Which firms benefit more from the "own-firm" and spillover effects of inward foreign direct investment?

First draft, please do not quote

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Abstract

An interesting issue in the research of host country effects of foreign direct investment (FDI) that is highly relevant to the government policy of the FDI in the host country would be the following. Are the benefits of inward FDI in the form of "own-firm" effects of FDI in foreign subsidiaries and positive spillover effects to the rest of firms captured to larger extent by some certain types of enterprises in the host economy? Are there particular characteristics of a firm (often called absorptive capacity, e.g. by Cohen, Levinthal 1989) that determine whether it can benefit from positive spillovers? In this paper we try to assess these issues based on enterprise level panel data from Estonia. We find that for the total factor productivity and labour productivity effects of FDI at the subsidiary level, the characteristics like export or domestic market orientation of the affiliate may matter. We do not find that the selected indicators like exporting, R&D activity, technology intensity of the sector matter for benefiting from horizontal spillovers of FDI in Estonia.

Keywords: foreign direct investment, productivity, spillovers, absorptive capacity

JEL Classification: F10, F21, F23

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1. Introduction

Since the second half of 1990s, or especially since the study by Aitken and Harrison on the effects of foreign direct investment (FDI) in Venezuela (1999), the researchers of host country effects of FDI have increasingly employed enterprise level panel data in their analysis, also in the discussion of productivity effects of FDI. The analysis of performance indicators shows almost always the performance gap between foreign owned and domestic firms (e.g. Griffith 1999). Empirical literature on spillovers, however, indicates that the impacts can be different and that the view of only positive effects of FDI on productivity in the host country is not likely to be the correct one (e.g. Aitken and Harrison on Venezuela in 1999, Djankov and Hoekman on the Czech Republic in 2000, Smarzynska on Lithuania in 2004 and a meta-analysis by Görg and Strobl, 2001). In recent years and especially in studies using panel data, both positive, negative and not significant spillover effects of FDI have been found.

An interesting issue that naturally grows out of this field of research and is highly relevant to the government policy of the FDI host country would be the following. Are the benefits of inward FDI in the form of "own-firm" effects of FDI (i.e. effects of receiving FDI into the firm) in foreign subsidiaries and positive spillover effects to the rest of firms captured to larger extent by some certain type of enterprises in the host economy? Are there particular characteristics of a firm (often called absorptive capacity, e.g. by Cohen, Levinthal 1989) that determine whether it can benefit from positive spillovers?

In this paper I endeavour to study whether the: (i) own firm effects of FDI and (ii) intra-industry spillovers of FDI have more beneficial effects on labour productivity and total factor productivity for such firms that: (a) have already had some international activities themselves (as e.g. exporting; or in case of spillovers – whether the foreign affiliates themselves benefit more from the presence of other foreign firms in the economy than wholly domestic firms); (b) for firms that spend on R&D; (c) are in sectors with high or medium-high technology intensity as opposed to firms in low or medium-low technology intensive sectors; (d) have higher productivity than the average firm in the host economy or are relatively big firms. It would be interesting to study also whether the age of a firm matters for benefiting from FDI, however, the data used in this paper on Estonia at this point does not enable us to study that. This

work also extends some of the results of the study on labour productivity effects of FDI in Estonia as presented in Vahter (2004).

In addition to studying spillovers to domestic owned firms, we also incorporate into our research the spillovers of FDI to other foreign affiliates in the economy. Spillovers to other foreign owned firms are increasingly important as the overall share of FDI in the economies, both in Central and Eastern Europe (CEE) and elsewhere can be significantly high (e.g. according to the World Investment Report 2004, the share of inward FDI stock in GDP reached 77.6 per cent in Estonia and 51.5 per cent in Hungary in 2003).

We also present the results on that how the performance gap in labour productivity between foreign owned and domestic owned firms diminishes when sector specificity and firm specific variables are taken into account in econometric analysis.

The study is based on econometric analysis in the production function estimation framework (as in e.g. Aitken, Harrison 1999). Using panel data techniques we account for firm-specific time invariant effects. We use firm-level panel data of manufacturing industry of Estonia.

This study of the "own firm" and spillover effects of FDI endeavours to contribute to the rapidly growing empirical literature of the field. It has the benefits of examining the possible excludability of some types of firms from absorbing the (positive) effects of FDI into the host economy, including the possibility that FDI spillovers are "club goods" rather than non-excludable public goods.

This paper is structured in the following way: Section 2 provides a very short review of the most relevant literature; Section 3 describes the methodology and data used. The results of econometric analysis are given in Section 4, Section 5 concludes.

2. Literature review

In order for the FDI to take place, the multinational enterprises (MNEs) must own some firm-specific competitive advantages that allow them to compete successfully in the foreign environment. These advantages—the firm-specific assets—can constitute of production technologies, but they may also be related to special skills in management, distribution, product design, marketing, and other links in the value chain, or be made up of brand names and trademarks (Caves 1996; Blomström,

Kokko 2003). The theory of FDI stresses the link between firm-specific knowledge based assets and the decision to invest abroad (e.g. Dunning: 1988; Blomström, Kokko 1996). These firm-specific assets are assumed to have some characteristics of a public good and can thus be transferred at low cost between the subsidiary of the MNE and its parent company and can "spill over" to the rest of host economy.

Technology transfer by FDI can be divided into "own firm" and spillover effects in the host economy:

1) the "own firm" effect means that the average performance characteristics of foreign enterprises differ from those of the domestic enterprises (DE) in the host country (are presumably better than these of the DEs, are improved by the FDI);
2) various (pecuniary and knowledge) spillover effects from the presence of foreign firms affect the performance of domestic firms (and other foreign affiliates active in the host country). The empirical literature shows a big variety in the results on FDI spilovers. Especially afeter enterprise level panbel data became available for the researchers, a variety of different findings on FDI spillovers has emerged: poritive, but also negative and not significant spillover effects have been found. (see e.g. Aitken, Harrison 1999: 605–608; Blomström, Kokko 1996, Smarzynska 2004).

Usually, in both the theoretical and empirical literature, the spillovers to domestic capital based enterprises are discussed. However, in addition to the technology transfer to the MNE's subsidiary and the productivity spillovers to the DEs, also other affiliates of MNEs in the host country may receive part of FDI productivity spillovers. If the share of foreign owned firms is relatively large in the host economy, these other foreign affiliates should not be left out from the analysis as possible receivers of spillover effects. It can be argued that external effects to other MNE affiliates can be increasingly important as the share of foreign owned enterprises in the host economy grows. Indeed, productive knowledge that is transferred via FDI may not be in all aspects a public good. It could sometimes be to some extent an excludable and complementary good, i.e. more like a "club" good benefiting more the firms with good learning capabilities and with similar backgrounds (the complementary goods) enabling them to understand better the context specific knowledge. Stefano Breschi has argued that a club good has many characteristics of the public good (as e.g. non-rivalry), but is shared only by a limited number of "club members" and thus

constitutes a public good with "members only" access (Breschi, Lissoni 2001). Thus positive spillovers of FDI may sometimes benefit more the foreign owned firms than the DEs, provided that the combinations of foreign owned firms have more complementary characteristics among them than the combinations of FIEs with DEs. Also the positive effects of FDI (both own firm effects annd spillovers) may be larger for firms that have other complementary knowledge accumulation activities, such as exporting (e.g. Bernard, Jensen 1999) or R&D (Cohen, Levinthal 1989) or are themselves local multinationals (i.e. have invested abroad themselves). Exporting involves an important obstacle to entry in the form of sunk costs of exporting, firms need some sort of firm specific assets/advantages in order to start exporting successfully and to be able to overcome these sunk costs (Bernard, Jensen 1999), this advantage can also probably help these firms to benefit more easily from knowledge transfer via foreign direct investment. The effects may be also different according to the size of the firm, age of the firm or according to the sector of the firm. Due to relatively small number of firms (326) in our panel data we cannot distinguish between many different sectors. The classification scheme is derived from the usual OECD-classification: high tech (HT) (NACE code 3530, -2423, -244, -30, -32, -33); medium-high tech (MHT) (-31, -34, -24 (excl. 2423), -352, -354, -359, -29); medium low tech (MLT) (-23, -25, -26, -27, -28, -351); and low tech (LT) (-15, -16, -17, -18, -19, -20, -21, -22, -36, -37). We will divide the firms into to two groups: medium high–tech and high–tech vs. medium low–tech and low–tech to study whether the technology intensity of the sector matters for the effects of FDI on productivity.

3. Methodology and data

In order to examine the effects of FDI on total factor and labour productivity, we follow the production function approach, as employed often in this sort of analysis, e.g. as in Aitken, Harrison (1999). In order to study the effects of FDI on total factor productivity and the role of export orientation and R&D intensity etc in these effects we estimate a Cobb-Douglas production function in logs with two measures of FDI presence included. FDI dummy $DUMF_{ijt}$ is equal to one if the firm i (in sector j at time t) is foreign investment enterprise, otherwise zero. The usual definition of FDI recipient firms by OECD, IMF or World Bank is the following: FDI recipient firms are defined as firms with foreign share equal to at least 10 per cent of ordinary shares

or voting power (IMF 1993). For Estonia, however, due to the nature of our data one cannot use the 10per cent level, thus 50per cent level is applied to distinguish between the foreign owned firms and DEs. Certainly the FDI dummy variable calculated for the 10 per cent level would have been much more beneficial for the analysis since foreign direct investment smaller than the majority shares can still influence the performance of the firm to a significant extent. However, as annual surveys of FDI "Foreign Investor" by Estonian Investment Agency and Tartu University have indicated, there are relatively few firms with FDI in Estonia that have the foreign share below 50 per cent (Varblane 2001). $Horizontal_{ijt}$ is the measure for capturing the intra-industry spillovers of FDI. $Horizontal_{ijt}$ is the share of FDI in a sector as measured by the ratio: sum of the assets of the foreign investment enterprises in a sector (with each foreign owned firms' own assets subtracted) to the sum of the assets of all firms in the sector.[2] Sectors are defined at NACE double-digit level. If productivity advantages of foreign capital spill over to domestic firms in the same sector, the coefficient of this variable should be positive. We use assets of the firms to calculate this variable, as the sales and value added figures of foreign owned firms may be distorted by the (likely) transfer pricing behaviour of multinational firms in Estonia due to the tax minimising goals of these multinationals.

$$y = \alpha + \beta_1 k_{ijt} + \beta_2 l_{ijt} + \beta_3 m_{ijt} + \beta_4 R\&D_{ijt} + \beta_5 DUMF_{ijt} + \beta_5 Horizontal_{ijt} + \varepsilon_{ijt},$$

where i, j and t index firms, sectors and time periods respectively. The logs of capital, labour and materials as inputs are included, as k, l, m respectively. Dependent variable y is log of sales. All the variables are deflated by the producer price index. Dummy variable for R&D spending is included, it takes the value of 1, if firm spends on R&D (the dummy is used to identify the relatively small number of firms spending or reporting spending on R&D in the sample). Other time invariant firm specific effects are captured by using the fixed effects (FE) model. In some specification that are later

[2] There is a caveat in estimating the model as specified in this section, if the variable $Horizontal_{ijt}$, instead of the definition used in this paper, were defined as simply the ratio of sum of FIE assets to sum of total assets of the sector. In that arguably inferior case, there might be difficulties in separating the "own firm" and spillover effects wholly from each other. Particularly this would be a problem for the sectors with a small number of firms and one or a small number of FIEs making up large proportion of that sector, or in the case of one very large FIE entering the sector. Naturally now this new sector level FDI penetration variable has different values for different firms, not only for different sectors. This ought to improve the results, by establishing a more clear difference between the „own firm" and spillover effects in the analysis.

estimated also the interaction term between firm-level and sector level FDI is used as $DUMF_{ijt} \cdot Horizontal_{ijt}$. It allows us to determine if the effects of foreign presence on other foreign firms differ from the effects on domestic firms. We will not address the possible simultaneity problem here in this paper but note that using panel data and fixed effects model helps to some extent to battle with possible endogeneity/simulatneity bias in the estimation of the production function (Wooldridge 2002). In later stages of this work-in-progress possibly Arellano-Bond estimation procedure or Olley-Pakes (1996) semiparametric procedure may be used to encounter this problem.

We estimate this empirical model separately for all of the firms and compare the results with those if we split the sample according to the export orientation of the firms, R&D spending of the firms or technology intensity of their respective sectors, size of the firms, productivity gap between foreign owned firms and domestic owned firms.

In the labour productivity framework the similar model is estimated, however, all the variables other than dummies and FDI related variables are now given per employee (in log format), the dependent variable is sales per employee, independent variables include capital (as proxied by tangible assets) per employee, materials per employee.

An important issue mentioned by several authors in the field is the non-random selection of FDI recipients. In the case the most productive local firms receive FDI and unless we account for this, the positive productivity effects of FDI might be overestimated. To account for this possibility, in addition to the usual methods of econometrics of panel data, Vahter (2004) employed a two-step procedure (Heckman procedure) to correct for the sample selection bias in his study on productivity effects of FDI in Estonia and Slovenia. For Estonia it was found there that after controlling for other firm specific factors the productivity of a firm did not influence significantly the probability of receiving FDI to the firms. The Mill's ratio correction variable constructed in the estimated Heckman two-stage model and used in the second stage proved also to be not significant based on the same data from statistical office of Estonia that is used in this paper. Thus the Mill's ratio variable has been omitted from the estimation process here.

Enterprise-level panel data on manufacturing industries in Estonia are used in order to study the productivity effects of FDI. The data from the Statistical Office of Estonia

are used. The (balanced) panel consisted of yearly data of 326 firms over period 1996–2001. The initial number of enterprises in panel was 382; over 50 firms were excluded for the purposes of econometric analysis, since these firms either did not exist during the whole period of 1996–2001 (less than 10 per cent of firms) or their field of activity was not manufacturing for the whole period.

4. Empirical results

The analysis of descriptive statistics of Estonian panel of the manufacturing industry firms shows that the share of the foreign investment enterprises in the number of firms was 26.1 per cent, these firms gave 47 per cent of sales, 58.5 per cent of exports, 39.4 per cent of employment, 42.5 per cent of R&D costs in 2001. The foreign affiliates are larger than DEs and indeed more export-oriented. They also tend to spend more on R&D per enterprise than DEs.

Table 1 about here

The comparison of labour productivity between domestic and foreign owned firms in Estonia shows that in 2001 the foreign owned firms had 34 per cent higher labour productivity than the domestic owned firms. However the Table 2 shows the results of the unconditional mean analysis, where the differences in the firm specific variables and sector specific issues have not been taken into account. One might often expect that the FIEs are more present in high productivity industries, thus the cause of higher productivity may not be the foreign ownership itself but it could be attributed to some extent to the sector specific factors. In Estonia, however, a lot of FDI is made into relatively low productivity industries as well (textiles etc), investor motivation surveys have indicated that at least until recently one of the main motivating factor in doing FDI into Estonia has been the cheap labour and relatively low cost level in general (Varblane 2001).

Table 2 about here

We now continue with the conditional mean analysis of the labour productivity differences between foreign owned firms and DEs and the TFP estimation to

determine whether the TFP is also higher in foreign affiliates. The sample we use can be described as being a random sample from a given population of firms, thus we perform both fixed effects and random effects regressions and after that perform the Hausman test in order to choose between them, the results of the Hausman test performed always indicated that we should prefer the fixed effects model. The Hausman test value e.g. for the model in Table 3 is chi2=121.25 (p=0.000) and for model 2 in Table 4 is chi2=98.15 (p=0.000).

The results of estimating the Equation 1 are included in Table 3. The point estimate of the FDI dummy's coefficient indicates that firms with foreign ownership have a TFP advantage of 7.7 per cent, ceteris paribus. The R&D dummy appears to be not significant, thus there appears no statistically significant TFP enhancing effect of spending on R&D.

Table 3 about here

In case we consider labour productivity (as sales per employee) the productivity advantage diminishes significantly as we include the time and sector dummies into the regression model together with the FDI dummy – from 34 per cent result from the unconditional mean analysis for year 2001 to 18.9 per cent based on regression analysis of the panel data, see Table 4 column number 1. After accounting also for other firm specific variables the performance gap decreases even more, to 9.1 per cent (in column 2). Thus sector specific factors and firm specific factors like capital intensity account for a substantial part of the productivity advantage of foreign owned firms, the effect of foreign ownership on labour productivity, or more exactly the effect of multinationality of the firms, ceteris paribus, is in this framework found to be about 9 per cent.

Table 4 about here

The results from table 4 also let us study whether the effects of FDI at the subsidiary level are different for different types of firms, whether they differ from the results of the case when the data for all the firms is used (as in model in column 2): we describe here the effects for domestic owned firms (column no 3), export oriented firms (column 4), firms active in low tech and medium low tech industries (column 5) etc.

Contrary to the expectations that the theory would provide us with (e.g. Cohen, Levinthal 1989), we find that in case we consider only predominantly export oriented

firms (firms that export more than 50 per cent of the sales) or firms spending on R&D (notice however that the share of enterprises spending on R&D is low in our sample – less than 15 per cent of all of the firms) we do not find statistically significant positive productivity effect of FDI at the firm level. Thus it appears that after controlling for firm specific other variables and respective sectors there is no labour productivity advantage foreign owned firms among export oriented firms and R&D "intensive" firms. However, there appears to be a rather large own firm effect of FDI among (predominantly) domestic market oriented firms (firms with exports less than 50 per cent of their sales) – even after controlling for firm specific variables the performance gap in labour productivity remains to be a substantial 26.1 per cent. This difference between export oriented and domestic market oriented enterprises can be perhaps partly explained by the different motivating factors for export oriented foreign owned firms and domestic market oriented foreign owned firms in Estonia. The surveys for Estonia also indicate that export oriented investors have different motivation for investing in Estonia than domestic market oriented investors. Exporters are more motivated by the costs of production and the labour force than by the market potential, as they do not plan to supply the domestic market. Also the demand of the local market may be deviated less towards relatively labour intensive products that is more manufactured by the export platform foreign owned firms in Estonia but rather towards more skill-intensive production. However, it remains a question whether that is the case in Estonia. The non-exporters, in turn, are more motivated in tapping the new market and benefiting from the expected market growth. Exporters represent in Estonia mainly the chemical, wood processing and furniture, electronics (assembly), textile, machinery and engineering industries, while non-exporters are mainly from the food and beverage and construction material industries (Varblane, Ziazic, 2000). Another possible (partial) explanation could be that we might not capture some possibly important sector specific factors with sector dummy variables in our regression analysis.

The results of panel data regression analysis for firms in sectors with low or medium-low technology intensity (according to the classification of the OECD) indicate for this group of firms has about the same FDI performance gap (9.7 per cent) as for the sample with all of the firms.

Table 5 about here

The results of the performance gap analysis based on the TFP estimation are gathered into Table 5. The findings are similar to the analysis of the performance gap in labour productivity There is a large gap between domestic market oriented domestic firms and domestic market oriented foreign firms. The TFP advantage of being a foreign firm is in this sub-sample even 20.6 per cent. Foreign owned firms active in low-technology or medium-low technology intensive sectors of manufacturing have higher TFP than their domestic counterparts, by 8.9 per cent, this is also higher than the result for the sample with all of the firms included. Again, as in case of labour productivity there seems to be no foreign ownership advantage in TFP for the firms who engage in R&D.

Tables 6 and 7 about here

We also tried to take a look at whether the horizontal spillovers are different among these groups of firms studied in this paper. Vahter (2004) used the labour productivity analysis instead of TFP framework to study the effects of FDI on productivity in Estonia and Slovenia and found no horizontal spillovers to the domestic and foreign owned firms in Estonia (but some indication of positive spillovers in Slovenia). Using the same measure for intra-industry spillovers of FDI we find no difference in the result on spillovers by these types of firms. The estimated coefficient of spillover variable *Horizontal* (that describes spillovers to the DEs) was statistically not significant in the "all firms" sample in both Table 6 and 7. I.e. in case when instantaneous spillovers are assumed and when a one period lagged structure is assumed for spillovers. The coefficients of variables *Horizontal* and *DUMF*Horizontal* added together should indicate the spillover effect to other foreign owned firms in the host economy. In table 6 the coefficient of the latter variable is positive and statistically significant. However, their result is not robust to different specifications of the model. Using a lagged value of the spillover variable in TFP estimation instead of the same period's value for the analysis of external effects (as in Table 7) indicated no significant spillovers to other foreign owned firms.

5. Conclusions

In this paper we studied whether the "own-firm" effect of FDI at the subsidiary level and the horizontal spillovers to the rest of firms depend on selected other sector or

firm level characteristics of firms, among them also two knowledge accumulation ways (in addition to FDI): exporting and R&D. Also the relationship between technology intensity of the sector of the firm to the benefits of FDI was taken under examination. Based on theory we would expect R&D and exporting to be productivity improving and provided that the production of the firm is relatively R&D intensive and export oriented, we would expect these characteristics to enhance the effect of FDI on productivity at the subsidiary level and also for benefiting from possible spillovers of FDI. In spillover analysis it is important to pay attention also to other foreign owned firms in the host economy as many of the spillover effects may affect them as well (especially in countries with high share of FDI in total GDP). The foreign owned firms (or exporting firms) might have more complementary assets acquired via being multinational (or trading in a foreign environment).

The results are relatively surprising, as based on enterprise level panel data of Estonia, there appears no large beneficial effect of FDI for export oriented firms and firms spending on R&D. On the contrary, the predominantly domestic market oriented firms (or firms that do not spend on R&D) seem to reap larger benefits (as measured in TFP or labour productivity) of getting FDI via the "own firm" effects. This result on the role of market orientation in the effects of FDI may be specific to Estonia or perhaps also to some transition economies and has probably to do with export platform FDI concentrating to significant extent (at least until year 2001) into relatively labour intensive and cost-sensitive manufacturing. We find no indication of horizontal spillovers or differences in (the lack of) spillovers between those mentioned types of firms.

Thus we do not find that the benefits of FDI are more restricted to firms engaging in exports or R&D or to those that are foreign owned firms themselves. I.e. we cannot say for Estonia that knowledge transferred via FDI is a "club good" in the sense that it benefits more those firms that have similar background or have engaged in other learning/knowledge accumulation (complementary assets creating) activities.

As this is still the first draft of the work in progress, the issue whether big firms or firms with relatively high productivity level benefit more from the inward FDI than the rest remains to be studied. These results will be added shortly.

Table 1 Descriptive statistics on the Share of FDI in Estonia (per cent)

	Estonia
Year	2001
FDI share in sales	46.6
FDI share in exports	58.5
FDI share in employment	39.4
FDI share in value added	48.7
FDI share in tangible fixed assets	54.4
FDI share in number of firms	26.1

Source: own calculations based on enterprise level panel database of Estonian manufacturing.

Table 2 *E*stonia – labour productivity (sales/employee) differences between Domestic and Foreign owned firms

Estonia, 1000s kroons	Year					
	1996	1997	1998	1999	2000	2001
Domestic enterprises	253	327	350	349	415	479
Foreign owned firms	407	480	497	475	542	644
The (foreign/domestic) ratio of productivity (sales/employees)	1.609	1.466	1.420	1.359	1.305	1.344
The (foreign/domestic) ratio of capital/labour ratio	4.092	3.014	2.310	2.039	1.812	1.834

Notes: capital/labour ratio – tangible fixed assets per employee.
Source: own calculations, based on enterprise-level panel database of Estonian manufacturing, 1996–2001.

Table 3 TFP analysis, foreign ownership and performance gap, FE model, Estonia 1996–2001

Number of obs = 1915
F(22, 1567) = 184.09
Prob > F = 0.0000

	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Capital	.0862628	.0192359	4.48	0.000	.048532	.1239936
FDI dummy	**.0772347**	.0393357	1.96	0.050	.0000786	.1543908
Materials	.3528961	.0347199	10.16	0.000	.2847937	.4209984
Labour	.622881	.0493169	12.63	0.000	.5261469	.719615
R&D dummy	-.0139529	.0213962	-0.65	0.514	-.055921	.0280152
Sector dummies:	Yes					
Year dummies:	Yes					
Cons.	3.07881	.2412251	12.76	0.000	2.605652	3.551968

Note: heteroscedasticity robust standard errors.
Source: own calculations, Estonian manufacturing industry panel database 1996–2001.

Table 4 The own-firm effect of FDI, labour productivity analysis

	1	2	3	4	5	6
			Domestic market			
	All firms	All firms	oriented firms	Export oriented firms	LT+LMT sector firms	Firms that spend on R&D
FDI dummy	**0.189**	**0.091**	**0.261**	**0.062**	**0.097**	**0.107**
	(0.055)* **	**(0.042)** **	**(0.138)***	**(0.047)**	**(0.051)***	**(0.172)**
capital/employees		0.08	0.106	0.074	0.084	0.055
		(0.019)***	(0.041)***	(0.02)***	(0.022)***	(0.035)
materials/employees		0.357	0.395	0.289	0.333	0.642
		(0.035)***	(0.073)***	(0.0322)***	(0.038)***	(0.116)***
R&D dummy		-0.011	0.01	-0.015	-0.015	
		(0.022)	(0.035)	(0.028)	(0.024)	
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.12	3.44	3.156	3.783		2.554
	0.096***	0.162***	0.278***	0.184***		0.518***
Number of observations	1949	1915	938	977	1622	284

Note: fixed effects estimation, heteroscedasticity robust standard errors in parenthesis; *statistically significant at 10 per cent, ** at 5 per cent, *** at 1 per cent level. LT- low-technology intensity sectors, LMT – medium-low technology intensity sectors.
Source: own calculations, Estonian manufacturing industry panel database 1996–2001.

Table 5 The own-firm effect of FDI, total factor productivity analysis

	1	2	3	4	5
	All firms	Domestic market oriented firms	Export oriented firms	LT+LMT sector firms	Firms that spend on R&D
FDI dummy	**0.077**	**0.206**	**0.0599**	**0.089**	**0.098**
	(0.039)**	**(0.113)***	**0.046**	**(0.047)***	**0.15**
capital	0.086	0.131	0.074	0.089	0.0476
	(0.019)***	(0.043)***	(0.02)***	(0.022)***	0.041
materials	0.352	0.39	0.288	0.329	0.632
	(0.034)***	(0.073)***	(0.032)***	(0.038)***	0.107
labour	0.623	0.627	0.659	0.644	0.524
	(0.049)***	(0.088)***	(0.057)***	(0.056)***	(0.149)***
R&D dummy	-0.014	0.008	-0.016	-0.018	
	(0.021)	(0.034)	(0.028)	(0.024)	
Sector dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	3.079	2.436	3.677	3.162	1.52
	(0.241)***	(0.398)***	(0.275)***	(0.267)***	-1.116
Number of observations	1915	938	977	1622	284

Note: fixed effects estimation, heteroscedasticity robust standard errors in parenthesis; *statistically significant at 10 per cent, ** at 5 per cent, *** at 1 per cent level. LT- low-technology intensity sectors, LMT – medium-low technology intensity sectors.
Source: own calculations, Estonian manufacturing industry panel database 1996–2001.

Table 6 Horizontal spillover (same period effect) effects of FDI, sample split by different types of firms, TFP estimation framework

	All firms	Domestic market oriented firms	Export oriented firms	LT+LMT sector firms	Firms that spend on R&D
Horizontal	0.069	0.08	0.081	0.167	0.123
	(0.083)	(0.153)	(0.112)	(0.088)*	(0.266)
DUMF*Horizontal	0.232	0.089	0.162	0.0997	0.481
	(0.137)*	(0.271)	(0.188)	(0.1539	(0.505)
Number of observations	1915	938	977	1622	284

Note: TFP estimation, FE model, all variables from Table 5 are also included, heteroscedasticity robust standard errors in parenthesis; *statistically significant at 10 per cent, ** at 5 per cent, *** at 1 per cent level.
Horizontal: captures horizontal spillover effects; DUMF*Horizontal: allows distinction between foreign owned and domestic firms as receivers of spillover effects.
Source: own calculations, Estonian manufacturing industry panel database 1996–2001.

Table 7 Horizontal spillovers (lagged by one period) of FDI, sample split by different types of firms, TFP estimation framework

	All firms	Domestic market oriented firms	Export oriented firms	LT+LMT sector firms	Firms that spend on R&D
Horizontal(lag1)	0.037	0.219	-0.141	0.149	0.026
	0.082	0.154	0.093	0.102	0.16
DUMF(lag1)*Horizontal(lag1)	0.011	-0.019	0.13	-0.111	0.132
	0.089	0.147	0.118	0.118	0.228
Number of observations	1599	775	824	1355	235

Note: TFP estimation, FE model, all variables from Table 5 are also included, heteroscedasticity robust standard errors in parenthesis; *statistically significant at 10 per cent, ** at 5 per cent, *** at 1 per cent level.
Source: own calculations, Estonian manufacturing industry panel database 1996–2001.

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