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Productivity, Export Performance, and Financing of the Czech Corporate Sector: The Effects of Foreign Direct Investment

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Abstract
The article looks in both theoretical and empirical terms at whether large foreign presence has affected domestic firms. Foreign firms might both intentionally and unintentionally influence the productivity, financing, and export performance of local firms within the same industry or across industries along the production chain via supplier and client linkages. Economic theory does not suggest an unambiguous answer to the question of whether the influence is positive or negative. To answer this question, both firm-level and industry-level data on performance, financing, and exports and interactions of firms within the production chain in the Czech Republic are analyzed.

1. Introduction

The Czech Republic, similarly to other Central and Eastern European (CEE) countries, successfully attracted foreign direct investment (FDI) during the 1990s, mainly thanks to privatization, a lack of domestic capital needed for economic transition, and EU accession prospects. Later, mainly after 2000, other determinants of FDI, such as wage cost factors, the size and location of the market, and FDI policies gained in importance.

Next to the well-known direct benefits to the host economy in terms of higher investment, output growth, and employment (Jones, Colin, 2006), (Geršl et al., 2007), FDI can have some indirect effects on the host economy, specifically on local (i.e., domestically owned) companies. These indirect effects, referred to in the literature as "spillovers", emerge due to interactions between foreign and local (i.e., domestic) firms both within an industry as well as across industries, along the production chain.

The available evidence and academic literature focuses mainly on productivity spillovers (Blomstrom, Kokko, 1998). Productivity spillovers refer to transfer of technology in a broader sense, including organizational and managerial practices and know-how, from foreign firms to domestic firms. Nevertheless, there are at least two additional important spillovers from foreign to domestic firms: "market access" spillover and "financing" spillover.[1] Market access spillover can be found if an increased foreign presence in the corporate sector leads to an increase in the export perfor-

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[1] There might be some other "indirect" effects as well: Ayygari and Kosova (2006), for example, look at whether inflows of FDI facilitate domestic entrepreneurship.

mance of domestic firms. Financing spillover means a situation where the entry of foreign firms facilitates the access of local firms to external financing.

In this article, we analyze the three indirect effects (spillovers) of FDI mentioned above, using firm-level data on manufacturing industries in the Czech Republic. The motivation to look more in detail at spillovers from FDI helps us understand the results of the interaction between foreign and domestic companies and thus the possible consequences of the huge inflows of FDI that the CEE countries have been experiencing. In comparison to existing studies on spillovers in the CEE countries, this article analyzes the most recent data (2000–2005) and focuses also on a further two spillovers – market access and financing spillover. While the former has already been partly researched and discussed in the literature (Aitken et al., 1997), we are not aware of any study focusing on the latter. Thus, this study provides the first attempt to analyze empirically the effect of FDI on the financial structure of local companies.

The article is structured as follows: Section 2 provides an overview of the inward FDI positions in the Czech Republic in comparison with the CEE region, presents the firm-level data used for the analysis, and analyzes the foreign presence in the manufacturing sector. Section 3 reviews the channels through which the three spillovers can work. Section 4 reveals the estimation strategy and describes the construction of the foreign presence variables used in the subsequent estimations. Section 5 attempts to estimate the productivity spillovers, using the Levinsohn and Petrin (2003) methodology. Section 6 estimates the extent of market access spillover, taking into account the data limitations. Section 7 focuses on analysis of financing spillover, looking at the effect of foreign presence on the degree of external financing and the level of financing costs of domestic companies. Section 8 presents the results of some robustness checks, while Section 9 concludes.

2. FDI Inflows and Evidence from Firm-level Data

The Czech Republic has been one of the most important target countries for foreign direct investment. The stock of FDI as a percentage of GDP increased from around 35 % in 2000 to 50 % in 2005, the third-highest figure in relative terms among the CEE countries (after Estonia and Hungary). The inflow of FDI has on average been 7.5 % of GDP annually over the period 2000–2005, compared to around 5 % for the CEE region as a whole.

The majority of the FDI going to the CEE countries has gone into services. This holds also for the Czech Republic (*Table 1*). Financial intermediation, trade, real estate and business services, and transport and communication account for around 50 % of the total FDI inward stock in the Czech Republic, similarly as in the CEE countries as a whole. The inflow of FDI into the services sector has usually been motivated by market seeking and cost optimization, but outsourcing and FDI in export-oriented services seem to have become an important factor as well. Most of the FDI in services can be related to past privatizations in the banking or telecommunications sector.

However, manufacturing accounts for around 40 % of the total FDI inward stock both in the Czech Republic and in the CEE region as a whole. The inflow of FDI into this sector has been motivated mainly by low input costs and production cost economization. It is also the sector where the most green-field investments have

TABLE 1 Industrial Structure of the Stock of Inward FDI
(in % of total inward stock of FDI; Czech Republic as of end-2005, CEE total as of end-2004)

	Czech Republic	CEE total
manufacturing	38.1	40.0
financial intermediation	18.8	16.1
wholesale, retail trade	9.8	14.3
real estate and business activities	12.3	12.1
transport, communication	12.1	7.9
electricity, gas and water supply	5.7	4.9
other	3.2	4.7

Source: WIIW; CNB; (Geršl et al., 2007)

been made. However, some FDI in manufacturing has also been driven by privatization and the market-servicing motive. As a large part of services might be linked to the performance of the manufacturing sector, we focus solely on manufacturing industries in the analysis.

Firm-level data on manufacturing firms (NACE Rev. 1.1 2-digit industries 15–36) are taken from the Amadeus database provided by Bureau van Dijk (September 2006 release). The data on companies' balance sheet items, profit-and-loss accounts and ownership constitute an unbalanced panel over the period 2000–2005.[2] We focus on manufacturing companies with a minimum of 10 employees and fixed assets and turnover of at least USD 10,000.

The Czech sample from Amadeus is a representative sample, as the total turnover from Amadeus accounts for 100 % of total manufacturing production and almost 90 % of employment from the WIIW database. At the same time, the industry structure is relatively similar.[3]

In the analysis, foreign companies are defined as companies whose global ultimate owner is from a country outside the host country, or whose immediate shareholders from countries outside the host country have a share of at least 51 % of the company's capital. This definition differs from the traditional definition of FDI (10 % of shareholder funds), but is in line with the literature on spillovers. Moreover, the empirical evidence shows that in most emerging markets, the important foreign companies that could have some effect on local companies are majority-owned (Geršl, Hlaváček, 2007).

Foreign companies account for about 12 % of all firms, but their relevance in terms of total assets, turnover, investment, and employment is much higher (*Table 2*). They account for around 40 % of total manufacturing assets, turnover, and investments, and for around 25 % of total manufacturing employment. This suggests that foreign companies are on average bigger and have a higher stock of investments, more employees, and higher turnover. The firm-level data from Amadeus also show that foreign companies are more productive (as measured by labor productivity) and

[2] Unfortunately, the given release of the Amadeus database does not include a history of ownership information, thus the most recent information about ownership status is used (i.e., as of September 2006) and is assumed to be valid over the whole period of the analysis.

[3] WIIW (Vienna Institute for International Studies) provides reliable comparative data on the industrial structure of CEE countries. A detailed comparison can be found in (Geršl, 2008).

TABLE 2 Relevance of Foreign Firms in the Czech Manufacturing Sector (as of 2004)

% of foreign firms in no. of firms	12.3 %	
% of foreign firms in total assets	38.9 %	
% of foreign firms in turnover	37.1 %	
% of foreign firms in stock of investment	41.3 %	
% of foreign firms in employment	23.4 %	
average total assets (in mil CZK)	foreign firms	887
	local firms	195
average stock of investment (in mil CZK)	foreign firms	463
	local firms	92
average employment (no. of employees)	foreign firms	335
	local firms	155
average turnover (in mil CZK)	foreign firms	1348
	local firms	321
average RoE (return on equity, in %)	foreign firms	23.9
	local firms	19.4
average labor productivity (in real value added per employee)	foreign firms	7.0
	local firms	6.6

Source: Amadeus

TABLE 3 Distribution of Exports to the EU25 (as of 2004)

	in % of total exports to EU25	**in % of sectoral output**
DA Food products; beverages and tobacco	3.1	14.7
DB Textiles and textile products	5.3	103.4
DC Leather and leather products	0.5	125.3
DD Wood and wood products	1.5	42.6
DE Pulp, paper & paper products; publishing & printing	3.2	41.9
DF Coke, refined petroleum products & nuclear fuel	1.1	22.1
DG Chemicals, chemical products and man-made fibres	5.8	52.3
DH Rubber and plastic products	5.3	45.7
DI Other non-metallic mineral products	3.1	31.6
DJ Basic metals and fabricated metal products	13.6	47.3
DK Machinery and equipment n.e.c.	12.7	86.5
DL Electrical and optical equipment	21.4	75.8
DM Transport equipment	19.6	59.1
DN Manufacturing n.e.c.	3.7	58.4
Manufacturing total	100.0	53.5

Source: WIIW; Amadeus

more profitable. However, the gap in productivity and profitability between foreign and local companies is not that large.[4]

Given that we focus also on market access spillover and financing spillover, it might be interesting to look at the export performance and financial structure of the Czech corporate sector. Out of the total exports of the manufacturing sector to the EU25 countries, products from the electrical and optical equipment and transport equipment sectors are the Czech Republic's most important export items (*Table 3*).

[4] Geršl et al. (2007) show that the relevance of foreign firms differs across CEE countries and that in some countries the gap in profitability is much bigger.

TABLE 4 Financial Structure of Manufacturing Firms (as of 2004) (in %)

	Foreign companies	Domestic companies
Capital (shareholder funds)	42.8	40.4
Debt	57.2	59.6
Long-term debt	9.4	8.0
Short-term loans	5.3	5.9
Creditors	15.7	16.7
Other liabilities	26.9	29.0

Source: Amadeus

This corresponds to the industry structure of inward FDI, suggesting that indeed a large part of the inward FDI has been due to relocation of production and subsequent export of output to foreign markets. However, exports also represent a large share of total output of other industries, such as textiles and leather, machinery, and chemicals.

Not all the exports of industries with high foreign relevance might be due to foreign firms if there are market access spillovers and local firms have also increased their exports. Unfortunately, the Amadeus database does not include data on the export performance of individual companies in the Czech Republic. Thus, for estimation of market access spillovers we will have to find a proxy for the export performance of local companies.

As regards financial structure, domestic companies are more indebted than foreign companies, which might reflect the initial capital (in the form of equity) provided to foreign subsidiaries by their parent companies (*Table 4*). Nevertheless, foreign companies have on average more long-term debt in their liabilities, while domestic firms rely more on short-term debt (short-term loans and creditors).

3. Channels of Indirect Effects of FDI on Domestic Firms

The available literature on spillovers differentiates between horizontal and vertical spillovers (Javorcik, 2004), (Merlevede, Schoors, 2005). If local firms benefit from the presence of foreign companies in their sector, we refer to horizontal spillovers, while if local firms benefit from interaction with foreign firms upstream or downstream in the production chain, we refer to vertical spillovers. In this sense, backward spillovers denote spillovers from the foreign firm to its local supplier (upstream – or backward – in the production chain), while forward spillovers refer to spillovers from foreign firms to their local customers (downstream – or forward – in the production chain).

The majority of the literature on spillovers deals with productivity spillovers (Schoors, van der Tol, 2002), (Javorcik, Spatareanu, 2003), (Damijan et al., 2003), (Javorcik, 2004), (Merlevede, Schoors, 2005, 2006), (Geršl et al., 2007). In this stream of literature, three main channels for horizontal spillovers are identified: the demonstration channel, the labor market channel, and the competition channel (Kokko, 1992). Within the demonstration channel, local firms imitate the foreign firm's technology. The labor market channel works via labor turnover of trained workers from foreign to local firms (Fosfuri et al., 2001). However, foreign presence can also have a detrimental effect on local firms through this channel, as it can brain drain local talent from local firms to foreign affiliates (Blalock, Gertler, 2003).

Within the competition channel, the entry of foreign firms increases competition in the host economy and forces local firms to use existing resources more efficiently and to adopt better technologies (Blomstrom, Kokko, 1998). On the other hand, if the competition induced by the entry of foreign firms is too high, less productive local firms may be driven out of the market (the market stealing effect – see (Aitken, Harrison, 1999)). The empirical evidence suggests that more potential for productivity spillovers exists in the interaction of local and foreign firms within the production chain (vertical spillovers), mainly via backward vertical spillovers when foreign firms intentionally help local suppliers to deliver high-quality inputs and share superior technology with them (Merlevede, Schoors, 2005, 2006), (Geršl et al., 2007).

Some authors argue that spillovers may be non-linear, meaning that the net effect on domestic companies' productivity changes with the degree of foreign presence (Damijan et al., 2003), (Merlevede, Schoors, 2005, 2006), (Geršl et al., 2007). For example, a relatively moderate presence of foreign companies may induce positive horizontal spillovers via the demonstration channel, but a further substantial increase in foreign presence may trigger a brain drain and lead to the market stealing effect, driving local companies out of the market (negative horizontal spillovers). Recent literature also focuses on the conditions or characteristics that make domestic companies sensitive to spillovers – so-called conditional spillovers (Schoors, van der Tol, 2002), (Javorcik, Spatareanu, 2003), (Javorcik, 2004), (Merlevede, Schoors, 2005, 2006). The main characteristics of a firm or industry that affect the conditional spillovers are the absorptive capacity of the firm, export orientation, import competition, sectoral competition, firm size, and the level and origin of foreign ownership.

Market access spillovers refer to the possibility for local firms to access new markets via the marketing and business networks of foreign companies with which local firms interact. As Aitken at al. (1997) put it, "multinational corporations are a natural conduit for information about foreign markets, foreign consumers, and foreign technology, and they provide channels through which domestic firms can distribute their goods. To the extent that multinationals directly or indirectly provide information and distribution services, their activities enhance the export prospects of local firms." In this regard, two channels of market access spillover can be identified: first, similarly to productivity spillovers, via the labor market channel experienced workers from foreign firms may be attracted by local firms, bringing their knowledge and valuable contacts about foreign distribution networks. This would hold mainly for horizontal spillovers, but the available evidence suggests that labor turnover, especially in sales departments and distribution, occurs to a large extent also vertically. Second – and this holds primarily for backward market access spillovers – foreign companies may again intentionally assist domestic suppliers, opening up their home markets to supplies. The typical sequencing of such spillover is for a foreign company to start with supplies of inputs from a local firm. Then, after the quality reaches a certain level, the foreign company invites the local firm to supply inputs also to its home production facilities or other subsidiaries in other countries.

Clearly, market access spillover may go hand in hand with productivity spillover, and the two reinforce each other, as the chance to compete in foreign markets puts pressure on local firms to increase their productivity. Moreover, export-oriented firms are used to higher competition on foreign markets and are usually more pro-

ductive than firms serving only local markets. Thus, they may be better prepared to adapt advanced technologies (productivity spillover).

In contrast, financing spillover differs slightly from the two previous spillovers, as here it is not the foreign firm that transfers "finances" to local firms. However, local firms' interactions with foreign firms may influence the way local companies are financed. First, increased competition in the sector due to the entry of foreign firms may put pressure on the profitability and performance of local firms (the brain-drain effect and the competition effect), which would be seen immediately by creditors (banks), leading to either a lower willingness to offer external financing or to more expensive financing (the interest rate margin). This would lead to negative horizontal spillovers in financing. However, positive horizontal financing spillovers are also possible, especially if the other spillovers (productivity and market access) are positive and thus lead to enhanced competitiveness, productivity, and ultimately also profitability of domestic firms. Second, the interaction between local and foreign firms along the production chain, mainly via local firms serving as suppliers, creates a need for local firms to invest in new and advanced technologies. However, new investments must be financed, and the fact that the foreign company provides the local firm with stable and large demand for inputs may help the local company to obtain credit from banks more easily, or at least at a lower interest rate margin. The foreign company thus transfers part of its "creditworthiness" to the local supplier, effectively providing an implicit guarantee to repay the debt if the investment is relatively specific.[5]

There is no theoretical or empirical literature on this issue. The impact of FDI inflows on the financing of foreign-owned firms is analyzed in (Geršl, Hlaváček 2007); the authors focus on the role of intra-group credit in financing subsidiaries across borders. They also focus on the general impact of FDI on the credit supply from local banks, arguing that the increased incentive of foreign-owned companies to use intra-group credit could lead local banks to turn to domestic firms often serving as suppliers to foreign firms and thus to increase financing of local companies. Thus, on a more macro-level, they actually argue that there might be an indirect positive effect (spillover) from FDI on the financing of local companies.

4. Estimation Strategy

The main objective of this study is to find out whether domestic companies benefit from foreign presence in the same sector (horizontal spillovers) and in upstream or downstream sectors (vertical spillovers). Within the vertical spillovers, more emphasis is put on backward spillovers, as the channel of supplier linkages might be more relevant given both the anecdotal evidence and some partial studies from the automotive industry. Thus, we estimate the impact of appropriately defined "foreign presence" variables on several performance indicators of domestic firms, taking into account other factors of influence using a number of control variables.

[5] Anecdotal evidence suggests that a very special relationship emerges between a foreign firm and its local supplier if the local firm is investing in very specialized assets. Both parties then have an interest in keeping the business alive even if the local company gets into repayment problems. There have been cases where the foreign client has in the end bought out the local supplier in order to safeguard the regularity of the inputs it needs.

As regards the performance variables, we selected the following dependent variables following the above discussion about the three possible spillovers, i.e., productivity, export performance, and financing. For the productivity estimation we use total factor productivity as the dependent variable, for export performance we use exports to EU-25 countries, and finally for financing we use the ratio of debt to total assets as well as the interest rate paid by domestic corporations (detailed definitions are given in the following sections).

Unfortunately, the available data do not include information about the interaction between local and foreign companies. However, there is a way of capturing at least the "potential" or "probability" that there will be some interaction having effects on local firms. Foreign presence in the same sector is captured by the variable $horizontal_{jt}$ and it is defined as the share of foreign firms' output in total industry output:

$$horizontal_{jt} = \frac{\sum_{i \in j} foreign_{it} * turnover_{it}}{\sum_{i \in j} turnover_{it}} \quad (1)$$

The variable *foreign* is a dummy variable that equals 1 if the company i is a foreign company, and 0 otherwise. The higher is the value of output produced by foreign firms and the higher is the number of foreign firms in the sector j, the higher is the variable *horizontal* and thus the potential for horizontal spillovers. Indeed, if a local firm produces in an environment where there are many other foreign firms in the same industry, some interaction is inevitable and the local firm will have to adapt (for example, by raising its productivity in order to withstand possible competitive pressure).

As discussed, one of the most promising interactions that can lead to positive spillovers to local firms is via supplier linkages. Ideally, one would need the share of the local firm's output sold to foreign firms. As this information is not available, we follow the current practice in the literature on spillovers and use input-output tables to trace inter-industry supply linkages. Thus, we proxy the share of the firm's output sold to foreign companies by the share of the sector's output for intermediate consumption within the domestic economy sold to foreign companies in downstream sectors. The input-output tables reveal information about the amount supplied by the sector j to its sourcing sector k. In addition, we employ information about the foreign presence in sector k (the variable *horizontal*). Thus, we define a variable $backward_{jt}$ as

$$backward_{jt} = \sum_{k \; if \; k \neq j} \gamma_{jkt} \, horizontal_{kt} \quad (2)$$

where γ_{jkt} is the proportion of sector j's output supplied to sourcing sectors k and is calculated using the input-output table for domestic intermediate consumption (i.e., excluding imports).[6] In addition, intra-industry supplies are not accounted for, as this

[6] Ideally, one should use a series of I-O tables to capture the dynamics of inter-industry trade. Due to data limitations, we employ the last available I-O table for domestic intermediate consumption for the Czech Republic, namely, for the year 2003. As this year is actually in the middle of the time span of our panel of firms, it can be considered as providing a relatively representative picture of inter-industry trade.

effect is captured by the variable *horizontal*. This proxy thus shows the "potential" or "probability" that a local firm will interact with (supply its inputs to) a foreign firm in the downstream sector.

Similarly, we define a variable $forward_{jt}$ that captures the potential for forward vertical spillovers to local firms that buy inputs from foreign firms. This proxy is defined as

$$forward_{jt} = \sum_{l\ if\ l \neq j} \delta_{jlt}\ horizontal_{lt} \tag{3}$$

where δ_{jlt} is the proportion of sector *j*'s inputs purchased from upstream sectors *l*. Intra-industry supplies are not accounted for in this case either, as this effect is captured by the variable *horizontal*. Note that for both cases, the weights γ_{jkt} and δ_{jlt} are calculated using the proportion in total output for intermediate consumption (or total input used), not only the output (input) supplied to (bought from) the manufacturing sectors (thus, the sum of γ_{jkt} or δ_{jlt}, respectively, is not equal to 1).[7]

In the following sections, we relate the performance indicator of a local firm *i* in NACE 2-digit sector *j* and in period *t* to the above constructed foreign presence variables (horizontal, backward, and forward) and other control variables (determined separately for estimations of productivity, market access, and financing spillover), estimating an unbalanced panel of local firms.[8]

$$\begin{aligned} performance\_variable_{ijt} &= \alpha_0 + \alpha_1 horizontal_{jt} + \alpha_2 horizontal_{jt}^2 + \alpha_3 backward_{jt} + \\ &+ \alpha_4 backward_{jt}^2 + \alpha_5 forward_{jt} + \alpha_6 forward_{jt}^2 + control\_variables_{ijt} + \varepsilon_{ijt} \end{aligned} \tag{4}$$

5. Estimating Productivity Spillovers

The typical approach to analyzing productivity is to estimate a production function and use the residuals not explained by the input factors (capital, labor) as a proxy for total factor productivity (Solow residuals). However, as Levinsohn and Petrin (2003) point out, when estimating the production function, one must account for the correlation between input levels and productivity. The reason is that profit-maximizing firms respond to increasing productivity by increasing the volume of factor inputs. Thus, methods that ignore this endogeneity (such as OLS or the fixed-effects estimator) inevitably lead to inconsistent estimates of the parameters of the production function.

In line with the recent literature, we employ a semi-parametric approach suggested by Olley and Pakes (1996) and modified by Levinsohn and Petrin (2003). This method allows for firm-specific productivity differences that exhibit idiosyncratic changes over time.[9] Using this technique, we estimate a log-linear transformation of a Cobb-Douglas production function:

[7] An illustrative example of how the variables are computed can be found in (Geršl, 2008).

[8] Most studies on spillovers use the fixed-effects estimator, due to both economic reasoning (heterogeneity among firms) and econometric assumptions (possible correlation between regressors and firm effects). A notable exception is Jarolím (2000), who uses the random-effects model. The appropriateness of using the fixed-effects model has been tested for the individual regressions using the Hausman test.

[9] The method is described in detail in (Levinsohn et al., 2004) and (Geršl et al., 2007).

$$va_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \varepsilon_{it} \quad (5)$$

where va_{it} is the log of the value added of a firm i, l_{it} is the log of labor input, and k_{it} is the log of capital. In order to be able to compare the resulting productivity across industries, the estimation is done using all domestic firms across individual 2-digit NACE industries.[10] Value added enters the equation as real value added, computed as real turnover minus real material costs. The data on operating turnover were deflated by the producer price index for the corresponding 2-digit NACE sector, while material costs were deflated by the unweighted average of the total manufacturing producer price index and import price index. Labor input refers to number of employees. For capital input, the stock of fixed assets was used, deflated by the average of the deflators for the following NACE sectors: machinery and equipment (29), office machinery and computing (30), electrical machinery and apparatus (31), motor vehicles, trailers and semi-trailers (34), and other transport equipment (35).[11]

A measure of the log of total factor productivity tfp_{it} – a performance variable that is subsequently used in the estimation of the spillovers – is obtained as the difference between the log of value added and the log of capital and the log of labor, multiplied by their estimated coefficients:

$$tfp_{it} = va_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{itt} \quad (6)$$

We estimate equation (4) via the fixed-effects estimator. To capture the possible non-linear impact of all three variables representing foreign presence on the productivity of local firms (Merlevede, Schoors, 2005), we additionally include squared *horizontal*, *backward*, and *forward*. As control variables, we use firm and year fixed effects as well as the Herfindahl index as a proxy for the level of concentration and thus competition within the sector.[12] Sectoral competition can also push firms to increase their productivity regardless of whether competitors in the sector are foreign--owned or not.[13]

In order to test the robustness of the estimation results, we also calculated the total factor productivity alternatively using real depreciation (deflated by the same price indices as the capital stock) instead of the stock of capital (Jarolím, 2000) and the real wage bill (deflated by the consumer price index) instead of the number of employees (Arnold et al., 2006). *Table 5* shows the results.

Despite the low performance of the model as documented by the low *R*-squared, the results in all the specifications can be interpreted as follows: first, the productivity spillovers tend to be significant and positive, at least up to some degree of

[10] Other studies, such as (Arnold et al., 2006) and (Geršl et al., 2007), estimate the total factor productivity separately for individual industries, or groups of similar industries. However, in such a setting the comparison across industries should ideally be made in terms of changes over time.

[11] This approach follows Javorcik (2004). Alternatively, capital could be deflated using the GDP deflator – see (Damijan et al., 2003) – or even the capital stock deflator if available – see (Arnold et al., 2006).

[12] The Herfindahl index was computed as the sum of the squared shares of the individual firms in sectoral output. It thus ranges from almost 0 (no concentration) to 10,000 (maximum concentration, i.e., one firm produces the whole sectoral output – 100 % squared).

[13] The Hausman test showed that the hypothesis of no correlation between the regressors and the individual effects can be rejected, thus the fixed-effects model is appropriate.

TABLE 5 Productivity Spillovers – Estimation Results

	(1)	(2)	(3)	(4)
horizontal	0.667*	0.667**	0.184	0.43
horizontal^2	-1.298***	-1.148***	-0.827**	-1.135***
backward	4.907***	5.055***	2.790*	3.065**
backward^2	-12.219***	-12.64***	-8.216**	-9.201***
forward	2.144**	2.379**	2.548***	2.704***
forward^2	-7.164**	-6.846**	-7.612**	-7.440**
hhi	0.522**	0.390*	0.521**	0.535**
constant	6.617***	6.212***	3.825***	3.592***
Observations	11 386	11 325	11 910	11 848
Firms	3 850	3 835	3 925	3 910
R-squared	0.01	0.01	0.01	0.01

Notes: Dependent variable: ln TFP; * significant at 10%; ** significant at 5%; *** significant at 1% level

Estimated with firm and year fixed effects

ln TFP (dependent variable) computed using (1) capital and labor, (2) depreciation and labor, (3) capital and wage bill, (4) depreciation and wage bill

foreign presence (positive sign of coefficients of horizontal, backward, and forward spillover). This has not been always found in the empirical studies of CEE countries. Geršl et al. (2007), who analyze ten CEE countries, show that in many countries the spillovers are insignificant or even negative.[14] Second, the results suggest that vertical effects tend to be higher and thus economically much more important than horizontal effects. This is in line with the findings of Geršl et al. (2007), Merlevede and Schoors (2005, 2006), and Javorcik (2004).

Third, both horizontal and vertical spillovers tend to be highly non-linear. The effect is positive up to a certain level of foreign presence, but turns negative after the foreign presence exceeds a certain threshold (around 50 %). Non-linear effects are also reported by Merlevede and Schoors (2005) and Geršl et al. (2007), but the latter find that in some countries, the effect is opposite to the effect found for the Czech Republic (i.e., the spillover is negative for low foreign presence and turns positive after a certain threshold is reached). Our findings thus indicate potential for the market stealing effect after 2000 and some crowding-out of domestic firms, but they might also reflect continued FDI inflow into these countries (i.e., purchases of more productive local firms by foreign companies). The coefficient of concentration as measured by the Herfindahl index is significant and positive, suggesting that higher concentration (i.e., lower competition) is – somewhat counter-intuitively – beneficial for productivity.

The results also indicate that the largest effect on productivity is due to being a supplier to a foreign company, although the effect is positive only for sectors with a relatively low foreign presence. This is in line with some anecdotal evidence about supply networks, such as for the automotive or ICT industries in Central Europe (European Commission, 2003).

6. Estimating market access spillovers

Market access spillover is difficult to estimate precisely given the unavailability of data on the export performance of individual companies. Thus, we construct

[14] Negative or insignificant spillovers have been found by Damijan et al. (2003) and Torlak (2004).

TABLE 6 Market Access Spillovers – Estimation Results

	(1)	(2)
Imports	0.729***	0.728***
Turnover	0.131***	0.131***
horizontal	496.6***	680.3***
horizontal^2		-365.9
backward	1 235**	1 366
backward^2		-2381
forward	81.69	615.3
forward^2		-1 646
constant	-297.0***	-296.4***
Observations	17 180	17 180
Firms	4 976	4 976
R-squared	0.7	0.70

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%
Estimated via fixed-effects estimator.

a proxy for export performance, assigning individual firms a share of total exports to the EU25 in the same proportion as their share in industry (2-digit NACE) output. Clearly, this proxy overestimates the export performance of local firms, as foreign firms will probably export more of their output than local firms if they arose out of the relocation-of-production motive.

We estimate equation (4) using the fixed-effects estimator. As control variables, we used imports as a share of industry output, turnover, and year fixed effects. The results are shown in *Table 6*.

The results suggest that to the extent our proxy is a reliable estimate of export performance, there might be important horizontal and backward market access spillovers. However, the bias introduced by our proxy should be counterbalanced by the coefficient for horizontal spillovers that captures the effect of foreign companies on the exports of the total sub-industry. Thus, the coefficient of the backward and forward variables should be less biased, indicating that being a supplier has important foreign market access implications. The regression also using non-linear effects did not lead to significant estimates.

7. Estimating Financing Spillovers

As discussed above, foreign firms may influence local firms' prospects of obtaining external financing. In order to test for this financing spillover, we estimate equation (4) again on the panel of domestic companies, using the fixed-effects estimator.[15] As the dependent variable, we use three alternative variables for leverage, i.e., the degree to which a company uses external debt financing: (a) total debt to total liabilities (total debt), (b) short-term loans and long-term debt (bank debt) [16], (c) bank debt. Total debt includes long-term debt, short-term loans, creditors, and other liabilities. As control variables, we use standard variables that are frequently used in the capital structure literature (Rajan, Zingales, 1995), (Bauer, 2004), such as size of

[15] The Hausman test indicates that the fixed-effects estimator is appropriate.

[16] Bank debt can of course include loans and other loan-type instruments (including bonds issued) from non-bank financial institutions (financial leasing, etc.) and non-financial corporations (intra-group loans); we label this variable bank debt as the majority of such debt is probably bank credit.

TABLE 7 Financing Spillovers (Access to Credit) – Estimation Results

	Total debt	Bank debt	Long-term debt	Liabilities to creditors
Log of turnover	0.00985***	-0.000623	-0.000998	0.00541*
Log of total assets	-0.00809	0.0269***	-0.000429	-0.000667
RoA	-0.00413***	-0.000936***	-0.000472***	-0.00110***
Tangibility	-0.0905***	0.0493***	0.0396***	-0.125***
Non-debt tax shield	1.707***	-0.0437	-0.0669**	0.655***
horizontal	-0.0608*	-0.0271	-0.0233	-0.0307
backward	0.807***	-0.0739	-0.158	0.482***
forward	-0.173*	-0.0425	-0.0284	-0.407***
constant	0.480***	-0.145***	0.107***	0.125**
Observations	18 009	18 009	18 009	18 009
Firms	4 937	4 937	4 937	4 937
R-squared	0.17	0.01	0.01	0.04

Note: Estimated via fixed-effects estimator. * significant at 10%; ** significant at 5%; *** significant at 1% level

the company (log of total assets and log of total sales), profitability (return on assets), tangibility (ratio of tangible assets to total assets) and non-debt tax shield (proxied by depreciation over total assets).[17]

The results indicate that there is a positive and significant effect on the total debt of being a supplier to foreign firms (*Table 7*). Thus, the results partly confirm the hypothesis that local firms involved in interactions with foreign firms along the production chain have easier access to credit.

However, the regressions using other definitions of the dependent variable show that there is no significant effect on bank or long-term debt, i.e., credit suitable for financing long-term investments. Thus, the remaining part of the total debt, i.e., current liabilities to creditors, is driving the results. Local companies that supply to foreign firms make much more use of financing from creditors. That could indicate that being a supplier to foreign firms does not help in obtaining long-term credit from banks, but because suppliers have to invest in order to be able to stay in business with foreign clients, they to a large extent use short-term sources of finance (liabilities to creditors) to finance their activities. At the same time, the results suggest that horizontal financing spillovers are negative. Thus, local companies that are exposed to increased competitive pressure and brain-drain effects can have difficulty accessing credit. Thus, we do not confirm the hypothesis raised by Geršl and Hlaváček (2007).

Even if the data do not reveal any significant spillovers in the area of access to long-term credit, the effect might go via the cost of credit. Suppliers to foreign firms might get cheaper loan financing, benefiting from the fact that being a supplier stabilizes the demand for the local firm's output and provides the local firm with expert knowledge and assistance from the foreign firm. Moreover, if there is also an effect on the productivity of local firms (productivity spillover), banks might be ready to regard such a local firm as a less risky client.

Thus, we estimate again equation (4), using the interest rate as a dependent variable. As the data do not include the interest rate individual companies are charged, we use the implicit interest rate computed in two alternative specifications: (a) interest

[17] We also tested for non-linearity of spillovers by including squared variables of foreign presence.

TABLE 8 Financing Spillovers (Interest Rate Charged) – Estimation Results

	Interest rate (total debt)	Interest rate (bank debt)
Total debt	-0.00549***	9.194
Tangibility	0.0119***	9.17
Cash flow to assets	-0.00561***	-4.59
Debt structure	-0.00137	-5.773
horizontal	0.0123**	43.72
backward	0.231***	290.3
forward	-0.0355**	-59.44
constant	-0.00298	-43.87
Observations	10 135	8 101
Firms	3 725	3 205
R-squared	0.02	0.00

Note: Estimated via fixed-effects estimator. * significant at 10%; ** significant at 5%; *** significant at 1% level

rate paid over total debt, (b) interest rate paid over bank debt (i.e., short-term loans and long-term bonds). As control variables, we use the standard determinants from the corporate finance literature (Horváth, 2006), such as total debt, liquidity (cash flow over assets), debt structure (share of long-term debt in total debt), and available collateral (tangibility). *Table 8* shows the results.

The results of the first regression show negative horizontal and backward vertical financing spillovers, i.e., a higher presence of foreign companies increases the interest rate paid by local firms. For the horizontal effect, this might be explained by increased competitive pressure and brain-drain effects. However, the results for backward spillovers are rather counterintuitive. The reason could be that local firms that serve as suppliers run certain risks that are reflected in the interest rate margin charged by banks, for example client concentration (supplying only one foreign customer, which could, however, change its supplier later on). Anecdotal evidence indeed suggests that supplying only a limited number of firms with specific products can lead to over-specialization, which might become a risky strategy if the foreign company relocates its production to other countries, for example.

8. Robustness Check: Alternative Definition of the Foreign Relevance Variables

To check whether the results are robust, we re-ran the regressions on productivity, market access and financing spillovers using an alternative definition of the foreign relevance variables. For the calculation of the variable *horizontal*, we alternatively used total assets and employees instead of total turnover. As discussed in section 2 (*Table 2*), the share of foreign firms in total assets is on average relatively similar to that in total turnover, but the share in employment differs. Moreover, there might be more variation in these shares across industries. Correspondingly, the values of the other two foreign relevance variables, i.e., *backward* and *forward*, changed as well.

The results for productivity spillovers using the asset-based variables for foreign relevance confirmed the sign, size, and significance for the backward spillovers only. The employment-based foreign relevance variables confirmed the significance and sign of the horizontal and backward variables, but the size of the effect doubled.

As regards market access spillovers, the results do not fully confirm the sign, size, and significance of the turnover-based results. Only the horizontal spillovers were

confirmed as staying positive and relatively large. The backward spillovers were found to be insignificant with both the asset-based and employment-based variables, while the forward spillovers turned significant and positive. Only in the non-linear version of the regression with asset-based variables are the backward spillovers significant and turning positive after a certain degree of foreign relevance (around 50 %) is reached.

Finally, in the area of financing spillovers (access to credit), the asset-based variables confirmed negative horizontal and forward spillovers, but not the positive backward spillovers for total debt and liabilities to creditors. However, the sign, size, and significance of the backward spillovers were confirmed by the employment--based variables, which also led to significant positive horizontal spillovers. As regards the interest rate charged, both alternative definitions of the foreign relevance variables confirmed the significance, sign, and size of the backward spillovers, while positive horizontal spillovers were confirmed by the employment-based results only.[18]

To sum up, the results of the analysis do not prove that robust, as they are partly influenced by how the foreign relevance variables are defined. However, most of the regressions did at least partly confirm the relevance of the backward spillovers, i.e., the supplier linkage channel.

9. Conclusions

The objective of this study has been to analyze three types of possible indirect effects of FDI on local companies in the Czech Republic, namely, productivity spillovers, market access spillovers, and financing spillovers. Firm-level data on the performance and financing of manufacturing companies from the Amadeus database were analyzed in order to detect whether foreign presence in the same sector and in industries along the production chain has any impact on productivity, export performance, leverage, and cost of finance of local firms. The existing literature offers contradictory results, often finding both positive and negative effects.

Our results show that there are important positive productivity spillovers to local firms, both on the horizontal level (in the same industry) and on the vertical level (along the production chain), but they have a non-linear shape. After the foreign presence reaches a certain threshold, the effects turn negative, a sign of brain-drain or too-high-competition effects. In any case, the vertical spillovers seem to be much more important than the horizontal ones, suggesting that being a supplier pays off.

As to market access spillovers, taking into account the limited information on exports, the results indicate that backward market access spillovers are especially significant. Thus, again, local companies that are engaged in providing supplies and inputs to foreign companies may access new markets via the marketing and business networks of their clients.

Finally, we found that foreign presence does not increase local companies' prospects of accessing long-term credit or getting cheaper financing. On the contrary, foreign presence in the same sector as well as in downstream sectors increases the reliance of local companies on short-term finance (especially liabilities to creditors) and increases the cost of finance. Thus, we do not confirm the hypothesis of Geršl and Hlaváček (2007) that FDI inflows may help local firms to obtain external finance more easily.

[18] All results of the robustness checks are available from the author on request.

However, all the results should of course be interpreted with caution, given the firm-level data limitations as well as the imperfect capture of the interaction between local and foreign firms. Thus, the effects of FDI inflows on host economies remains a topic to be researched in more detail and stays on the agenda of policymakers and economists in today's globalized world.

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