Dissecting the productivity spillover potential of foreign-owned firms: Firm-level evidence for Bulgaria and Hungary

Holger Görg[*]*, Alexander Hijzen*[*]*, Balázs Muraközy*[+] *and Nikolay Markov*[#]

Abstract:

This paper analyses productivity spillovers from inward foreign direct investment in Bulgaria and Hungary using comparable firm level data derived from official census data. We allow for differences in spillovers depending on the export orientation of multinationals and domestic firms, and depending on the production technology used by multinationals. Our analysis shows that there are substantial differences in results between the two countries. We find some evidence for positive productivity spillovers to domestic exporters in Hungary. These spillovers, however, only emanate from capital and material intensive multinationals. There is some weaker evidence that capital intensive FDI can also benefit domestic exporters in Bulgaria. We also show that the results are different for large and small domestic firms (with the former more likely to benefit) and public and private domestic firms (where the latter are more likely to benefit) in the Hungarian data. Our results thus show that allowing for heterogeneity in FDI as well as taking account of differences in the type of domestic firm are important when evaluating potential spillovers.

JEL classification: F23

Keywords: foreign direct investment, productivity spillovers, exporting, competition

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Acknowledgements

Paper prepared for the research programme "Competitive pressure and its social consequences in EU member states and in associated countries" (HPSE-CT-2002-00149 COMPPRESS). Financial support from the Leverhulme Trust (Grant No. F114/BF) is gratefully acknowledged.

1 Introduction

There seems to be a widely held assumption on the part of policy makers that inward foreign direct investment (FDI) brings benefits over and above the additional investment to the host country. In particular, multinational enterprises (MNEs) are seen as being vehicles for inflow of new technology, which may "spill over" to domestic firms and, hence, foster development and assist catching up in less developed economies. Furthermore, MNEs introduce higher levels of competition in the economy. This may be particularly relevant for transition economies which, after opening up markets aim at increasing productivity growth and levels of competition in the economy.

The inflow of foreign knowledge may benefit domestic firms as they may learn from multinationals, allowing them to upgrade their own production process and as a result increase productivity. The theoretical argument for why one may expect such "productivity spillovers", as they are usually referred to, from foreign multinationals is straightforward. Given the multinationals' limited knowledge of the local market, and distance from their parent firm, they are generally at a disadvantage compared with local firms in the host country. Hence, multinationals will only be able to locate profitably abroad if they have some sort of offsetting advantage. This takes the form of a "firm specific asset" (FSA), such as superior production technique, know-how or management strategy, which has at least to some extent the characteristics of a public good and enables the firm to locate profitably abroad (Caves, 1996). These FSAs can be transferred at low or zero cost between subsidiaries of the same firm.

The possibility of productivity spillovers arises because multinationals may find it difficult to protect a leakage of an FSA to other firms in the host country. The public good characteristics imply that once the FSA is out on the external market it can be used by other firms as well, due to it being to some extent non-rival and non-excludable. The inability of the multinationals to protect the asset is due to a number of reasons. Firstly, labour may move from multinationals to domestic firms, taking with them some of the knowledge of the FSA. Secondly, domestic firms supplying to or purchasing inputs from multinationals may be exposed to the superior technology used in the foreign firm. Thirdly, domestic firms may be in competition with multinationals on the final product

market, hence being able to learn from the foreign competitor. These mechanisms may be particularly important in transition economies, which are likely to have fairly high levels of human capital but lack up to date technology and management practices. The crux however of transition is the introduction of market discipline to domestic firms. The introduction of market discipline may be the main virtue of foreign entry in a transition context.

The purpose of this paper is to analyse the role productivity spillovers in different transition economies. Moreover, using firm-level census data for Hungary and Bulgaria for the period 1995-2001 we provide a detailed analysis of the different effects of foreign MNEs on the productivity of domestic firms. A comparison between those two countries is interesting as Hungary is one of the most advanced transition economies whilst Bulgaria is more representative of the group of relative laggards. We start off with a brief overview of the international evidence on productivity spillovers, which has exploded in the last ten years or so and a discussion of some selected studies which explicitly focus on transition economies. From our overview we identify two gaps in the literature on productivity spillovers in transaction economies.

First, the literature on productivity spillovers in transition economies so far has failed to appropriately disentangle the potential competition effect associated with FDI and the positive productivity effect that may arise when foreign firms fail to effectively protect their FSA. Following previous work for the UK by Girma et al. (2005) we attempt to decompose the different effects of foreign ownership on productivity by distinguishing between the local presence of MNE and their presence in export markets. The rationale is that we may expect stronger competition effects from domestic market oriented FDI, whereas multinationals that are export oriented may generate positive knowledge spillovers. We also distinguish domestic firms into exporters and non-exporters. The assumption is that the latter are more likely to be in competition with domestic market oriented multinationals. By contrast, the former may avoid such competition. Also, in as far as exporters are generally found to be more technology intensive and productive than non-exporters (e.g., Girma et al., 2004) we would expect the former to be better able to assimilate the knowledge transferred by multinationals and, hence, may be more likely to benefit from productivity spillovers.

Second, surprisingly little attention has been paid in the spillover literature more generally to the potential for productivity spillovers based on the importance of FSA of foreign owned affiliates. So far one seems to have taken the presence of FSA for granted and assumed that the potential for productivity spillovers is simply proportional to the output presence of foreign-owned firms in the industry. Presumably, this is due to the idea that FSA are unobservable. In the present paper we hypothesise that while this may be the case the production technology of foreign affiliates in the local economy may still give an impression of the importance of FSA that are transferred within multinationals to their foreign establishment and therefore the potential of productivity spillovers in the industry. Indeed, it has been well established in both the theoretical and empirical literature that multinationals are more technologically advanced among a number of observable dimensions. We expect thus expect that the potential of productivity spillovers increases in the capital intensity of foreign multinationals in the industry. The role of materials in the production of foreign affiliates is ex ante unclear. To the extent that materials are imported from the home country they may reflect the extent to which FSA are transferred within the firm. The purchases of materials in the host economy may also be expected to yield significant benefits to locals firms as demonstrated by Javorcik (2004) for Lithuania.

Our results suggest that one should be careful not to exaggerate the positive role of foreign firms in enhancing the productivity of domestic firms in transition economies. Interestingly, whilst direct competition tends to be associated with negative effects in most developed economies this is not necessarily the case in transition economies. While for Hungary a leader in transition results are similar to those obtained for example in the UK, Bulgaria, a laggard in transition appears to suffer less the more direct it has to face up to foreign competition. Moreover, we find using different specifications that the capital-intensity of foreign MNE plays an important role in explaining the potential of productivity spillovers. However, the actual extent of productivity spillovers is importantly affected by the absorptive capacity of domestic firms. The role of material intensity of foreign firms is unclear.

The remainder of this paper is structured as follows. In Section 2 we give a brief overview of the evidence on productivity spillovers highlighting also studies that focus explicitly on transition economies. In Section 3 we briefly discuss the data. In Section 4 we set out the econometric methodology. Section 5 presents and discusses the main results. Section 6

analyses the generality of our results by splitting the sample along a number of different dimensions. Finally, Section 7 provides some concluding remarks.

2 Evidence on productivity spillovers

Over the last thirty years, a large empirical literature has developed, starting with Caves (1974), Globerman (1979) and Blomström (1986) using data for Australia, Canada and Mexico, respectively. Since then, their empirical models have been extended and refined although the basic approach is still, by and large, similar. Most econometric analyses are undertaken in a framework in which labour productivity or total factor productivity of domestic firms is regressed on a range of independent variables. To measure productivity spillovers from multinationals a variable is included which proxies the extent of foreign firms' penetration, usually calculated as the share of employment or sales in multinationals over total industry employment/sales in a given sector. In other words, the regression allows for an effect of FDI on productivity of domestic firms in the *same industry*, i.e., horizontal spillovers. If the regression analysis yields a positive and statistically significant coefficient on the foreign presence variable, this is taken as evidence that spillovers have occurred from MNEs to domestic firms.[1]

A large body of evidence has been amassed in terms of studies of horizontal productivity spillovers for many developing, transition and developed countries. Much econometric work has been completed that provides, at best, mixed results as to the importance of spillovers. There is some supportive evidence from case studies of spillover benefits to domestic firms (e.g., Moran 2001) although there is, even at that level, disagreement in particular instances.[2] A number of explanations have been offered to explain these mixed results, including methodological differences (Görg and Strobl, 2001) and country characteristics (Lipsey and Sjöholm, 2005). Rather than reviewing all of these papers we

[1] This approach, of course, treats the mechanism through which spillovers take place as a "black box". Hence, one does not know the channels through which spillovers actually occur. Görg and Strobl (2005) present a first attempt at looking empirically at one of the channels in more detail, by measuring productivity spillovers through movements of workers from multinationals to domestic firms.

[2] For example, Larrain, Lopez-Calva and Rodriguez-Claré (2000) conclude that the location of Intel in Costa Rica has had positive effects on the local economy, Hanson (2000) argues that there is little evidence for spillovers from Intel on domestic firms. Hanson (2000) also argues that the location of Ford and General Motors in Brazil have failed to show the expected spillover benefits.

focus on a number of particular econometric studies, which can serve to highlight the main arguments.[3]

Aitken and Harrison (1999) use plant level panel data for Venezuela covering the period 1976 to 1989. Estimating an augmented Cobb-Douglas production function and controlling for plant level fixed effects they find some evidence that the presence of foreign multinationals in the same industry has had negative effects on the productivity of domestic firms. They attribute this to a negative competition effect. Domestic firms compete with multinationals on domestic product markets. When multinationals enter, they capture business from domestic firms which due to increasing returns to scale reduces their output and forces them up their average cost curve, reducing productivity. They argue that these effects seem to have more than outweighed any potentially positive productivity spillovers.

By contrast, using data for a developed economy, namely the US, Keller and Yeaple (2003) find that even in a high-income developed country, domestic firms are able to gain in terms of productivity improvements from the presence of foreign multinationals in the same industry. They use firm level panel data for the years 1987 to 1996 and find evidence for substantial horizontal spillovers from multinationals. One of their explanations for such large effects is their measurement of FDI activity in an industry, which is based on the industry classification of the activity of the affiliates' employees, rather than the classification of the affiliate as a whole (by its main line of business).

Turning to the evidence for horizontal productivity spillovers in transition economies a number of studies are worth mentioning. Konings (2001) investigates firm level panel data for Bulgaria, Romania and Poland over the period 1993 to 1997. The data are obtained from the Amadeus database and, hence, includes a sample of large firms. Using a similar approach to Aitken and Harrison (1999) he finds no evidence for positive spillovers from multinationals to domestic plants in any of the countries. Rather, his estimates suggest that in Bulgaria and Romania there are negative effects from the presence of multinationals. Konings, similar to Aitken and Harrison (1999) attributes this to negative competition effects. Djankov and Hoekman (1999) and Zukowska-Gagelmann

[3] A more detailed discussion of a long list of spillover studies is provided by Görg and Greenaway (2004).

(2003) come to similar conclusions in their analysis of spillover effects using firm level data for the Czech Republic and Poland, respectively.

Damijan et al. (2003) use firm level data for eight transition countries, Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Slovak Republich and Slovenia. Apart from Estonia and Slovenia, all data are obtained from the Amadeus database. They find some evidence for positive spillovers only for Romania. For other countries, the spillover effect is either statistically insignificant or negative.

The paper by Javorcik (2004) extends the standard approach of searching for horizontal spillovers by developing the idea that spillovers are more likely to occur through vertical relationships, rather than horizontally as has been the predominant view in the literature. Using firm level panel data for Lithuania for 1996 – 2000 she finds evidence consistent with her conjecture. Domestic firms in sector *j* increase their productivity following the establishment of multinationals in industries which are being supplied by *j*. She refers to this as spillovers through backward linkages. While the evidence on such backward linkages is robust to a number of amendments, there is no robust evidence that domestic firms benefit from horizontal spillovers from multinationals.

3. Data

For the present study we draw on census data for the countries of this study held by the statistical office in each country. These data represent an improvement to the use of Amadeus data as the latter are biased towards large firms while our data is representative of all firm sizes, based on the Census. These data give us very detailed information on the almost complete universe of firms for each country. There are however two drawbacks to using these data compared to other publicly available data. First, national statistical offices may collect and provide data in different ways. In particular, variables may be defined differently. We therefore make sure that we use only comparable variables in our analysis. Second, due to user restrictions of micro-data in the countries we were not able to pool the data. Rather, we estimated the econometric model separately on the data for the countries analysed. A detailed description of the available data and the cleaning is provided in the data appendix.

For the analysis of intra-industry productivity spillovers due the presence of foreign multinationals we will make use data for Bulgaria and Hungary for the period 1995-2001. For Bulgaria a firm is said to be foreign owned when at least 50% is held by a foreign firm. For Hungary we have a continuous of foreign ownership. We decided to use all available information rather than classifying firms on the 50% ownership criterion as for Bulgaria. Table 1 provides some summary statistics on the main variables of interest used in this study.

[insert Table 1]

4. Econometric methodology

To estimate intra-industry productivity spillovers due to the presence of foreign multinationals we choose, in line with the literature, a Cobb-Douglas specification of a production function for firm *i* in industry *j* at time *t*,

$$\ln y_{ijt} = \alpha_0 + \sum_{m=1}^{M} \beta_m \ln z_{ijt} + \sum_{f=1}^{F} \gamma_f FPI_{jt} + d_j + d_t + \varepsilon_{it} \qquad (1)$$

We assume three factors of production *z*: labour (L), capital (K) and materials (M).[4] Labour is measured by the number of employees, capital by fixed assets, and materials by the difference between turnover and value-added. The regression includes a full set of industry, region and time dummies. The error term consists of a time-invariant firm specific effect and a remaining white noise error term. The first error component is purged in a within transformation of equation (1). The endogeneity of input quantities with respect to unobserved productivity shocks is accounted for to the extent that endogeneity problems only arise from the time-invariant differences in unobserved productivity. We justify this assumption on the basis of the relatively short time period of our data. The second error component is clustered around industries in order to take account of the fact that our variables of interest are constant within industries (Moulton, 1990). Finally, the regressions are only conducted for domestic firms to prevent any bias in the results due to cherry-picking behaviour by acquiring firms.

[4] In alternative regressions we estimated production functions using value added, capital and labour. Results of these estimations are largely similar to those reported below.

The regression is extended with relevant indicators of foreign presence, constructed at the 3-digit level of disaggregation.[5] The Foreign Presence Index (*FPI*) is obtained by dividing the sum of turnover produced by multinationals over total turnover in industry *j*.

$$FPI_{jt} = \frac{\sum_{i=1}^{F} y_{ijt}^{f}}{\sum_{i=1}^{N} y_{ijt}} \qquad (2)$$

The overview in the previous section concluded that the evidence on intra-industry spillovers is ambiguous. A potential explanation could be that foreign presence is associated with offsetting effects. In an effort to disentangle the different effects we exploit information on both input and output orientation of foreign-owned firms. While previous work for a number of developed countries has taken account of the output market orientation of foreign firms no efforts have been made to explicitly analyse the role of 'input orientation' or the 'production technology' of foreign firms to analyse the potential for intra-industry productivity spillovers. We experiment with two sets of measures. First, add two interaction terms to the FPI index in (2) which are obtained by multiplying the share of sales of multinationals in industry j by the average intensity of input *v* in the production by multinationals in that industry,

$$FV_{jt} = \frac{\sum_{i=1}^{F} y_{ijt}^{f} \sum_{i=1}^{F} v_{ijt}^{f}}{\sum_{i=1}^{N} y_{ijt} \sum_{i=1}^{F} y_{ijt}^{f}} = \frac{\sum_{i=1}^{F} v_{ijt}^{f}}{\sum_{i=1}^{N} y_{ijt}} \qquad (3)$$

where *v* refers to capital and materials respectively. The coefficient on FPI should then be interpreted as the productivity spillover arsing from multinationals in that industry had they been using only labour in the production process. The interaction terms show how the spillover effect changes in the average capital and material intensity of multinationals in the industry. These measures thus explicitly take account of the production technology of multinational firms.

[5] While higher levels of disaggregation may in principle be desirable it has been noted that for the countries of interest many firms are incorrectly or inconsistently classified.

Alternatively, we may like to emphasise the presence of multinationals within local input markets in order take account of both size and technology effects. Thus, we decompose FPI in (2) into the foreign presence in each input market v in industry j,

$$FPI_{jt}^{V} = \frac{\sum_{i=1}^{F} v_{ijt}^{f}}{\sum_{i=1}^{N} v_{ijt}} \tag{4}$$

where *v* refers to employment, capital and materials respectively.

In an effort to disentangle the different effects of foreign presence we may also exploit information on the output or market orientation of foreign-owned firms. For this purpose we construct a measure for foreign presence in the domestic market and one for foreign presence in the export market (Girma et al., 2005; Görg and Hijzen, 2005). The assumption is that a negative competition effect is strongest from domestic market oriented FDI, while export oriented FDI may be more likely to lead to positive spillovers.

The Foreign Presence Index in the domestic market (FPI^{D}) is given by

$$FPI_{jt}^{D} = \frac{\sum_{i=1}^{F} y_{ijt}^{f} - x_{ijt}^{f}}{\sum_{i=1}^{N} y_{ijt} - x_{ijt}} \tag{5}$$

where y is total output and x is total exports at the level of firm *i*. Similarly, the Foreign Presence Index in the export market (FPI^{E}) is calculated as

$$FPI_{jt}^{F} = \frac{\sum_{i=1}^{F} x_{ijt}^{f}}{\sum_{i=1}^{N} x_{ijt}} \tag{6}$$

Following Girma et al. (2005) we also explore the role of the export activity of domestic firms in determining spillovers. The export activity of domestic firms is seen as being an indicator of firms' absorptive capacity, with exporters being expected to be better able to benefit from spillovers due to their being linked into foreign networks through exporting activities. Also, exporters are seen to be less likely to be in competition with domestic market oriented FDI and, hence, should be less exposed to a potentially negative competition effect. Consequently, we run each specification for non-exporting firms (DOM), permanent exporters (EXP) and firms that switch between exporting and non-exporting (SW) in addition to using the full sample (ALL).

5. Results

Table 2 reports the results using the aggregate index of foreign presence across different types of domestic firms. The results suggest that spillovers are either insignificant or negative. For Hungary, we not do find any evidence that the presence of foreign firms affects the productivity of domestic firms in the same industry for Hungary. In contrast, for Bulgaria foreign presence matters for the productivity of domestic firms. However, the effect of foreign presence is negative. This could reflect the competition effect of foreign firms that crowds out domestic firms. Distinguishing for the export status of domestic firms does not appear to play an important role.

[insert Table 2]

We now turn to the results where we control for the production technology of foreign firms. We use two methods: foreign presence plus interaction terms (Table 3) and input presence indicators (Table 4). The first approach focuses on technology effects, whereas the second specification combines size and technology effects.

The foreign presence index in Table 3 now gives the impact of foreign presence on the productivity of domestic firms where foreign firms are assumed to be producing using labour only. The effect of this is negative as one would expect. Firms that move to Hungary to exploit differences in labour costs are unlikely to generate technology spillovers, while they are expected to increase the competition of domestic firms. Importantly, the impact of foreign presence on the productivity of domestic firms is more

positive the higher the capital-intensity of production. This is often hypothesised in the literature, but to the best of our knowledge no direct evidence has been provided to sustain this claim. These effects appear to be particularly important for domestic exporters. Again FPI appears to pick up the negative effect of competition on domestic exports. However, domestic exporters gain the higher the capital-intensity and the material input intensity of the foreign firms in their industry. The positive effect of material intensity may reflect two different channels. First, it may reflect the positive effect of backward linkages in facilitating productivity spillovers as documented in Javorcik (2004). Second, it may reflect the role of imported intermediate inputs in facilitating technology transfer (Amiti and Konings, 2005; Görg et al., 2005).

[insert Table 3]

For Bulgaria the use of interaction terms turns out to be problematic as it introduces serious multi-collinearity problems. If anything however the results suggest that a similar logic might be at work also in Bulgaria. Given the multicollneaity problems we employ an alternative specification to get a handle on the role of the observed input technology of foreign firms. Our alternative specification is based on the demand for inputs by foreign firms relative to that of all firms in the same industry. These indicators thus combine potential size and technology effects of foreign firms on the productivity of domestic firms.

While these measures do not yield any significant results for Hungary for Bulgaria we find that input orientation matters for domestic exporters. More in particular, we find that the relative capital-intensity of foreign firms has a positive effect on the productivity of those firms and that the relative importance of intermediate inputs has a negative effect. The positive role of foreign owned capital is consistent with our earlier findings using interaction terms for Hungary. Again the results suggest that FSA may to some extent be observed by focusing on the capital-intensity of multinational firms. The negative effect for materials may reflect the fact the bulk of the materials are purchased from other industries or are imported. The negative effect may reflect the "empty shell" effect of foreign firms.

[insert Table 4]

In Table 5 we decompose our measure of foreign presence into the foreign presence in the domestic and export market. The results are consistent with those presented in Table 2 but contain some interesting additional information.

[insert Table 5]

Hungarian firms that never export (DOM) appear to suffer from direct foreign competition in the home market. Hungarian permanent exports on the contrary appear to benefit from foreign presence in the domestic market but lose when they have to compete head on in export markets. This result contrasts previous findings for developed economies such as the UK where domestic exporting firms generally appear to benefit from export-oriented MNE's in their markets. This usually explained by pointing at the role of knowledge of foreign markets that may spillover to domestic exporters. The difference in the case of Hungary might be explained by the different nature of the products being exported. In developed economies the bulk of exports consist of highly differentiated goods whereas for Hungary exports may often be considered homogenous goods. To the extent that foreign firms are more productive than domestic firms by combining their FSA with local inputs they may be able to crowd out local exporting firms. The positive sign of the domestic orientation of foreign firms on the productivity of domestic exporters may suggest that domestic exporters are on average more productive and may therefore be better able to benefit from foreign presence in their industry. However, having to compete head on with MNEs in export markets more than offsets the benefits from foreign firms in the industry.

Interestingly, whilst direct competition tends to be associated with negative effects in most developed economies the results for Bulgaria illustrate that this is not necessarily the case in all transition economies. While for Hungary, one of the most advanced transition economies, results are similar to those obtained for example in the UK, Bulgaria, one of the least advanced transition economies appears to suffer less from the presence of foreign firms the more direct it has to face up to foreign competition. Whilst domestic non-exporters suffer from the presence of export-oriented MNEs in their industry, domestic exporters suffer from the domestic orientation of MNEs. If anything this suggests that competition from foreign multinationals may be a good thing. These results may thus

provide some evidence of the importance of foreign firms in introducing market discipline in transition economies.

6. Robustness checks

In this section we analyse the generality of our results by splitting the sample along a number of different dimensions. In addition to export status of domestic firms we spilt the sample into small and large firms and public and private firms. Tables 6 and 7 provide the results on the input and output orientation of foreign firms on the productivity of domestic firms for different sets of the population of domestic firms.

[insert Table 6]

For Hungary (Table 6) we find that the effects of foreign presence are more positive the larger the domestic firms. Perhaps surprisingly, importance of employment in foreign firms relative to the industry as whole is positive and weakly significant. Compared to the results in Tables 3 and 4 the results are sharpened when using private firms only. Foreign presence does not appear to play a major role for domestic public firms. In general, these results suggest that there exists substantial heterogeneity in the role of foreign firms for the productivity of domestic firms. The results for Bulgaria do not provide any new insights. However, also for Bulgaria it turns out to be important to distinguish between domestic firms of different size and public/private status.

[insert Table 7]

7. Concluding remarks

This paper analyses the presence of productivity spillovers from inward foreign direct investment in transition economies. Specifically, we use comparable firm level data, derived from official census data, for Bulgaria and Hungary to investigate this issue. We allow for differences in spillovers depending on the export orientation of multinationals and domestic firms. Furthermore, we allow potential spillovers to be different depending

on the production technology used by multinationals. Empirically, this is implemented exploiting data on capital and materials intensity of production used by multinationals.

Our empirical analysis shows that there are substantial differences in results between the two countries. This is not unexpected, as Hungary is one of the more developed of the Central and Eastern European transition economies while Bulgaria is arguably a relative laggard in terms of economic development. More specifically, we find some evidence for positive productivity spillovers to domestic exporters in Hungary. These spillovers, however, only emanate from capital and material intensive multinationals. There is some weaker evidence that capital intensive FDI can also benefit domestic exporters in Bulgaria. We also show that the results are different for large and small domestic firms (with the former more likely to benefit) and public and private domestic firms (where the latter are more likely to benefit) in the Hungarian data. Our results thus show that allowing for heterogeneity in FDI as well as taking account of differences in the type of domestic firm are important when evaluating potential spillovers.

Data Appendix

For the present study we draw on the census data for the countries of this study. These data give us very detailed information on the almost complete population of firms for each country. There are however two drawbacks to using the raw data compared to other publicly available data. First, the statistical offices may collect and provide data in different ways. In particular, variables may be defined differently. Second, due to user restrictions of micro-data in the countries of this study we did have direct access to the data.

In order to overcome these problems a thorough inventarisation of the available micro data was made. For the inventarisation a detailed questionnaire was circulated amongst the partner countries. Given our objective we are particularly interested in the information on foreign ownership and exports. In order to maximise comparability of results across countries representativeness of the data is paramount. For this reason data obtained from census records (based on double entry booking) are preferred.

The dataset for **Bulgaria** covers the period 1994-2001. All firms are included that are legally required to administer their business using double-entry bookkeeping. Only for the period 1998-2002 were the 50 largest firms removed from the data. Foreign ownership is defined as a binary variable taking the value of unity when a foreign company has a more than 50% interest in a firm and zero otherwise. The foreign ownership indicator is consistently measured over time and is available for all observations. The dataset includes information on exports although not for all years.

The Census data for **Hungary** are available for the period 1986-2002. However, the variables are subject to substantial changes in their definitions in 1992. Furthermore, changes in the ownership structure in the years prior to 1995 may present significant problems for the analysis. For this reason it is recommended to start the analysis for Hungary in 1995. While such limitations were not made explicit in the response forms for any of the other transition countries this is likely to be a common feature for all transition economies.

The Hungarian data comprise approximately 20%-30% of all manufacturing firms which account for about 90% of sales (and 98% of exports). The dataset includes all firms with more than 20 employees in the early years of the sample period and all firms with more than 5 employees from 1998 onwards.

Foreign ownership is defined as the share of equity held in foreign hands. Changes in the ownership structure prior to 1995 make it difficult to consistently track changes in foreign ownership over time. The dataset includes information on the value of exports. A separate export dataset containing detailed product information can be matched in for subset of large firms.

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Tables

Table 1a:
Summary Statistics Hungary

	Obs DOM	Mean	Std. Dev.	Obs FOR	Mean	Std. Dev.
ALL						
Turnover	35517	253.3	2809.3	8282	1619.4	13108.9
Employment	35517	94.2	294.3	8282	230.9	612.5
Materials	35517	117.3	1074.9	8282	970.7	10270.8
Fixed assets	35517	0.6	5.3	8282	1.8	7.0
Exports	35517	50.2	515.6	8282	953.6	11778.7
%D turnover	26177	0.0176	0.2605	6366	0.0800	0.2385
%D TFP	24688	-1.5130	1457.8920	5978	-334.8511	10225.3000
DOM						
Turnover	18224	100.9406	562.2233	581	856.1594	3033.273
Employment	18224	49.10168	161.4349	581	179.401	546.406
Materials	18224	40.18574	205.7692	581	267.0879	1092.915
Fixed assets	18224	0.4850667	1.612938	581	3.388603	17.11108
Exports	18224	0	0	581	0	0
%D turnover	12832	0.0088617	0.2755489	396	0.013462	0.2205588
%D TFP	12098	-6.572983	452.3596	373	303.6259	2040.122
EXP						
Turnover	8351	601.7782	5540.272	5840	2009.438	15528.04
Employment	8351	203.8494	494.6517	5840	267.9437	690.0793
Materials	8351	286.1148	1996.932	5840	1262.096	12201.69
Fixed assets	8351	0.6820558	1.874819	5840	1.659184	5.547538
Exports	8351	183.6447	991.7922	5840	1314.874	14006.62
%D turnover	6435	0.025376	0.2315432	4560	0.0876948	0.2343026
%D TFP	6135	13.26865	2739.517	4309	-520.114	12004.64
SW						
Turnover	8942	238.3208	1370.491	1861	633.5666	1907.137
Employment	8942	83.58824	216.5075	1861	130.8184	259.0393
Materials	8942	116.8355	860.6167	1861	275.7159	1002.778
Fixed assets	8942	0.7667473	10.23915	1861	1.599295	5.662822
Exports	8942	27.89569	339.3216	1861	117.7728	639.8784
%D turnover	8942	0.2281432	0.1310758	1861	0.7677455	0.1309925
%D TFP	6910	0.0265903	0.2564987	1410	0.0740237	0.2532747

Table 1b:
Summary Statistics Bulgaria

	Obs DOM	Mean	Std. Dev.	Obs FOR	Mean	Std. Dev.
ALL						
Turnover	29638	75541.8	833730.6	1956	139035.8	458721.7
Employment	29638	94.4	317.5	1956	135.1	224.8
Materials	29638	52511.9	725995.7	1956	94557.1	361391.5
Fixed assets	29638	154.9	791.3	1956	434.1	2072.2
Exports	29638	17950.6	251168.2	1956	40946.6	211851.6
%D turnover	25520	-0.0654	0.5404	1618	0.0960	0.5504
%D exports	25520	-0.0992	3.4773	1618	0.3788	5.2443
%D TFP	25520	-0.0402	0.3470	1618	-0.0194	0.3253
DOM						
Turnover	18011	16769.2	48407.9	379	28947.7	70333.5
Employment	18011	29.6	56.8	379	29.6	57.3
Materials	18011	11545.4	33840.8	379	20804.4	50104.3
Fixed assets	18011	123.2	410.9	379	811.5	4222.2
Exports	18011	0	0	379	0	0
%D turnover	14904	-0.0591	0.5536	297	0.0668	0.5979
%Dexports	14904	0.0000	0.0000	297	0.0000	0.0000
%D TFP	14904	-0.0466	0.3684	297	-0.0325	0.3388
EXP						
Turnover	821	373953.7	4213609.0	292	106479.9	643839.4
Employment	821	292.1	637.1	292	148.0	242.3
Materials	821	291655.0	3871686.0	292	79000.3	587588.3
Fixed assets	821	210.3	626.9	292	292.3	998.0
Exports	821	113338.3	1017835.0	292	68049.4	339694.1
%D turnover	706	0.0286	0.4865	219	0.2123	0.5091
%Dexports	706	0.0944	1.4713	219	0.2560	1.0479
%D TFP	706	-0.0348	0.2535	219	0.0002	0.2478
SW						
Turnover	10806	150829.2	732874.0	1285	178903.3	468592.3
Employment	10806	187.3	470.9	1285	163.3	242.0
Materials	10806	102624.0	544550.5	1285	119845.0	342881.4
Fixed assets	10806	203.5	1184.1	1285	355.1	1005.6
Exports	10806	40622.6	304421.6	1285	46864.7	203682.0
%D turnover	9910	-0.0816	0.5229	1102	0.0807	0.5426
%Dexports	9910	-0.2622	5.5626	1102	0.5053	6.3338
%D TFP	9910	-0.0309	0.3181	1102	-0.0197	0.3350

Table 2:
Basic regression results by export activity

	Hungary				*Bulgaria*			
	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
L	0.244	0.282	0.221	0.234	0.109	0.103	0.216	0.110
	(11.64)	(11.35)	(7.73)	(7.04)	(7.64)	(9.39)	(4.49)	(3.82)
	***	***	***	***	***	***	***	***
K	0.072	0.067	0.061	0.084	0.048	0.047	0.066	0.051
	(12.52)	(10.66)	(5.93)	(8.61)	(10.78)	(7.82)	(4.57)	(5.77)
	***	***	***	***	***	***	***	***
M	0.458	0.444	0.497	0.439	0.707	0.681	0.652	0.750
	(19.77)	(17.83)	(15.75)	(12.93)	(43.98)	(56.18)	(12.64)	(24.16)
	***	***	***	***	***	***	***	***
FPI	-0.034	0.005	-0.40	-0.83	-0.091	-0.069	-0.183	-0.077
	(-1.00)	(0.11)	(-0.69)	(-1.58)	(-2.11)	(-1.30)	(-1.63)	(-1.76)
					**			*
Constant	0.004	0.045	-0.064	0.018	0.025	0.046	0.104	0.010
	(0.61)	(4.91)	(-4.37)	(1.17)	(1.98)	(3.51)	(3.65)	(0.90)
		***	***		*	***	***	
N	21436	7438	7363	6635	27383	16705	786	9892
R-square	0.632	0.593	0.665	0.640	0.797	0.768	0.856	0.843

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.

Table 3:
Regression results by input presence MNEs

	Hungary				*Bulgaria*			
	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
L	0.244	0.282	0.221	0.233	0.11	0.104	0.217	0.111
	(11.60)	(11.31	(7.72)	(7.03)	(7.61)	(9.50)	(3.87)	(3.81)
	***	***	***	***	***	***	***	***
K	0.072	0.068	0.060	0.084	0.047	0.046	0.066	0.500
	(12.56)	(10.63	(6.00)	(8.73)	(10.80)	(7.89)	(4.26)	(5.63)
	***	***	***	***	***	***	***	***
M	0.458	0.445	0.496	0.440	0.706	0.68	0.652	0.750
	(19.75)	(17.87	(15.65)	(12.99)	(43.52)	(54.89)	(11.56)	(24.07)
	***	***	***	***	***	***	***	***
FPI	-0.184	-0.087	-0.365	-0.940	-37.106	-49.362	-4.237	-14.068
	(-1.90)	(-0.35)	(-2.91)	(-0.47)	(-1.45)	(-1.52)	(-0.06)	(-0.59)
	*		***					
*FPI *FM*	0.154	-0.016	0.431	-0.076	37.037	49.356	4.063	13.972
	(1.25)	(-0.10)	(2.91)	(-0.27)	(1.45)	(1.51)	(0.06)	(0.58)
			***					
*FPI *FK*	0.265	0.211	0.345	0.185	37.087	49.319	4.053	14.073
	(2.48)	(1.42)	(2.12)	(0.89)	(1.45)	(1.51)	(0.06)	(0.58)
	**		**					
Constant	0.003	0.044	-0.068	0.015	0.021	0.041	0.081	0.009
	(0.41)	(4.71)	(-4.89)	(0.93)	(1.58)	(2.91)	(1.69)	(0.82)
		***	***			***	*	
N	21436	7438	7363	6635	27383	16705	786	9892
R-square	0.632	0.594	0.666	0.64	0.796	0.767	0.856	0.842

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.

Table 4:
Regression results by input presence MNEs

	Hungary				*Bulgaria*			
	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
L	0.245	0.282	0.221	0.234	0.109	0.104	0.22	0.111
	11.6	11.3	7.69	7.04	7.67	9.42	4.55	3.83
	***	***	***	***	***	***	***	***
K	0.072	0.068	0.061	0.084	0.047	0.047	0.065	0.05
	12.56	10.68	6.03	8.63	10.71	7.74	436	5.8
	***	***	***	***	***	***	***	***
M	0.458	0.444	0.496	0.439	0.706	0.681	0.649	0.75
	19.72	17.89	15.55	12.94	44.15	56.37	12.64	24.22
	***	***	***	***	***	***	***	***
FPI^L	0.062	-0.083	0.185	0.067	0.028	0.033	0.214	0.052
	0.69	-1.08	1.21	0.46	0.025	0.23	0.73	-1.13
FPI^K	-0.068	-0.038	-0.078	-0.07	0.011	-0.004	0.377	0.015
	-1.22	-0.66	-0.9	-0.086	0.18	-0.07	2.13	0.23
							**	
FPI^M	0.005	0.081	-0.055	-0.043	-0.111	-0.076	-0.65	-0.115
	0.06	1.29	-0.033	-0.035	-1.15	-0.78	-2.15	-1.13
							**	
Constant	0.005	0.043	-0.069	0.019	0.027	0.047	0.095	0.011
	0.079	4.73	-4.49	1.24	2.06	3.42	3.13	1.01
		***	***		**	***	***	
N	21436	7438	7363	6635	27383	16705	786	9892
R-square	0.632	0.593	0.665	0.639	0.798	0.767	0.854	0.843

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.

Table 5:
Regression results by export and domestic market orientation MNEs

	Hungary				*Bulgaria*			
	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
L	0.244	0.282	0.22	0.234	0.11	0.104	0.215	0.112
	11.6	11.37	7.75	7.01	7.84	9.72	4.57	3.9
	***	***	***	***	***	***	***	***
K	0.072	0.067	0.06	0.084	0.049	0.047	0.066	0.052
	12.56	10.66	6.03	8.62	10.72	7.65	4.47	5.9
	***	***	***	***	***	***	***	***
M	0.458	0.445	0.496	0.439	0.705	0.68	0.653	0.748
	19.71	17.9	15.61	12.94	44.36	56.75	12.81	23.97
	***	***	***	***	***	***	***	***
FPI^D	0.016	-0.111	0.131	-0.022	-0.056	-0.021	-0.258	-0.078
	0.37	-1.89	1.68	-0.35	-1.08	-0.037	-2.37	-1.36
		*	*				**	
FPI^X	-0.037	0.038	-0.111	-0.045	-0.041	-0.052	0.048	-0.016
	-1.36	0.93	-2.09	-1	-2.36	-2.35	0.063	-0.094
			**		**	***		
Constant	0.003	0.043	-0.064	0.018	0.021	0.044	0.112	0.011
	0.5	5.24	-4.44	1.14	1.56	3.35	4.2	0.098
		***	***			***	***	
N	21436	7438	7363	6635	27138	16583	786	9769
R-square	0.632	0.594	0.666	0.639	0.796	0.768	0.852	0.843

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.

Table 6: Detailed results Hungary

	Small				*Large*			
	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
FPI^D	-0.017	-0.11	0.81	0.01	0.11	-0.22	0.191	-0.122
	-0.4	-1.94	0.83	0.15	1.38	-0.87	2.34	-1.03
		*					**	
FPI^X	-0.036	0.031	-0.159	-0.049	-0.047	0.078	-0.065	-0.061
	-0.13	0.8	0.064	-1.05	-0.86	0.67	-1	-0.88
FPI	-0.07	-0.079	-0.265	0.042	-0.506	0.243	-0.405	-1.207
	-0.69	-0.58	-1.52	0.21	-2.68	0.58	-1.98	-3.92
					***		*	***
*FPI *FM*	-0.047	0.022	0.177	-0.247	0.678	-0.397	0.582	1.394
	-0.34	0.13	0.69	-0.86	3.63	-0.78	2.92	3.77
					***		***	***
*FPI *FK*	0.141	0.227	0.2	0.128	0.55	0.117	0.537	1.05
	1.72	0.156	1.13	0.6	2.37	0.23	2.03	3.44
	*				**		**	***
FPI^L	0.003	-0.081	0.13	0.006	0.293	-0.028	0.294	0.325
	0.04	-1.05	0.72	0.04	1.69	-0.09	1.84	0.91
					*		*	
FPI^K	0.025	0.076	-0.073	0.029	-0.1	0.323	-0.066	-0.427
	0.31	1.23	-0.38	0.27	-0.58	1.18	-0.44	-1.14
FPI^M	-0.082	-0.046	-0.11	-0.093	-0.005	-0.153	-0.008	0.113
	-1.56	-0.79	-1.04	-1.17	-0.06	-0.73	-0.1	0.6
	Private				*Public*			
FPI^D	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
	0.019	-0.117	0.143	-0.017	-0.137	-0.069	-0.143	0.046
	0.44	-2.01	1.82	-0.25	-1.3	-0.21	-1.4	0.22
FPI^X		**	*					
	-0.039	0.039	-0.121	-0.044	-0.01	0.112	0.06	-0.243
	-1.39	0.041	-2.19	-0.97	-0.02	1.44	0.84	-1.66
			**					
FPI	-0.155	-0.051	-0.355	-0.007	-0.668	0.204	-0.425	-0.846
	-1.65	-0.38	-2.8	-0.03	-1.83	0.41	-1.37	-1.48
			***		*			
*FPI *FM*	0.101	-0.012	0.413	-0.225	0.927	-0.162	0.552	1.545
	0.84	-0.07	2.66	-0.85	*	-0.25	1.34	2.8
			***					***
*FPI *FK*	0.263	0.206	0.349	0.169	0.322	0.68	0.307	0.256
	2.46	1.34	2.13	0.81	0.9	1.13	0.9	0.42
	**		**					
FPI^L	0.051	-0.08	0.185	0.039	0.328	-0.337	0.067	1.408
	0.58	-1	1.2	0.27	1.02	-1	0.24	1.85
								*
FPI^K	0.012	0.075	-0.05	-0.025	-0.301	-0.029	-0.028	-0.565
	0.13	1.21	-0.03	-0.2	-1.24	-0.08	-0.11	-1.66
FPI^M	-0.073	-0.038	-0.087	-0.074	0.038	0.4	0.005	-0.346
	-1.27	-0.65	-0.96	-0.88	0.44	1.78	0.05	-0.98
						*		

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.

Table 7: Detailed results Bulgaria

	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
	Small				*Large*			
FPI^D	-0.027	-0.015	0.13	-0.053	-0.12	-0.14	-0.457	-0.101
	-0.52	-0.28	0.95	-0.77	-1.82	-1.05	-3.49	-1.81
					*		***	*
FPI^X	-0.051	-0.053	0.131	-0.046	0.008	-0.049	0.048	0.024
	-2.62	-2.3	1.17	-2	0.42	-1.68	0.6	1.15
	***	**		**		*		
FPI	-45.739	-59.246	-12.846	-29.615	1.366	33.257	0.608	-6.439
	-140	-1.71	-0.18	-0.91	0.05	0.87	0.01	-0.21
		*						
*FPI *FM*	45.695	59.246	12.815	29.5	-1.483	-33.507	-1.046	6.389
	1.4	1.7	0.18	0.9	-0.05	-0.87	-0.01	0.21
		*						
*FPI *FK*	45.742	59.222	13.55	29.67	-1.366	-33.37	-0.616	6.48
	1.4	1.7	0.19	0.91	-0.05	-0.87	-0.01	0.21
		*						
FPI^L	0.016	0.013	0.287	0.003	0.09	0.279	-0.033	0.106
	0.12	0.09	0.59	0.02	0.67	0.92	-0.08	0.89
FPI^K	-0.073	-0.068	-0.632	-0.072	-0.175	-0.249	-0.516	-0.15
	-0.73	-0.7	-1.44	-0.53	-1.56	-1.18	-1.29	-1.51
FPI^M	-0.008	-0.002	0.572	-0.016	0.069	0.001	0.332	0.06
	-0.14	-0.04	2.15	-0.19	0.88	0	1.67	0.89
			**					
	Private				*Public*			
FPI^D	ALL	DOM	EXP	SW	ALL	DOM	EXP	SW
	-0.348	-0.006	-0.197	-0.05	-0.132	-0.135	-0.221	-0.144
	-0.62	-0.09	-1.87	-0.78	-2.38	-1.19	-0.89	-1.81
FPI^X			*		**			*
	-0.048	-0.054	0.034	-0.03	-0.008	-0.042	0.155	0.027
	-2.55	-2.26	0.41	-1.5	-0.27	-1.37	0.93	0.73
	**	**						
FPI	-42.958	-52.36	-44.181	-17.673	-76.284	-88.903	-73.962	-89.81
	-1.68	-1.63	-0.72	-0.79	-2.22	-1.27	-0.41	-1.86
	*				**			*
*FPI *FM*	42.96	52.365	44.139	17.635	76.123	88.944	73.604	89.639
	1.67	1.63	0.72	0.79	2.22	1.28	0.41	1.86
	*				**			*
*FPI *FK*	42.941	52.336	44.059	17.618	76.519	88.672	74.5	90.236
	*	1.63	0.71	0.78	2.22	1.28	0.41	1.86
					**			*
FPI^L	0.027	0.001	0.23	0.09	-0.07	0.166	-0.329	-0.226
	0.22	0.01	0.76	0.75	-0.54	0.77	-0.53	-0.122
FPI^K	-0.081	-0.051	-0.638	-0.06	-0.167	-0.268	0.098	-0.156
	-0.8	-0.49	-2.04	-0.55	-1.23	-1.23	0.18	-0.89
			**					
FPI^M	-0.005	-0.002	0.362	-0.041	0.093	0.034	-0.076	0.198
	-0.09	-0.03	1.89	-0.58	1.17	0.29	-0.14	1.83
			*					*

Notes: *, **, *** indicate statistically significant at 10%, 5% and 1% respectively. Robust standard errors in parentheses. Regressions include full set of industry, region and time dummies. FPI indices at 3-digit industry. Error terms are clustered around 3-digit industries.