic firms to some extent. Labor costs per employee proxy the human capital stock of the enterprise, which rests on an assumption that firms with higher average per capita labor costs do on average employ higher skilled labor. We allow human capital to have different impact on TFP growth in foreign relative to domestic firms.

If FDI is an efficient channel of technology transfer, it is reasonable to infer that the "foreign ownership factor" (F_i) not only shifts the technological constant A_{it} of the host firm but also affects the efficiency of its factor utilization. As a consequence, it is not possible to assume identical production functions across firms but have to allow the efficiency of capital, labor and use of materials to differ between foreign owned and domestic firms. This is allowed for by multiplying *K, L* and *N* by foreign ownership dummies (F_ik_{it}, F_il_{it}, F_in_{it}) to obtain different α, β and γ for foreign and domestic firms. A dummy variable is also included in the model to separate majority-owned foreign firms from minority-owned foreign firms. This is to find out whether majority foreign ownership facilitates transfer of more complex technology and management skills to local firms.

For firms without foreign participation, knowledge spillovers (S_{jt}) from foreign firms in the same industry may be important. These externalities, however, may not only be positive, as local enterprises may be "crowded out" by foreign enterprises if they do not have the capability to adapt quickly enough. Foreign enterprises create externalities by demonstrating new technologies and management methods, competition, backward and forward linkages with local suppliers and workforce training. Previous studies control for these effects either by taking the share of aggregate foreign employment in total industry's employment or aggregate foreign share in total industry's output. We test for these externalities by including the variable $S.D_{jt}$ (share of aggregate sales by FIEs in industry's total sales) that controls for crowding out caused by relatively large domestic sales of FIEs and imitation and agglomeration effects stimulated by the export orientation of FIEs.

Finally, we test for alternative sources of international R&D spillovers. We do this by including the export propensity (X_{it} - export to output ratio) and import propensity of the firm (M_{it} - ratio of imports to the material costs).

We argued above that it is not reasonable to expect all firms to have identical production function in terms of identical input parameters. It is urgent to allow for foreign and

domestic firms to differ in terms of the efficiency of factor inputs. In addition, we also allow for sector specific effects by including sector dummy variables d_j. In transition economies it is also necessary to assume that the efficiency of enterprises will improve over time as more productive capital and more skilled labor is employed. The model controls for this by including a time variable d_t. In the absence of other proxies, the time variable is also intended to capture time specific aggregate shocks to the whole economy. These shocks are inherent to transition economies.

In order to identify sources of TFP growth of manufacturing firms in transition countries, in section 5 we estimate model (2) constrained to determinants of TFP growth specified in (3) using three different specifications. First, we examine the importance of direct transfers of technology through FDI to selected local firms and the associated, indirect intra-industry spillovers from FDI to other domestic firms in the same industry. In the second step, we investigate the importance of R&D accumulation of domestic firms for the capability to adjust to intra-industry spillovers from firms with foreign participation. Finally, we focus on the importance of alternative sources of diffusion of technology to domestic firms, such as imports of capital and intermediate goods and learning by exporting.

4. DATA

Data at the firm level provides the best way to test for productivity spillovers. Panel data for the period 1994(5)-1998 were obtained for eight transition countries. For Estonia and Slovenia data were obtained from local Statistical offices, while for other transition countries source of data is the Amadeus database[1]. Our database consists of manufacturing firms with more than 100 employees (for Slovenia the lowest bound of 10 employees is applied). Due to different firm data coverage and different quality of the source data, non-balanced panel data had to be constructed (the exception being the Estonian and Slovenian data). The size of firm panel data samples differs significantly across countries. The poorest coverage of firms is for Hungary (134 firms) and Slovakia (136 firms), while for other countries the coverage of firms regarding the distribution of firms by size is good.

[1] As a part of the Phare ACE research project P97-8138-R coordinated by LICOS Institute, we had access to the Amadeus CD-ROM (version June 2000), a Pan European financial database, provided by Bureau van Dijk Electronic Publishing SA.

Panel of Bulgarian firms consists of maximum of 1233 annual observations, the Czech republic's panel includes 1115 firms, Estonian panel has 373 firms, Poland panel consists of 2199 firms, Romanian panel includes 1918 firms, and Slovenian panel includes 1093 firms per year.

Table 1 about here

Share of FIEs in total number of firms in our panels is on average about 10 per cent. The exception being the panels for Estonia and Hungary, where these shares are about 30 per cent. Let us leave aside for the moment the panel of Hungarian firms due to poor quality of data. Table 1 reveals that the aggregate shares of FIEs in total employment of individual transition economies exceed the shares of FIEs in total number of firms by 35 per cent to 90 per cent. On the other side, the aggregate shares of FIEs in total assets and sales exceed the share in total number of firms by two- to threefold. This indicates that FIEs are not only larger relative to domestic firms in terms of employment, assets and output, but also that FIEs are more capital intensive and more efficient in terms of labor productivity. In addition, breakdown of the above figures by individual manufacturing sectors reveals greater concentration of FIEs in more capital and skill intensive sectors. Another interesting fact can be seen from the figures on R&D accumulation by foreign and domestic firms. In Bulgaria, the Czech Republic, Estonia, Romania and Slovakia, the R&D activities are basically concentrated in foreign firms. On the contrary, the Polish and Slovenian domestic firms seem to lay emphasis on R&D accumulation in the same manner as FIEs do. This may have important implications for the autonomous innovative ability of domestic firms and their absorption capacity for potential R&D spillovers in the economy in both groups of countries.

Having in mind the above differences in characteristics between foreign and domestic firms, one can argue that our panels of firm data might suffer under selection bias. This is due to the fact that foreign investment decisions are not randomly distributed but are probably subject to firms' characteristics and to their initial performances. Foreign and domestic firms, hence, cannot be treated as homogenous units of observation due to possible endogeneity of foreign investment decisions. In order to correct for this problem the generalized Heckman two-step procedure for correcting sample selection bias has been used. According to Heckman (1979), in the first step we determine the probability of

foreign investment choices using a probit model. We base foreign investment choices on initial firm size, firm's initial capital and skill intensity, initial labor productivity, firm's initial export propensity and sector dummies. Year 1994 (1995 for some countries) or one year before the ownership change (for FDI that occurred later than 1995) has been chosen as the initial year in our probit estimations. In the second step we then follow generalized Heckman approach as developed by Amemiya (1984) and calculate inverse Mill's ratios (also called lambda) for all observations (for non-zero as well as zero observations regarding foreign investment choices). In doing so we obtain an additional independent variable in our estimated model, which we then use as an instrument for the unobserved impacts on foreign investment decisions.

Table 2 about here

The results of probit model in Table 2 do in fact confirm the existence of selection bias in our database. When deciding about the investment choices in transition countries, TNCs were found to tend to acquire more capital and skill intensive firms. In 5 countries, the probability of TNCs to acquire more capital and skill intensive local firms is confirmed. Labor intensive firms are less likely to be chosen by TNCs (a negative correlation is confirmed in 4 countries). In Slovenia and Estonia, more export oriented firms are found to be preferred by TNCs. This may be true also for firms in other transition economies, but unfortunately, we do not dispose with the export data at the firm level for all countries.

Before switching to estimation results different appropriate econometric techniques for estimating the consecutive (4), (5) and (6) models should be addressed. As we deal with the panel data the OLS may give biased and inconsistent estimates of the consecutive models. These models may suffer from probable correlation between the productivity effects and the output variable. As there are no suitable firm specific instruments to control for this problem, one should rather use one of the two panel data techniques (random or fixed effects model) that do explicitly take into account the firm specific effects.[2] As argued by Djankov and Hoekman (1998), none of the two techniques, though preferable to OLS, is absolutely accurate for the purposes of our estimations. Fixed effects model (FEM) assumes constant TFP growth over time for a single firm. In the present context, this is

[2] For discussion on use of different panel data techniques refer to Hsiao (1986), Baltagi (1995), and Greene (1997).

inappropriate assumption, as the aim is to examine the impact of different factors on changes in TFP growth. On the other hand, major disadvantage of random effects model (REM) is in the assumption that changes in TFP growth at the firm level are random and only reflected in the error term, i.e. uncorrelated over time. We perform estimations using both the OLS, REM and FEM techniques. The Hausman (1978) test shows that FEM provides better specification of our models relative to REM. However, as argued above FEM is not a proper specification in our case due to the assumption on firm's constant TFP growth over time. In addition, as the consecutive models are estimated in first differences, Hausman test found no significant differences between OLS and REM estimations. We therefore report only OLS estimations that provide biased, though more efficient estimations relative to REM and FEM specifications.

5. ESTIMATION RESULTS

5.1. ACCOUNTING FOR DIRECT AND INDIRECTS EFFECTS OF FDI

In this subsection direct and indirect effects of FDI (as a channel of technology transfer) on productivity growth of manufacturing firms in transition economies are estimated. Based on equations (2) and (3), we estimate the following model:

$$(4) \qquad y_{it} = b_{it} + \delta F_i + \alpha k_{it} + \beta l_{it} + \gamma n_{it} + \chi F_i k_{it} + \phi F_i l_{it} + \varphi F_i n_{it} + \kappa H_{it} + \lambda F_i H_{it} + \\ + \mu S_{jt} + \theta_j d_j + \psi_t d_t + \varepsilon_{it}$$

where b_{it} is a log of a constant term (residual that accounts for alternative sources of TFP growth not accounted for in the model), δ measures the difference in TFP growth rates between domestic and foreign firms, α, β, γ, and χ, ϕ, φ represent shares of factor inputs in domestic and foreign firms, respectively, κ and λ represent the impact of human capital in domestic and foreign firms, μ measures intra-industry spillovers from foreign to domestic firms, θ and ψ are parameters of sector and time dummies, while ε is the error term.

Table 3 about here

The estimation results in Tables 3 indicate that FDI is an important direct channel for the transfer of technology to FIEs located in the Czech republic, Estonia, Poland, Romania and Slovenia. However, this evidence only appears after the regression is corrected for initial

selection bias for foreign investment decisions[3]. In Bulgaria, Hungary and Slovakia FIEs do not seem to grow faster than domestic firms. At least for Hungary and Slovakia this is clearly a result of the poor quality of data. In the five transition economies with significant impact of FDI, foreign ownership is found to contribute to average growth rate of firms by 0.5 to 0.7 percentage points. Only in Romania this figure is significantly larger (1.1 percentage points) indicating much lower average productivity level of domestic firms. These figures are much higher than those obtained by previous studies of other transition countries. Djankov and Hoekman (1998) found that in the Czech Republic the average growth rate of FIEs relative to domestic firms was 0.03 percentage points higher. Konings in the last version of his paper (2001), employing a different estimation technique, found no evidence on differences in average growth rate between FIEs and domestic firms in Bulgaria and Romania, while in Poland FIEs were found to grow faster by some 1.13 to 0.21 percentage points. The above different results among individual studies may refer to different specification of estimation model and different estimation techniques. Another reason for different results may also lie in the fact that we estimated our model in a panel of manufacturing firms only, while other researchers used panels of both the manufacturing and non-manufacturing firms.

The results in table 3 also confirm that TNCs do not necessarily transfer more complex technology to their subsidiaries where they acquire a majority share. A dummy on majority ownership proved to be insignificant in all countries.[4]

The results also indicate that with the exception of Romania there are no significant spillovers to other firms in the same industry. The results also found that there were no differences in capability to adapt to spillovers between foreign and domestic firms (insignificant interaction terms between spillovers and FDI dummy). Using a similar model specification, there were no significant spillovers found in any of the previous studies on transition economies. Djankov and Hoekman (1998) and Konings (2001) found even negative spillovers in the Czech Republic, Poland and Romania. As suggested by Kinoshita (2000), the lack of finding spillovers in individual transition countries might

[3] Compare the results in Table 3 to those in Table A1 in Appendix, where the latter refer to the model estimations without correction for sample selection bias.

[4] The study by Rojec, Damijan and Majcen (2000) failed to find significant differences in operational characteristics between majority and minority owned foreign firms in Slovenia as well as in Estonia.

probably be explained by the fact that so far we didn't control for the absorptive capacity of domestic firms to adapt to spillovers generated by FIEs.

5.2. ACCOUNTING FOR INNOVATIVE AND ABSORPTIVE CAPACITY OF DOMESTIC FIRMS

In this subsection we report estimation results when productivity growth and potential spillovers in domestic firms are related to their innovative and absorptive capacity. We estimate the following model:

$$(5) \qquad y_{it} = b_{it} + \delta F_i + \alpha k_{it} + \beta l_{it} + \gamma n_{it} + \chi F_i k_{it} + \phi F_i l_{it} + \varphi F_i n_{it} + \kappa H_{it} + \lambda F_i H_{it} + \\ + \eta RD_{it} + \mu S_{jt} + \rho RD_{it} S_{jt} + \theta_j d_j + \psi_t d_t + \varepsilon_{it}$$

where in addition to (4) η is the rate of return on firms' R&D investments (parameter of innovative capacity of firms), and ρ measures absorptive capacity of firms to adapt to technology shocks in domestic market. The model is estimated in a panel of domestic firms only, since we are interested in accounting for the importance of different potential productivity spillovers that are available to domestic firms in the economy.

Tables 4A and 4B about here

Relatively high shares of R&D accumulation of domestic firms in some transition economies should result in some impact on innovative capacity of firms and absorptive capability of firms to exploit knowledge spillovers from FIEs at the sector level. The estimation results in Table 4A, however, indicate significant positive innovation effects only in the Czech Republic, while in Slovakia even negative innovation effects were found. Still, our results provide no evidence for any spillovers from FDI to domestic in any of the transition economies. After controlling for absorptive capacity we find evidence on positive spillovers to domestic firm only in Romania. Surprisingly, even negative impact of absorptive capacity of firms is found in more advanced transition countries (Czech Republic and Poland).

Evidence from other studies is mixed. Djankov and Hoekman (1998) after controlling for firms' innovative and absorptive capacity report no significant spillovers to domestic firms in the Czech Republic in the period 1992-1996. In contrast, Kinoshita (2000) finds innovative capacity of Czech domestic firms not to be correlated with their TFP growth

and she also finds no significant spillovers (measured as the share of foreign owned firms in total sector's employment). But in contrast to Djankov and Hoekman she does find significant positive impact of absorptive capacity of Czech domestic firms in the period 1995-1998 to exploit spillovers generated by FIEs.

The above insignificant results on spillovers may also be a consequence of the implicit assumption that these spillovers are equally relevant for all manufacturing sectors. But we know that in some industries the R&D accumulation is more important in order to be able to attain economies of scale. Hence, in some of the industries firms have to accumulate human capital in larger proportions and are therefore more capable to take advantage of intra-industry spillovers generated by FIEs. In the next step, we therefore restrict our panel to those firms only that are located in industries characterized by larger economies of scale and larger R&D expenditures.[5] However, restricting the panels does not alter much the estimation results (see Table 4B). In addition to the whole panels, the innnovation effect becomes significant also in Estonia and Romania. On the other side, however, there is still no evidence on any spillovers to domestic firms. After controlling for the absorptive capacity of firms, the evidence is found again on negative spillovers to domestic firms in Bulgaria, Poland and Romania, while there is no evidence on positive spillovers.

Based on the above findings one can conclude that FIEs provide an important channel of technology transfer to transition economies. However, this positive effects is restricted only to selected local firms, while all other domestic firms suffer under strong competition effects.

5.3. ACCOUNTING FOR INTERNATIONAL R&D SPILLOVERS TO DOMESTIC FIRMS

The economic growth in transition economies after 1993 is not restricted to firms with foreign participation only, but is a general feature of the U-shaped economic performance and technological modernization of firms during the process of transition. Hence, if the R&D accumulation by individual local firms is not correlated with the growth of firms and if there are no spillovers from FIEs, there must be some alternative sources of technology

[5] We estimate the model (5) in a panel of firms in the following 2-digit ISIC sectors: 24, 29, 30, 31, 32, 33, 34 and 35.

transfer to local firms. In this subsection we check for the impact of these alternative sources of international technology diffusion for domestic firms' TFP growth. Trade provides an important source of international R&D spillovers (see Coe and Helpman 1995, and Coe, Helpman and. Hoffmaister 1997). In order to account for international R&D spillovers through international trade we estimate the following model:

$$(6) \qquad y_{it} = b_{it} + \delta F_i + \alpha k_{it} + \beta l_{it} + \gamma n_{it} + \chi F_i k_{it} + \phi F_i l_{it} + \varphi F_i n_{it} + \kappa H_{it} + \lambda F_i H_{it} + \\ + o X_{it} + \pi M_{it} + \eta RD_{it} + \upsilon RD_{it} X_{it} + \omega RD_{it} M_{it} + \theta_j d_j + \psi_t d_t + \varepsilon_{it}$$

where in addition to (4) o and π represent international R&D spillovers via firms' (sectors') exports and imports, η is the rate of return on firms' R&D investments, υ and ω measure the absorptive capacity of domestic firms to technology shocks through exports and imports. The model is estimated again in a panel of domestic firms only. International R&D spillovers to domestic firms are ideally measured by the share of imports in total costs of materials (imports of capital equipment and intermediate goods) and by the share of exports in total sales (indicating capability of firms to meet high quality standards in western markets). However, because the data on firm export and import performance is missing for most of the countries in our database (with the exception of Estonia and Slovenia), the data on NACE 4-digit sector export and import performance[6] has been used instead. More specifically, we have explicitly taken into account only trade flows with the EU, since these may be the most important channel of knowledge spillovers through trade to transition economies.

Tables 5A and 5B about here

The estimation results in Table 5A reveal that only for Slovenia significant positive international R&D spillovers to domestic firms both through exports as well as through imports can be found. These positive spillovers are not restricted to firms with higher R&D accumulation, but is a general feature of Slovenian manufacturing firms. On the other side, while significant international R&D spillovers were found also for firms in the Czech Republic, these are available only to firms with higher R&D accumulation. Moreover, the evidence show that there are negative spillovers for Czech firms that do heavily depend on

[6] Export and import performance at the industry level is calculated as a ratio of industry's exports and imports to total industry's sales and total industry's material cost, respectively.

exports to western markets. Similar results for Czech Republic were found by Djankov and Hoekman (1998). While they did not account for knowledge spillovers through exports, they found significant positive impact of large import penetration on TFP growth of domestic firms.

These results again provide no evidence on general importance of alternative sources of technological modernization for most of the transition economies. The reason behind may again be the fact that technological modernization is more important for some R&D intensive sectors only. Therefore, we re-estimate the model (6) in a panel of firms engaged in R&D intensive industries. The results in Table 5B in a certain way confirm the above expectations. For Slovenia, again, exports are found to be an important vehicle of knowledge spillovers from western countries, while imports serve as an important channel of international knowledge transfers only for firms with higher R&D accumulation. For Czech firms the previous linkage between trade and productivity growth is missing after taking into account R&D intensive sectors only. In contrast, a positive correlation between export and import performance and productivity growth has been established for firms in Poland and Romania. These international knowledge spillovers are, however, available only to firms with higher R&D accumulation. For other transition economies international trade does not seem to be an important vehicle of technological modernization and productivity growth.

Comparing results obtained by either way of indirect international R&D spillovers (from FIEs and through trade) may give us an important information on the net effects of both sorts of indirect spillovers for domestic firms without direct foreign linkages. Comparing results between Tables 4A and 5A and Tables 4B and 5B reveals that in Poland and Romania negative spillover effects generated by FIEs are by some 10 to 25-times larger than positive international spillover effects through trade. This evidence, hence, suggests that the competition effects from foreign owned firms to domestic firms may outweigh the positive spillovers generated through trade.

This, in turn, raises the question on what were the real determinants of technological modernization and productivity growth in local firms in transition countries. If it was not the FDI and potential intra-industry spillovers generated by FDI, if it was not the autonomous R&D accumulation and if was not the international trade, then there must

exist some other alternative means of technological modernization in transition economies. Unless the technological gap between local firms and competitive western firms is too large, resulting in crowding out of domestic firms in R&D intensive industries and reallocation of domestic resources towards less R&D intensive and more lower skilled labor intensive sectors. Certainly, more research should be devoted to this issue in the future.

6. CONCLUSIONS

The paper studies the importance of both direct and indirect means of technology transfer for firms in eight transition countries and its impact on their productivity growth. Using firm level panel data for the period 1994 - 1998 and employing growth accounting approach, we seek to explore the importance of FDI, intra-industry knowledge spillovers from FDI, firm's own R&D accumulation and of international R&D spillovers through trade for firm's TFP growth.

After controlling for selection bias, common economic policy influences and industry effects, we found FDI as the most important vehicle of technology transfer to 5 out of 8 transition economies. In contrast to widely spread considerations, we found no or even negative intra-industry knowledge spillovers from foreign owned firms to domestic firms. In addition, the evidence is found that in a certain way trade serves as an important alternative source of international R&D spillovers to local firms in the Czech Republic, Poland, Romania and Slovenia. Both imports and exports are found to be significant sources of international knowledge spillovers to local firms with no foreign participation. The paper, hence, provide an evidence that technology is being transferred to firms in transition economies primarily through direct foreign linkages. The spillovers through arm-length trade are only exceptionally present, while the spillovers from foreign to domestic firms are negative or insignificant. The net effects of both sorts of indirect spillovers may therefore be important for domestic firms without direct foreign linkages. The evidence suggests that the competition effects from foreign owned firms to domestic firms outweigh the positive spillovers generated through trade.

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Table 1: Descriptive statistics for foreign vs. domestic manufacturing firms in 1998

	BG	CZ	EST	HU	PL	RO	SK	SLO
No of all firms	1233	1114	363	110	2199	1918	136	1093
No. of FIEs	87	181	106	39	180	206	11	116
% of FIEs in no. of firms	7.1	16.2	29.2	35.5	8.2	10.7	8.1	10.6
% of FIEs in Employment	13.6	21.8	52.1	22.6	11.1	8.0	12.0	18.5
% of FIEs in Sales	20.4	34.5	48.2	26.1	21.7	14.2	23.1	26.9
% of FIEs in Assets	22.8	31.1	36.4	15.9	21.2	19.5	28.7	13.8
% of FIEs in R&D Expend.	52.1	29.3	71.4	21.0	9.3	26.8	23.9	14.2

Table 2: Probability of foreign investment decisions (Results of probit model)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Size	1E-07	*9E-07	2E-06	-9E-07	9E-07	3E-07	***1E-05	**-7E-08
	(0.049)	(1.683)	(0.668)	(-0.503)	(1.285)	(0.285)	(2.980)	(-2.179)
Capital intensity	**0.009	0.001	***0.003	***0.007	***0.007	**0.007	-0.003	2E-06
	(2.093)	(1.534)	(3.045)	(2.707)	(2.731)	(2.231)	(-0.657)	(1.035)
Skill intensity	***0.609	*-0.011	***0.015	-0.005	***0.083	0.042	-0.042	**0.0001
	(3.779)	(-1.649)	(3.589)	(-0.251)	(2.898)	(0.840)	(-0.380)	(2.130)
Labor intensity	***-0.010	***-0.014	0.009	-0.012	-0.005	***0.011	**-0.025	***-0.010
	(-2.961)	(-5.859)	(1.530)	(-1.368)	(-1.094)	(5.028)	(-2.129)	(-3.035)
Lab. productivity	-0.006	4E-05	6E-05	**-0.003	-0.001	0.004	0.006	*5E-06
	(-0.583)	(0.140)	(0.182)	(-2.064)	(-1.092)	(1.574)	(0.643)	(1.747)
Exp. propensity			**0.006					***0.014
			(2.242)					(9.493)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.080	0.055	0.255	0.106	0.109	0.044	0.263	0.127
Number of obs.	1233	1115	373	134	2199	1918	136	1093

Notes: (i) dependent variable: FDI dummy, (ii) probit estimations on initial data (for year 1995 or one year before the ownership change), (iii) t-statistics in parentheses, (iv) *****, **** and ***** indicate significance at 1, 5 and 10 per cent level, respectively.

Table 3: Impact of FDI: Direct effects and spillovers (Sample of foreign owned and domestic firms; with control for sample selection bias)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	**0.118	-0.204	***-0.378	0.054	***-0.237	***-0.629	0.240	***-0.303
	(2.011)	(-1.617)	(-3.742)	(0.098)	(-2.883)	(-9.125)	(0.714)	(-5.522)
Capital	***0.094	***0.925	***0.048	**0.256	***0.179	***0.166	**0.332	***0.027
	(8.076)	(28.202)	(4.873)	(2.247)	(6.819)	(15.610)	(2.076)	(3.401)
Capital-FDI	-0.021	***-0.294	**-0.046	***-1.106	-0.013	-0.003	-0.185	-0.018
	(-0.646)	(-4.348)	(-2.246)	(-4.015)	(-0.185)	(-0.127)	(-0.230)	(-0.750)
Labor	***0.185	***0.265	***0.662	0.118	***0.131	***0.221	***0.973	***0.468
	(7.401)	(5.073)	(14.434)	(0.621)	(3.849)	(22.029)	(6.609)	(31.971)
Labor-FDI	-0.047	-0.140	***0.642	0.006	0.015	***0.131	0.206	***-0.296
	(-0.726)	(-0.996)	(12.236)	(0.021)	(0.234)	(4.547)	(0.169)	(-7.164)
Intermediates	***0.550		***0.011	***0.480	***0.447	***0.611		***0.238
	(60.158)		(2.307)	(4.097)	(33.190)	(80.277)		(32.185)
Intermediates-FDI	*0.053		0.002	0.069	***-0.352	***-0.055		***0.108
	(1.854)		(0.255)	(0.309)	(-13.537)	(-3.357)		(3.478)
FDI dummy	0.068	***0.576	***0.678	-0.237	***0.469	***1.140	-0.493	***0.551
	(0.628)	(2.523)	(4.201)	(-0.257)	(2.805)	(8.522)	(-0.633)	(5.552)
Majority share dummy	0.003	0.063	0.001	-0.191	0.087	0.046	0.047	-0.029
	(0.045)	(1.175)	(0.025)	(-0.784)	(1.384)	(1.359)	(0.137)	(-1.089)
Spillovers	-0.0001	-0.0002	0.0011	-0.0008	-0.0002	**0.0007	-0.0007	-0.0002
	(-0.323)	(-0.466)	(1.043)	(-0.329)	(-0.446)	(2.263)	(-0.193)	(-0.785)
Spillovers*FDI	-0.0002	-0.0007	-0.0012	0.0051	-0.0001	**-0.0013	0.0020	0.0004
	(-0.273)	(-0.847)	(-1.032)	(1.213)	(-0.049)	(-2.274)	(0.278)	(0.910)
Lambda	-0.009	**-0.330	***-0.416	0.150	***-0.293	***-0.718	0.231	***-0.333
	(-0.164)	(-2.389)	(-4.323)	(0.265)	(-3.061)	(-8.934)	(0.613)	(-5.351)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3756	4177	1119	282	1188	6818	365	4372
Adj. R^2	0.870	0.265	0.767	0.276	0.602	0.749	0.097	0.528

Note: t-statistics in parentheses. *****, **** and ***** indicate significance at 1, 5 and 10 per cent level, respectively.

Table 4A: Impact of R&D - Importance of innovative and absorptive capacity (Sample of domestic firms only)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	***0.115	***0.090	***-0.427	-0.041	0.004	-0.016	0.018	***-0.278
	(6.814)	(3.477)	(-3.503)	(-0.370)	(0.195)	(-1.620)	(0.231)	(-2.861)
Capital	***0.096	***0.931	***0.049	***0.267	***0.211	***0.179	0.222	***0.034
	(7.972)	(27.334)	(5.223)	(3.016)	(7.948)	(18.428)	(1.571)	(3.810)
Labor	***0.182	***0.257	***0.665	0.166	***0.110	***0.212	***1.075	***0.453
	(7.298)	(4.825)	(14.959)	(1.137)	(3.268)	(23.176)	(7.648)	(28.753)
Intermediates	***0.551		**0.011	***0.490	***0.453	***0.610		***0.257
	(60.878)		(2.454)	(5.464)	(33.939)	(87.278)		(32.856)
R&D	-0.002	***0.015	-0.006	0.001	0.006	0.0003	***-0.004	-0.001
	(-0.504)	(6.258)	(-0.323)	(0.463)	(1.436)	(0.256)	(-11.58)	(-1.240)
Spillovers	-0.0001	-0.0002	0.001	0.001	0.0002	0.0004	-0.002	-0.0001
	(-0.332)	(-0.396)	(0.648)	(0.489)	(0.490)	(1.393)	(-0.359)	(-0.375)
Spillovers*R&D	0.0001	**-0.0002	0.0003	-0.0005	**-0.0005	***0.0002	0.002	0.0001
	(1.149)	(-2.397)	(0.418)	(-0.474)	(-2.539)	(3.602)	(0.356)	(1.613)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3490	3520	815	209	1061	6187	304	3937
Adj. R^2	0.870	0.269	0.317	0.416	0.633	0.766	0.384	0.488

Note: t-statistics in parentheses. ***, ** and * indicate significance at 1, 5 and 10 per cent level, respectively.

Table 4B: Impact of R&D - Importance of innovative and absorptive capacity (Sample of domestic firms in technology intensive sectors)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	***0.089	0.053	0.119	0.100	***-0.202	**-0.033	-0.164	***-0.738
	(3.011)	(1.364)	(0.061)	(0.844)	(-4.128)	(-1.964)	(-0.873)	(-4.255)
Capital	***0.072	***0.689	***0.047	0.140	***0.322	***0.089	**0.913	0.012
	(3.522)	(18.752)	(2.741)	(1.330)	(5.764)	(4.935)	(2.104)	(0.778)
Labor	***0.199	***0.199	***0.413	-0.001	0.084	***0.182	***1.080	***0.374
	(4.286)	(3.845)	(3.333)	(-0.998)	(1.475)	(9.589)	(3.935)	(14.269)
Intermediates	***0.698		***0.271	***0.819	***0.003	***0.710		***0.311
	(38.714)		(5.787)	(7.403)	(9.693)	(56.917)		(22.430)
R&D	0.000	**0.008	*0.269	-0.001	-0.002	***0.012	***-0.004	-0.001
	(0.106)	(2.369)	(1.934)	(-0.118)	(-0.451)	(3.715)	(-9.904)	(-0.977)
Spillovers	0.001	0.0001	0.002	-0.001	-0.0004	0.0003	0.010	-0.0002
	(1.637)	(0.191)	(0.075)	(-0.612)	(-0.498)	(0.549)	(0.146)	(-0.488)
Spillovers*R&D	***-0.009	0.000	-0.004	-0.002	***-0.001	***-0.001	-0.006	0.0001
	(-6.233)	(-0.309)	(-1.597)	(-1.384)	(-2.565)	(-3.116)	(-0.112)	(0.815)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	966	1329	136	69	364	1511	99	1301
Adj. R^2	0.903	0.339	0.372	0.915	0.422	0.820	0.570	0.533

Note: t-statistics in parentheses. *****, **** and ***** indicate significance at 1, 5 and 10 per cent level, respectively.

Table 5A: Impact of R&D and of international knowledge spillovers through trade (Sample of domestic firms only)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	***0.115	***0.085	***-0.404	-0.132	***-0.207	-0.010	0.010	***-0.542
	(7.042)	(3.321)	(-3.498)	(-0.791)	(-7.210)	(-1.091)	(0.124)	(-5.117)
Capital	***0.095	***0.933	***0.049	0.162	***0.242	***0.178	0.219	**0.023
	(7.904)	(27.413)	(5.180)	(1.569)	(6.824)	(18.356)	(1.543)	(2.210)
Labor	***0.184	***0.256	***0.663	0.001	***0.122	***0.212	***1.084	***0.401
	(7.372)	(4.806)	(14.901)	(1.128)	(2.704)	(23.176)	(7.660)	(21.252)
Intermediates	***0.550		**0.011	***0.656	***0.003	***0.611		***0.272
	(60.799)		(2.413)	(6.162)	(15.429)	(87.376)		(28.665)
R&D	0.0001	***0.012	0.002	0.005	*-0.012	**0.002	0.007	-0.00004
	(0.046)	(4.913)	(0.196)	(0.671)	(-1.659)	(1.924)	(0.302)	(-0.062)
Exports/Sales	-0.00001	0.00005	0.00011	-0.00001	-0.00009	-0.00001	0.00007	***0.00061
	(-0.874)	(0.912)	(0.282)	(-0.392)	(-1.272)	(-0.738)	(0.495)	(3.674)
Imports/Material costs	0.00001	-0.00003		0.000043	0.00015	0.000003	-0.0001	**0.00003
	(0.613)	(-0.998)		(0.879)	(1.173)	(0.469)	(-0.488)	(2.062)
R&D*Exports/Sales	0.00001	***-0.00004	-0.00004	0.00001	0.0001	0.0000	-0.00002	-0.000004
	(0.259)	(-2.708)	(-0.146)	(0.146)	(1.103)	(0.631)	(-0.481)	(-0.191)
R&D*Imports/Mat.costs	0.00001	***0.00004		-0.00009	-0.00010	-0.000002	-0.00005	-3.1E-07
	(0.132)	(3.204)		(-0.930)	(-0.766)	(-0.660)	(-0.239)	(-0.190)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3490	3520	815	162	1061	6187	304	2943
Adj. R^2	0.870	0.270	0.316	0.419	0.632	0.766	0.382	0.475

Note: t-statistics in parentheses. ***, ** and * indicate significance at 1, 5 and 10 per cent level, respectively.

Table 5B: Impact of R&D and of international knowledge spillovers through trade (Sample of domestic firms in technology intensive sectors)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	***0.084	0.047	-0.252	0.053	***-0.225	*-0.029	-0.151	***-0.745
	(2.853)	(1.234)	(-0.832)	(0.438)	(-4.816)	(-1.737)	(-0.658)	(-4.287)
Capital	***0.074	***0.691	***0.047	0.168	***0.311	***0.084	**1.029	0.016
	(3.560)	(18.828)	(2.672)	(1.591)	(5.541)	(4.676)	(2.349)	(1.001)
Labor	***0.231	***0.197	***0.384	0.0001	*0.093	***0.181	***1.092	***0.380
	(4.877)	(3.825)	(3.047)	(-0.690)	(1.617)	(9.631)	(3.924)	(14.378)
Intermediates	***0.698		***0.275	***0.789	***0.003	***0.709		***0.308
	(37.774)		(5.771)	(7.162)	(9.700)	(57.266)		(21.925)
R&D	-0.002	***0.011	0.060	-0.003	***-0.024	***-0.016	-0.027	-0.001
	(-0.534)	(3.585)	(1.211)	(-0.279)	(-3.076)	(-3.985)	(-0.358)	(-1.231)
Exports/Sales	-0.00001	-0.00003	-0.00052	0.00001	0.00007	-0.00012	0.00018	*0.00043
	(-0.405)	(-0.362)	(-0.518)	(0.150)	(0.240)	(-1.250)	(0.775)	(1.782)
Imports/Material costs	0.00005	0.00012		0.000001	0.00031	0.00034	0.0007	0.00001
	(0.252)	(0.952)		(0.006)	(0.379)	(0.699)	(0.670)	(0.468)
R&D*Exports/Sales	0.00001	0.00001	-0.0006	0.00006	**0.0002	***0.0005	0.0003	0.00002
	(0.249)	(0.179)	(-0.418)	(0.700)	(2.406)	(6.733)	(1.009)	(0.851)
R&D*Imports/Mat.costs	0.00001	-0.00005		-0.00016	-0.00018	*0.00058	-0.002	*0.00001
	(0.110)	(-0.717)		(-1.173)	(-0.884)	(1.750)	(-1.322)	(1.764)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	966	1329	136	69	364	1511	99	1301
Adj. R^2	0.898	0.341	0.367	0.912	0.418	0.824	0.573	0.536

Note: t-statistics in parentheses. ***, ** and * indicate significance at 1, 5 and 10 per cent level, respectively.

APPENDIX

Table A1: Impact of FDI: Direct effects and spillovers (Sample of foreign owned and domestic firms; without control for sample selection bias)

	BG	CZ	EST	HU	PL	RO	SK	SLO
Constant	***0.127	***0.092	0.009	-0.087	0.008	*-0.021	0.041	-0.019
	(7.754)	(3.842)	(0.180)	(-0.663)	(0.437)	(-1.914)	(0.475)	(-1.359)
Capital	***0.094	***0.924	***0.050	**0.254	***0.195	***0.180	**0.318	***0.027
	(8.081)	(28.165)	(5.080)	(2.238)	(7.564)	(16.995)	(2.010)	(3.377)
Capital-FDI	-0.021	***-0.296	**-0.045	***-1.116	-0.007	-0.006	-0.183	-0.016
	(-0.640)	(-4.383)	(-2.142)	(-4.092)	(-0.094)	(-0.209)	(-0.228)	(-0.664)
Labor	***0.185	***0.263	***0.677	0.120	***0.125	***0.213	***0.965	***0.466
	(7.422)	(5.043)	(14.685)	(0.635)	(3.673)	(21.180)	(6.586)	(31.772)
Labor-FDI	-0.046	-0.142	***0.623	0.005	0.002	***0.131	0.220	***-0.301
	(-0.724)	(-1.008)	(11.811)	(0.017)	(0.031)	(4.528)	(0.181)	(-7.256)
Intermediates	***0.550		**0.011	***0.474	***0.451	***0.610		***0.240
	(61.315)		(2.297)	(4.139)	(33.566)	(79.685)		(32.386)
Intermediates-FDI	*0.053		0.003	0.074	***-0.356	***-0.054		***0.108
	(1.854)		(0.312)	(0.329)	(-13.657)	(-3.265)		(3.457)
FDI dummy	0.053	0.049	0.038	0.000	0.012	-0.007	-0.141	0.039
	(0.885)	(0.829)	(0.591)	(-0.001)	(0.153)	(-0.187)	(-0.268)	(1.475)
Majority share dummy	0.003	0.065	0.034	-0.190	0.087	0.051	-0.023	-0.022
	(0.044)	(1.202)	(0.655)	(-0.781)	(1.377)	(1.497)	(-0.072)	(-0.836)
Spillovers	-0.0001	-0.0002	0.001	-0.001	-0.0001	**0.001	-0.001	0.000
	(-0.325)	(-0.435)	(0.861)	(-0.341)	(-0.277)	(2.336)	(-0.135)	(-0.700)
Spillovers*FDI	-0.0002	-0.001	-0.001	0.005	-4.9E-05	**-0.001	0.002	0.0004
	(-0.264)	(-0.699)	(-0.969)	(1.226)	(-0.047)	(-2.039)	(0.298)	(0.799)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3756	4177	1119	282	1188	6818	365	4372
Adj. R^2	0.870	0.265	0.763	0.279	0.599	0.746	0.098	0.525

Note: t-statistics in parentheses. *****, **** and ***** indicate significance at 1, 5 and 10 per cent level, respectively.