Assessing the impact of foreign direct investment in transition economies

Citation for published version (APA):

Kravtsova, V. (2007). *Assessing the impact of foreign direct investment in transition economies*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20071017vk>

Document status and date:

Published: 01/01/2007

DOI:

[10.26481/dis.20071017vk](https://doi.org/10.26481/dis.20071017vk)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Assessing the Impact of Foreign Direct Investment
in Transition Economies

Assessing the Impact of Foreign Direct Investment in Transition Economies

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Universiteit Maastricht,
op gezag van de Rector Magnificus, Prof mr. G.P.M.F. Mols
volgens het besluit van het College van Decanen,
in het openbaar te verdedigen op woensdag 17 oktober 2007 om 14.00 uur

door

Viktoriya Kravtsova

Promotor

Prof. dr. P. Mohnen

Co-promotor

Prof. dr. A. Kokko, Stockholm School of Economics

Beoordelingscommissie

Prof. dr. L.L.G. Soete (voorzitter)

Prof. dr. J. Konings, Hogenheuvcollege, Leuven

Dr. S.M. Lundan

"Good fortune will elevate even petty minds, and give them the appearance of a certain greatness and stateliness, as from their high place they look down upon the world; but the truly noble and resolved spirit raises itself, and becomes more conspicuous in times of disaster and ill fortune." **Plutarch**

Acknowledgments

“Keeping one step ahead of the prosecutor within” is what work on the Ph.D. thesis was all about for me.

Unwillingly gaining a lot of freedom from the ill-managed Ph.D. program at MERIT has lead to the positive pressure I had to put on myself in order to develop an honest judgment within myself on how my Ph.D. should look like. Taking this path was not an easy choice (even though I am not sure there was any choice). And when on my way I met people who, with their own vision, justified my attitude even better than I did, gave a lot of encouragement. Here, I would like to acknowledge the greatest inspiration that came from Bob Dylan. Even though I never met him personally he was one of those people I was persistently listening to during the last few years. And I do not take it as a coincidence that my attention was drawn to his words exactly during the Ph.D. stage. I would like to use this opportunity to thank him for being around and for the work that he has done.

I would like to thank my supervisors Ari Kokko and Pierre Mohnen, who played different, but equally important role in the completion of this work. I also would like to thank Ari Kokko, Magnus Blomström, Swedish Institute (Svenska Institutet) and Stockholm School of Economics (HHS) for providing a very generous opportunity to have a very productive time working on my thesis in Sweden. Special thanks to the Job Cohen fund and the Economic Faculty of the Maastricht University, particularly Tom Veen and Silvia Beenen, for letting me teach there and therefore survive in Maastricht. It was also important to get a research grant for a few months back at home, in Ukraine, where I completed my thesis. Thanks to Valentine Zelenyuk, Tom Coupe, EERC Program and Kiev Economic Institute (KEI) for hosting me in Kiev on numerous occasions.

Apart from the financial support so needed during my Ph.D., at a certain point I also had to find appropriate data for the econometric analysis and I have received generous help from Joep Konings, Stijn Vanormelingen and LICOS Centre in Leuven (Belgium), Robert Stehrer and WIIW Institute in Vienna (Austria) and Urmas Varblane and Tartu University (Estonia).

Many thanks to a number of people I met during the Ph.D., who had positive influence by helping me with good advice and some who shared/opposed my views. I would like to thank numerous anonymous referees of the journals where I have submitted most parts of the thesis, especially the Journal of Productivity Analysis, which also provided me with the opportunity to reflect my view on the work of other people. Thanks to (in alphabetical order) Teresa Caparas, Nigel Driffield, Jan Fagerberg, Rüdiger Glott, Michael Henry, Kirsten Haaland, Ekin Keskin, Sandra Leitner, Ake-Bent Lundval, Rudolf Muller, Rajah Rasiah, Bulat Sanditov, Leopold Simar, Francisco Toro (very special thanks), Bart Verspagen, Paul Wilson. Specials thanks to Alevtina Kakhidze for helping me design the cover page for this thesis.

Table of contents

Samenvatting	4
Introduction	5
I. Foreign Direct Investment in Transition Economies: Selective Survey of the Literature	7
1.1. Introduction	7
1.2. Openness and FDI in Transition economies	7
1.3. FDI and Spillover Effects	16
1.4. Main determinants of FDI spillover effects: theory and empirics	18
1.4.1. Local economy characteristics in FDI spillover literature	19
1.4.2 Foreign investor (MNC) characteristics	28
1.4.3. Other possible environmental characteristics	33
1.5. Overview of further empirical studies and its contribution to the existing literature on FDI spillovers	37
II. Innovative Capability in MNC Subsidiaries: Evidence from Four European Transition Economies	40
2.1. Introduction	40
2.2. Theoretical framework and previous empirical findings	42
2.3. Data sources, empirical model and variables	44
2.4. Regression results discussion	52
2.5. Summary and concluding comments	58
III. Foreign Presence and Efficiency in Transition Economies: Two-Stage Semi-Parametric Model with Bootstrap Application	61
3.1. Introduction	61
3.2. FDI Spillovers in transition economies: overview of the methodology and empirical evidences	62
3.3. Data description	64
3.4. First stage: efficiency results discussion	66
3.5. Second stage: Determinants of efficiency and FDI spillover effects	72
3.6. Conclusions	77
IV. Foreign Direct Investment and Technical and Efficiency Change of Domestic Firms: Malmquist Productivity Index in test for FDI Spillovers	81
4.1. Introduction	81
4.2. Overview of Spillover Channels	82
4.3. Methodology	87
4.4. Data description	91
4.5. Results discussion	93
4.6. Concluding Remarks	100
V. Regional Dimension of the Impact of Foreign Direct Investment on the host economy: a case of Ukraine	101
5.1. Introduction	101
5.2. Literature review	102
5.3. Foreign vs. domestic knowledge: two sides of one economy	105
5.4. Data analysis and model estimation	111
5.5. Results discussion	116
5.6. Conclusions	119
References	121
Conclusions	131
Curriculum Vitae	135

Samenvatting

Directe buitenlandse investeringen (FDI) wordt geacht waarde toe te voegen aan de lokale economie, ofwel direct door het creëren van werk en belastingopbrengsten, of indirect, via technologische of productiviteit overschotten in lokale bedrijven. Technologische en productiviteit overschotten worden soms geïdentificeerd als de meest belangrijke voordelen van buitenlandse investeringen, in het bijzonder voor ontwikkelingslanden en landen in economische transitie waar binnenlandse technologieën minder vooruitstrevend zijn dan technologieën die in grote buitenlandse multinationals (MNCs) worden gebruikt. Derhalve is het vooral verontrustend dat de meeste studies over landen die in economische transitie zijn nog geen rekening houden met positieve bewijzen van overschotten, gezien de hoge verwachtingen voor internationale integratie, waarvoor de meest voor de hand liggende uitdrukking te zien is in investeringen over de directe grenzen.

Het vinden van een empirische verwantschap voor verschillende types van buitenlandse kennis is een grote uitdaging voor studenten die werken aan overschotten in buitenlandse investeringen. Dit proefschrift is een stap in die richting. Het zoekt naar een verklaring voor de invloed van buitenlandse aanwezigheid in de industrie en de regio van binnenlandse bedrijven, zowel voor effectieve als technologische veranderingen in het kader van een economie die in transitie is.

Het is aan te nemen dat de technologische overdracht van produkten en processen uit het buitenland zijn verbonden aan technologische veranderingen in binnenlandse bedrijven, die hen dichter naar de nieuwe technologische grens moet duwen. De organizationele kennis is meer gerelateerd aan het concept van efficiëntie, waarbij bedrijven leren hoe ze met minder input (input georiënteerd model) hetzelfde kunnen produceren of met dezelfde input (output georiënteerd model) meer output kunnen produceren. Niet alleen met de binnenlandse industrie, maar ook met de interregionale dimensies van het overschot effect is rekening gehouden.

Er is vastgesteld dat innovatieve bekwaamheden van buitenlandse bedrijven die in economien opereren worden bepaald door verschillende factoren. Een ruwe generalisatie zou inhouden dat de meest onafhankelijke filialen – zij die qua verscheidenheid georiënteerd zijn naar de lokale markten, opgericht door overnames, niet door greenfield investeringen, en waar de buitenlandse multinational alleen het minderheid in eigendom heeft – zijn ook diegenen die de sterkste innovatieve mogelijkheden hebben. Voor marketing en management bekwaamheden is het patroon bijna het tegenovergestelde. Het hoogste niveau van geschiktheid is vastgesteld bij dochtermaatschappijen die sterke banden hebben met het moederbedrijf, met hoog gehalte aan buitenlandse eigendomsaandelen en substantiele export terug naar het moederbedrijf. Er is ook gebleken dat buitenlandse bedrijven meer efficiënt blijken te zijn in het voorbeeld van landen in economische transitie waar de competitie en het algemene niveau van economische ontwikkelingen hoger zijn. De resultaten van de study in de Oekraïne tonen dat buitenlandse aanwezigheid negatieve overschot effecten heeft op de technologische veranderingen in binnenlandse bedrijven, maar een positief effect hebben op hun doelmatige veranderingen. De resultaten laten ook zien dat regionale verschillen in de Oekraïne effect hebben op de significantie en richting van de invloed van buitenlandse aanwezigheid.

Introduction

Foreign direct investment (FDI) is eventually expected to add some value to the local economy, either directly through job creation and tax revenues, or indirectly, via technology or productivity spillovers to local firms. Technology and productivity spillovers have sometimes been identified as the most important benefits of FDI, particularly for developing countries and transition economies where domestic technologies are less advanced than those employed by large foreign multinational corporations (MNCs). Therefore, it appears particularly worrying that most of the studies on transition economies do not appear to yield any positive evidence of spillovers, considering the high hopes regarding international integration – the most obvious expression of which may be cross-border investment flows – expressed in many of these countries.

While openness to global international restructuring may still be in its infancy in transition economies, concern over how national policy actions with regard to FDI have influenced the development of local economies has come to the forefront of economists' and policymakers' attention. This holds not only for policy towards FDI but, increasingly, also for innovation, restructuring and other policies traditionally seen as set at the national level.

This thesis contributes to the existing literature on the role of FDI in the host economy by assessing the impact of foreign presence in transition economies. Here, attention-grabbing hypotheses have been tested using both unique micro- and macro-level datasets on transition economies and novel econometrical applications. The first Chapter presents comprehensive macro-analysis of modern history of FDI in the World and, particularly, in the European transition countries. Offering an unambiguous logical structure this Chapter also provides a selective literature review on the impact of FDI on the host country, presenting the main gaps in the existing research on this topic and positioning the work done explicitly in the thesis.

The second Chapter explores the determinants of innovative capability in a sample of MNC subsidiaries operating in the European transition economies. It is hypothesized that capability in product and process technology can be determined by a different set of variables than capability in marketing and management. These differences may have some impact on the kinds of spillovers generated by different kinds of foreign direct investment projects.

The hypothesis that different kinds of foreign direct investment projects may affect domestic firms' performance is extended in the third Chapter. The organizational knowledge of foreign companies operating in the transition countries, which transit from plan to market, is seen to be one of the comparative advantages of MNCs. Therefore, the impact of foreign presence can have in those countries is hypothesized to be seen in the increased efficiency of the domestic firms. To evaluate the performance of domestic firms the Data Envelopment Analysis (DEA) was used to estimate a frontier built for each sector with similar technology common for a sample of transition countries. To estimate the impact of foreign presence on the estimated efficiency scores of

domestic firms a truncated regression and bootstrap technique has been applied in a second stage post-DEA analysis.

Finding an empirical proximity of measure of different types of foreign knowledge has been a hard challenge for scholars working in the field of FDI spillover effect. The fourth Chapter is one of the first steps in this direction. It seeks to clarify the influence of foreign presence in the industry on domestic firms in terms of both efficiency change and technological change in the setting of transition economy. Here, the technological transfer of product and process from abroad is assumed to be associated with technological change of domestic firms, pushing them closer to the new technological frontier. The organizational knowledge is more related to the concept of efficiency, where firms learn how to produce the same amount of output using less inputs (input-oriented model) or produce more with the same set of inputs (output-oriented models). In this Chapter the firm-level panel data has been used to estimate the components of the Malmquist Productivity Index and various panel data techniques were applied in the following regression analysis.

In the next step, in Chapter five, the regional aspects of spillovers from foreign to domestic firms have been studied in the case of transition economy of Ukraine. Furthermore, in diverse parts of the country, East and West, characterized by different attitude to FDI, the impact of foreign presence is hypothesized to have different effects on the technical and efficiency change of domestic firms in the regions of the two parts of Ukraine.

I. Foreign Direct Investment in Transition Economies: Selective Survey of the Literature

1.1. Introduction

With the fall of Berlin Wall in 1989, the “wind of change” brought the need for reforms in the political and economic systems of the countries of Central and Eastern Europe. Two years later, in 1991, the former Soviet Republics joined the movement of transition from planned to market economies. Almost at the same time, this group of twenty-seven countries went down similar paths, facing the same problems of liberalization and openness, macroeconomic stabilization and institution building, infrastructure and capacity rebuilding. As some of the countries have made it from communism into European Union and many others have already been recognized as market economies, it is clear that for most of the countries in the initial cluster the transition process is drawing to a close. What can we learn from this unique natural experiment of transition?

Many aspects of transition have been studied (see for example Fisher et al, 1998, Stiglitz, 2002, Åslund, 2002, Havrylyshyn and Rooden, 2003, etc.). In this research, the focus will be on the role of openness and, in particular, on Foreign Direct Investment (FDI) in the transition process. This chapter studies the intersection of the features of transition economies delineated above and the characteristics of FDI. It summarizes the main theoretical and empirical literature on the impact of FDI on the host country and classifies the main determinants of this influence. This chapter will also serve as a guide to what is emphasized in the remaining sections of this thesis.

1.2. Openness and FDI in Transition economies

As more and more transition countries realized their political and economic independence, vigorous debates on the best strategy for transition took center stage. Massive institutional destruction and reform was on the agenda for all transition economies. In time, countries adopted a set of formal institutions far different from those of market capitalism. Most essential economic activities, from the internal organization of enterprises to the governance of transactional relations in general, had been governed by powerful institutions that followed central planning doctrines.

Unlike in the case of developing countries, the problem was not one of underdeveloped or poorly working institutions, but rather a situation where a new set of institutions had to evolve and develop. The slow accumulation of market institutions is one of the lessons learned from transition. A number of countries, like Poland, Hungary, and Slovenia were successful in institutional development, and are commonly argued to be the exception to the rule (EBRD, 2002). Indeed their progress is remarkable.

However, one should take into account the favorable starting conditions and settled politics in these countries, right from the start of the transition.

In terms of economic growth, transition economies have performed very well since 2000; they have grown faster than any other region in the world except emerging Asia. Especially 2004 saw outstanding economic growth in countries of Former Soviet Union (FSU) (EBRD, 2005). However, structural and institutional reforms have not been enhanced much during this period. Therefore, a relationship between economic growth and structural reforms remains somewhat obscure.

Among the explanations proposed by EBRD (European Bank of Reconstruction and Development) is the idea that structural reforms affect economic growth with a lag and that there are more fundamental drivers of growth including the political, institutional and cultural climate. According to EBRD indicators, countries of Central and Eastern Europe and Baltic countries are among the leaders in structural reforms in the region. Among Former Soviet Union (FSU) countries, the drive to reforms has not been equally strong; there is still a possibility for easy revenue gains especially in commodity sectors (e.g. oil, gas, cotton, gold, aluminum, etc.). However, EBRD indicators for countries from the FSU do not show any slow down in the structural reforms; even Turkmenistan is stable in facilitating reforms. The areas that have been most extensively reformed are the financial and banking sectors (EBRD, 2005). Public administration strengthening is still on the agenda, even in the new EU member states.

Openness and trade liberalization in transition countries has been selective. The terms of trade improved significantly, especially for FSU countries, following price increases for oil and other commodities. Even for non-primary commodity exporters, such as Ukraine, terms of trade have been improving at the rate of the rise in Chinese demand (EBRD, 2004). The export of steel and similar products gave a boost to the Ukrainian economy comparable to the one rising oil prices gave Russia and the Caspian oil and gas exporters.

Current accounts deficits are observed in more advanced SEE and Baltic countries, where the investment climate is improving. Conversely, as a reflection of the gap between public and private returns on investment in FSU countries, there is a very significant surplus in the current account in these countries (around 8% of GDP for Russia and even more in Ukraine over the last few years). While these countries are capital-poor, both in terms of infrastructure and private capital, and should import capital (e.g. via FDI), the outflow of domestic investment is remarkable. As will be shown below, a large amount of FDI does flow into Russia (see Figure 3), but an even larger resource stream flows out of the country as private investors fear that they will not be able to reap their returns (EBRD, 2005).

Figure 1 sets out the main developments in FDI flows in the world economy for the period 1989-2004, showing transition countries as a whole attract a very small share.

Figure 1. FDI inflows in Transition Economies and the rest of the World, 1989-2004

Source: UNCTAD Database

Note: For the purpose of the analysis the group 'Transition economies' includes also eight new EU-member states (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia), which have been recently reclassified by United Nations Statistical Division into EU-group. These countries have joined the EU on the 1st of May 2004.

Developed countries account for the lion's share of worldwide FDI-inflows. At the same time, the share of FDI going to developing countries has been growing in recent years. Compared to those groups of countries, the share of FDI flowing to the transition economies remains small. Until 1995, when most of the FSU countries started to recover from economic collapse and sharp drops in GDP, FDI was less important as a source of capital formation in the transition economies than in other developing countries. In the second half of the 1990s, however, FDI inflows to the transition economies became more and more significant. The relative growth of FDI was halted in 1998 by the financial crisis in Russia. But since 2000, FDI inflows in transition countries have been growing steadily. The Russian Federation, with around \$12 billion in 2004, is the largest recipient of FDI flows in the region.

While FDI inflows into transition economies have been growing, the cumulative stock of foreign capital remains small in these economies. Total FDI inflows for the period 1989-2004 is detailed in Figure 2.

Here, Europe is the biggest recipient of FDI in the world, followed by North America and other developed countries and then by Asia and Oceania. Figure 2 shows that transition economies account for about 4% of the total amount of FDI. It is less than the

share of Latin America (9%), which saw a continuous decline of FDI flows for the last four years and where a significant upsurge is registered in 2004, reaching \$68 billion (World Investment Report (WIR), 2005)¹.

Figure 2. Cumulative FDI inflows during 1989-2004

Source: UNCTAD Database

The amount of FDI in transition economies is greater only than that in Africa (2%), where FDI in natural resources was particularly strong. Angola, Equatorial Guinea, Nigeria, Sudan (all rich in natural resources) and Egypt were the top recipients in 2004, accounting for a little less than half of all inflows to Africa (World Investment Report, 2005).

FDI inflows varied drastically not only at the global level, but also within the group of transition countries. In the Figure 3, FDI inflows accumulated during 1989-2004 are expressed in absolute terms for six main groups.

Figure 3 shows that during 1989-1992, of all transition countries, it was mainly Central and Eastern Europe that experienced FDI presence. Later on, with the collapse of the Soviet Union, the amount of FDI has grown in the FSU and SEE, but not immediately and at different rates across different groups, reflecting the influence of various factors. In South-East Europe, FDI inflows started to grow only in 2003. Led by large privatizations, these inflows nearly triple (World Investment Report, 2005). Noteworthy is the performance of the Central and Eastern European

¹ It should be noted, however, that this region has a long history of FDI and includes such large countries like Brazil and Mexico which have been the largest recipients of FDI in this region. According to WIR (2005), Brazil and Mexico remain to be the largest recipients of FDI in the region with inflows of \$18 billion and \$17 billion respectively in 2004. This is to compare with \$11 billion in South-East European countries (SEE) and \$16 billion in Central and Eastern European countries (CEE), which are two biggest recipients of FDI in the group of transition economies (see Figure 3 for a definition of the groups).

countries, where FDI inflows dropped by more than half in 2003 from \$21 billion to \$9 billion. As these countries have approached accession into the European Union, the reliance on FDI as a source of internationalization has declined.

In the FSU, excluding the Baltic countries, inflows grew from \$5 billion in 2000 to \$24 billion in 2004, benefiting largely from the high prices of petroleum and natural gas. The growth in the group of Asian countries FSU4 and FSU3 is mainly due to FDI flows into oil-abundant Kazakhstan, with \$4 billion in 2004, and Azerbaijan, with nearly \$5 billion in 2004: the two account for 87% of the FDI in their groups. The same applies for group FSU2 of European countries, where Russia holds a lead with nearly \$14 billion in 2004 representing 85% of FDI inflows in the group².

Figure 3. Share of FDI inflows in Transition Economies by Country Group, 1989-2004

Source: UNCTAD Database

Note: CEE = Central and Eastern European countries (Poland, Hungary, Czech and Slovak Republics, Slovenia); SEE = South-East European countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYRR Macedonia, Romania, and Serbia and Montenegro); FSU1= Estonia, Latvia and Lithuania; FSU2=Russia, Ukraine, Belarus, Moldova; FSU3 = Armenia, Azerbaijan, Georgia; FSU4 = Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

The size of FDI inflows into Baltic countries is misrepresented in this graph due to the comparatively small size of these three countries. Directly after the collapse of the So-

² For a comparison, Ukraine has received \$1,7 billion and is the second largest recipient in the FSU2 group (12.5%).

viet Union in 1991, the greatest growth of the share of FDI inflows in GDP is observed in the Baltic States (Figure 4).

Like the Baltic countries, the Central and Eastern European (CEE) countries that acceded to the EU in 2004 also relied heavily on FDI in the initial stage of transition. Again noteworthy is the performance of this group of countries in the period when they were approaching European Union accession. Since the year 2000, their reliance on FDI as a source has declined even more sharply in relative terms (share of FDI in GDP) than in absolute terms (Figure 3.)

Figure 4. Share of FDI inflows in GDP in Transition Economies by Country Group, 1989-2004

Source: UNCTAD Database

Note: For definition of country groups, see Figure 3

FDI in natural resource-based activities continue to constitute a big share of GDP in Central Asian countries. As of 2001, FDI shares in GDP had increased substantially in the oil-based economies of group FSU3 and FSU4.

Conversely, the share of FDI in GDP in the European FSU countries (group FSU2 in the Figure 4) remains the smallest in this set almost throughout the whole period of transition. The FDI flows into the oil sector of the Russian Federation did not make a significant difference in the relative representation of FDI in this group. Notably, the Russian economy has experienced constant GDP growth since 1999.

However, it is not possible to draw any conclusions about the effects of foreign presence on the basis of data on the aggregate inflow of FDI and its share in GDP. The character of FDI differs significantly across countries, and these differences are likely to result widely varying effects on the host economy. For instance, Figure 5 shows the distribution of the inward FDI stock between manufacturing, services, and infrastructure in four of the country groups discussed earlier, and shows that the relative impor-

tance of manufacturing, services, and infrastructure investments varies greatly. In particular, it can be seen that services account for the bulk of FDI in the CEEs, the Baltics (FSU1), and the Balkans (SEE), while manufacturing dominates in Russia and Ukraine.

Considering the large share of services in the overall stock of foreign investment, it is notable that very little analysis has been devoted to this sector: the majority of studies focus on manufacturing. One reason is related to data. Many services are not traded across international borders, and cross-country comparisons are difficult because of differences in quality and prices. The figure does not include FDI in agriculture and mining: these sectors account for very low shares of foreign direct investment in all four country-groups.

Figure 5. Stock of Inward Foreign Direct Investment in transition economies by the Main Sectors, 2005

Note: CEE = Central and Eastern European countries (Poland, Hungary, Czech and Slovak Republics, Slovenia); SEE = South-East European countries (Albania, Bosnia and Herzegovina, Croatia, FYRR Macedonia, Romania); FSU1= Estonia, Latvia and Lithuania; FSU2=Russia, Ukraine.

Source: WIIW (The Vienna Institute for International Economic Studies) Database on Foreign Direct Investment in Central and Eastern Europe, 2007

The FDI flowing to the manufacturing sector is also heterogeneous. Figure 6 shows how the inward FDI stock is distributed between low, medium, and high-tech sectors.

The overall pattern is that the share of high-tech manufacturing is higher in the CEE groups and lowest in Russia and Ukraine. The share of low-tech manufacturing is highest in the Baltic region, and medium-tech FDI has a particularly strong position in Russia and the Ukraine. As suggested in the theoretical background discussion, these

differences are due to various host country characteristics, including market size, development level, and business environment.

Figure 6. Stock of Inward Foreign Direct Investment in transition economies by the technology-intensity groups of manufacturing sectors, 2005

Note: CEE = Central and Eastern European countries (Poland, Hungary, Czech and Slovak Republics, Slovenia); SEE = South-East European countries (Albania, Bosnia and Herzegovina, Croatia, FYRR Macedonia, Romania); FSU1= Estonia, Latvia and Lithuania; FSU2=Russia, Ukraine.

Source: WIIW (The Vienna Institute for International Economic Studies) Database on Foreign Direct Investment in Central and Eastern Europe, 2007

Table 1 provides a more detailed description of the heterogeneity of FDI stocks at the country level. Here, it can be seen that the differences are substantial even within the four country groups. The overall FDI stock in services is larger than that in manufacturing in the CCE group. However, this result is driven mainly by the largest economy, Poland: the Czech Republic, Hungary, and Slovenia all record higher FDI stocks in manufacturing. In the Baltics, it is mainly Estonia and Latvia that have substantial FDI in services, whereas Lithuania is primarily a host for manufacturing FDI. The cross-country pattern regarding the technology level of FDI is also interesting. In the CEE group, it is mainly Slovenia, Hungary, and the Czech Republic that have a bias towards high-tech industries. As noted earlier, these are also the countries that recorded the highest shares for the service sector. Medium-tech industries are particularly important in Slovakia, Russia, and Ukraine, while low-tech dominates in Estonia and Latvia. A reasonable conclusion from these figures is that the heterogeneity of foreign investors should be taken into account in all discussions about the effects of FDI on the host country.

Table 1.

Stock of Foreign Direct Investment (FDI) in 2005

Country	Infrastructure	Services	Manufacturing			
			Total	High-tech	Medium-tech	Low-tech
(1)	(2)	(3)	(4)	(5)	(6)	(7)
CEE	26294.10	66074.47	56485.81	20387.54	17311.49	12753.90
Slovenia	1057.40	2259.80	2614.70	1330.20	823.00	448.30
Slovakia	1554.96	4849.98	4490.49	1141.76	2470.13	774.81
Poland	11509.10	35744.10	27699.70	8346.40	5833.60	7839.30
Hungary	2337.58	1967.89	2088.60	1279.51	809.72	-14.56
Czech Rep.	9835.06	21252.70	19592.32	8289.67	7375.04	3706.05
SEE	3355.92	16277.48	12548.78	2925.19	4024.96	4323.50
Croatia	399.91	5760.99	3314.32	1111.76	1402.32	755.62
Bosnia and Herzegovina	145.29	1153.60	929.14	-	-	-
Albania*	26.97	154.57	108.44	12.74	45.09	49.84
Macedonia	8.75	26.32	26.88	9.69	9.55	5.04
Romania	2775.00	9182.00	8170.00	1791.00	2568.00	3513.00
FSU1	4656.55	10746.98	4705.25	417.57	847.96	1846.63
Estonia	1998.97	6115.77	1426.54	272.81	269.08	821.58
Lithuania	1390.78	2624.51	2739.11	96.56	397.28	727.55
Latvia	1266.80	2006.70	539.60	48.20	181.60	297.50
FSU2	2162.33	4775.57	20307.60	1854.94	12287.66	5836.11
Russia	1007.00	1365.70	16338.30	1359.80	10293.90	4470.70
Ukraine	1155.33	3409.87	3969.30	495.14	1993.76	1365.41

Note: * the stock of FDI in Albania is presented at the level of the year 2004 due to the lack of information on the later time period. The three main groups of FDI destination in the presented countries were formed as following: Infrastructure (column 2) - FDI stock in (NACE 1-digit) 'electricity, gas and water supply', 'construction' and 'real estate, renting & business activities'; Services (column 3) - 'wholesale, retail trade, rep. of mot. veh., etc', 'hotels and restaurants', 'transport, storage and communication' and 'financial intermediation'; Manufacturing total (column 4) accounts for high-, medium and low-tech groups (based on OECD classification of technology-intensive sectors) plus a group not elsewhere classified manufacturing (NACE 2-digit).

Source: WIIW (The Vienna Institute for International Economic Studies) Database on Foreign Direct Investment in Central and Eastern Europe, 2007

While openness to global international restructuring may still be in its infancy in transition economies, concern over how national policy actions with regard to FDI have influenced the development of local economies has come to the forefront of economists' and policymakers' attention. This holds not only for policy towards FDI but, increasingly, also for innovation, restructuring and other policies traditionally seen as set at the national level. How far should economies go towards openness and global-

ization? What can they expect from foreign presence? These are the questions on the policy agenda for many transition countries today.

Earlier works (Fischer et al., 1996, 1998) found a significant effect of initial conditions, history and geography on growth in the early years of the transition. For example, growth was generally slower, *ceteris paribus*, for those countries that were further to the east or that had spent a longer period under communism. With respect to FDI policy, the results of our brief analysis suggest that initial conditions do play a role in the pace and development strategies in transition economies. On the whole, a group of Central and Eastern European (CEE) and Baltic countries, which are relatively more economically developed, experienced a greater reliance of FDI, particularly in the early stages of the transition. At the same time, the impact of FDI on economic development remains unclear.

1.3. FDI and Spillover Effects

For transition economies, FDI is expected to bring much-needed capital, new technologies, marketing techniques, and management skills. It is often hoped that the transfer of knowledge resulting from FDI will go beyond the direct effect of the project by foreign investors and, via knowledge spillovers, will benefit domestic firms. Spillovers from FDI take place when the entry or presence of multinational corporations benefit a host country (e.g. by increasing the productivity or efficiency of domestic firms) and the multinationals do not fully internalize or capture the value of these benefits.

An attempt to identify direct effects (the deliberate transfer) and indirect effects (unplanned spillovers of knowledge) of FDI on the host country has been recently presented by Lundan and Dunning (2002). In Chapter 16 of their book they emphasize on a clear distinction made between competitive effects (increased efforts brought by foreign entrance) and spillover effects (externalities), where competition effect is grouped into direct effects of FDI. Such strong assumption leads to the conclusion that foreign firms entering the market deliberately crowd out/in domestic firms. It is reasonable to argue that foreign firms may wish to avoid competition and push the domestic firms out of the market (may be even deliberately planning it), but it is not very straightforward to grasp why foreign firms would deliberately crowd in domestic firms.

Earlier literature has shown that it costs money to realize potential spillover gains. If there is no competition from foreign entry, why should the local firm in a stable market position care to change the way things are done? The competitive threat is an integral part of the spillover effect that we record.

In this framework the change in wages is also classified as a direct labor market effect, while in reality the presence of foreign firm
mestic firms. It is not necessarily in the scope of foreign firm entering a new market to deliberately increase or decrease wages (or influence them at all).

These critical points identify the difficulty to frame the clear-cut difference between direct and indirect effects of foreign presence. This literature review leaves such ambition for future studies and narrows down its mission to identifying the main developments, both in empirical and theoretical studies, on FDI spillovers.

Four main channels of FDI spillover effect have been previously identified in the literature (Kokko, 1998) and worth mentioning here:

- Demonstration or imitation. If foreign firm enters the host market and its successful technology becomes geographically close to domestic firm, this will encourage domestic firms to adopt or imitate it.
- Labor mobility. Human capital can spillover from foreign firm to other enterprises as skilled labor moves among employers
- Competition. Through the pressure of competition foreign entry disturbs the existing equilibrium and stimulates local firms to introduce new products to defend their market share and adopt new management methods and increase productivity.
- Backward and forward linkages with domestic firms. Through cooperation between foreign firm and upstream suppliers (backward linkages) and downstream customers (forward linkages) by introducing, for example, higher quality standards for both vertically and horizontally linked firms. Since in many cases foreign affiliates are export-oriented, local firms might gain via market access or export spillovers by being involved in distribution networks, etc. The level of embeddedness of foreign affiliates into domestic market is positively correlated with spillover effect of FDI.

Despite the great expectations often voiced for FDI by governments in transition economies, the results of empirical studies on spillover effect suggest that there is no significant impact on domestic firms from FDI in transition economies (Damijan et al, 2003, Konings, 2001). Why?

Many authors draw attention to the fact that spillover effects are not an automatic process (Blomstrom et al., 2001, Kokko, 1992). There are factors that can determine the impact of FDI presence on the host economy. These aspects are linked both to the characteristics of the local economy (such as level of competition, scale of their technological gap, absorptive capacity, linkages and trade regime) and to the characteristics of multinational company (MNC) (such as nationality, entry mode, degree of foreign ownership, motivation and value of technology) as well as to other environmental characteristics. In the next section, the theoretical and empirical issues on the main determinants of FDI spillover effect are discussed.

1.4. Main determinants of FDI spillover effects: theory and empirics

The studies on FDI spillover effects are heterogeneous in many respects, both considering the variables included as determinants of spillovers, the countries, industries and time periods that are analyzed, as well as the findings of the analyses.

The existence, dimension, and size of spillover effects are generally believed to depend on three categories of determinants: (1) multinational company (MNC) and foreign affiliate characteristics, (2) local firm and economy characteristics and (3) institutional parameters, e.g. intellectual property rights, infrastructure, etc. (Table 2).

Table 2.

Main Determinants of FDI Spillover Effect ^a

Local firm/economy characteristics	Foreign investor (MNC) characteristics	Other environmental characteristics
Absorptive capacity	Nationality in terms of levels of protection and sector structure	Distance/space – transport costs
Technological gap	Entry mode – M&A vs. greenfield	Product and technology differentiation
Export capacity	Degree of foreign ownership	Social, cultural and legal differences
Size of the local firms	Trade policy of MNC	IPR
Competition	Training received by workers at MNC	
Overall country development	Wage differential – labor mobility	
Linkages with local suppliers and producers	Working contract conditions – labor mobility	
	Motivation	
	Innovative level of technology	

^aTable is based on Crespo and Fontoura (2005) literature survey.

Previous studies have shown that host country conditions are crucial in determining the behavior of foreign firms (Kokko, 1994). The level of competition, the abundance of educated human resources (Blomström, Kokko, et al., 1995, Sjöholm, 1999), the gap between the productivity of foreign and domestic firms (Wang and Blomström, 1992, Perez, 1997), infrastructure (Kinoshita, 2001) and the institutional set up for intellectual property right protection (Smarzynska Javorcik, 2004b) are among the most important host country characteristics identified in the literature. These and some other factors will be reviewed in the following paragraphs.

1.4.1. Local economy characteristics in FDI spillover literature

While the potential for positive spillover effects is one of the main motives for the inward FDI promotion programs found in most countries, it is also well established that spillovers are not automatic consequences of the entry or presence of foreign MNC affiliates (Blomström and Kokko 2003). Instead, the effects of FDI seem to vary between countries and industries (Blomström and Kokko 1998, Görg and Greenaway 2004, Meyer 2003). Although the overall picture is mixed, there are some indications that the differences in estimated spillovers are not purely random (Crespo and Fontoura 2005). In particular, several studies have discussed the technology or productivity gaps between foreign MNC affiliates and local firms, and highlighted the importance of absorptive capacity: to benefit from spillovers, local firms need to have sufficient innovative capability to adopt the technologies introduced through FDI (Girma 2003, Kokko 1994, Kinoshita 2001).

The importance of local conditions has also been noted, with the argument that high education levels, good infrastructure, a strong financial sector, protection of intellectual property rights, and other indicators of relatively high development promote spillovers (Rodriguez-Clare 1996, Javorcik 2004, Yudaeva et al. 2004). All of these factors tend to promote both technology inflows through FDI and the ability of local firms to absorb spillovers. Moreover, higher development levels are connected to smaller wage gaps between local and foreign firms, which should contribute positively to those spillovers that occur when workers move from foreign-owned to locally-owned firms, taking with them some of the skills absorbed in the foreign affiliate (Lipsey and Sjöholm 2004). The high wage gaps that characterize most developing countries limit labor mobility, as workers often prefer to stay in the relatively well-paid jobs in foreign affiliates. The role of competition has also been emphasized in several studies, with the argument that competition promotes learning as well as continuous upgrading of technologies (Wang and Blomström 1992, Kokko 1996, Sjöholm 1999). Some models try to illustrate the main characteristics of a local economy that facilitate spillover effect.

Wang and Blomstrom (1992) develop a model in which competition plays a crucial role in the decision of MNCs to transfer technology. Based on the argument that technology transfer by MNC to the host market is associated with appropriate costs and risks, MNCs will be willing to transfer technology only if the competition forces them to do so. Otherwise, MNCs simply choose to reduce the supply of technology or leave the market. Local firms must be able to understand and internalize foreign knowledge for spillover effects to take place. The importance of the learning efforts of host-country firms in increasing the rate at which MNCs transfer technology has been emphasized by Wang and Blomstrom (1992). They model two types of costs: those to MNCs from transferring technology to their subsidiaries, and the learning costs to domestic firms. The model predicts that the gap between foreign and domestic firms might eventually be closed, but whether this will or will not happen depends on the

competitive pressures that exist in the host market. MNCs are interested in not allowing the gap to close, and therefore action must be taken by internal institutions.

Nonetheless, the effect of competition on the spillover effect is recognized as ambiguous. A positive effect is related to the fact that domestic firms have less scope to ignore foreign knowledge and are pushed to exert effort in learning how to increase their efficiency and be more productive. A potential increase in competition has little influence on spillover effects in markets where domestic firms enjoy a high degree of market power. Blomstrom et al. (2001) argue that profits associated with absorbing foreign knowledge are smaller in markets where firms enjoy more market power than in the highly competitive markets. Therefore, the demand for foreign knowledge is smaller in less competitive markets.

To realize potential spillovers, local firms need to have the capability to absorb foreign knowledge. Therefore, the scale of the technological gap between foreign and local firms is one of the indicators of the learning capabilities of domestic firms.

This is a complex issue. The technology gap influences spillovers in two ways. On the one hand, a small gap, which indicates strong capabilities, tends to promote learning and spillovers. On the other hand, if the gap is too small, there may be nothing to spill over. These two opposite effects of the technology gap introduce a typical optimization problem from the policy-maker's perspective. The seminal contributions to the study of the importance of the technological gap were made by Findlay (1978) and Koizumi and Kopecky (1977).

This discussion goes back to the literature from the 1970s, when the issue of 'appropriate technology' was widely debated. 'Appropriateness' in this context refers to how well adjusted the technology used by multinationals is to the local factor price ratio. If capital is relatively more expensive in the host country, then multinationals should use less capital there, and vice-versa. As a result of this debate, MNCs were often criticized for using technologies that were too capital intensive for host country conditions.

In light of the discussion in the spillovers literature, we can rethink the concept of the 'appropriateness' of technology. In this new context, appropriate technology for MNCs must be more advanced than the one used by local firms in order to create a potential for spillover effects, but at the same time to be not too advanced for the locals to learn and absorb. Therefore, host country policy might be interested in creating incentives to encourage MNCs to select technologies likely to facilitate spillovers.

As a continuation of the technological gap debate, the concept of absorptive capacity underlines the necessity of a minimum of human capital to be able to benefit from foreign knowledge. Absorptive capacity, in the context of the FDI spillover effect literature, refers to the capability of local firms to internalize external knowledge originating in foreign firms.

A more general theoretical foundation for the concept of 'absorptive capacity' was developed by Cohen and Levinthal (1989) and Abramovitz (1995). In their seminal work, Cohen and Levinthal (1989) provided empirical evidence that R&D not only

generates new information, but also enhances the firm's ability to assimilate and exploit existing knowledge. This dual role of R&D for the firm's incentive to invest in R&D opened a new view on the 'character of learning' for scholars in this field. R&D came to be seen not only as a source of knowledge development and innovation stimuli within the firm, but also as a mechanism to improve the absorption of knowledge that exists outside of the firm. Absorptive capacity is "the fraction of knowledge in the public domain that the firm is able to assimilate and exploit" (Cohen and Levinthal, 1989). Later, Abramovitz (1995) noted that among a number of factors that influence a country's economic performance (e.g. political, financial, educational, institutional, etc.), the elements that determine its ability to efficiently absorb and internalize knowledge potentially available at the frontier may be called 'absorptive capacity'.

Furthermore, it has been argued that the threat of a high potential for imitation, or high absorptive capacity, by host country firms can influence the technological content of the capital goods imported by multinational affiliates. Glass and Saggi (1998) develop a model where the quality of technology transferred through foreign direct investment is linked to innovation and imitation, including the case when the absorptive capacity of the host country is limited. Successful imitation of low quality level technologies by domestic firms makes benefits from FDI involving high quality technology possible through a reduction of the technology gap. Policy-wise the model suggests that a subsidy to imitation or a tax on low quality FDI production encourages imitation relative to innovation, thus releasing the constraint faced by foreign firms seeking to produce in the country hosting FDI. The larger the market for high quality levels of products or the larger the resources in the MNC' home country relative to the host country, the smaller the extent of high-quality FDI. However, the larger the resources required for innovation relative to imitation or the larger the cost disadvantage of multinationals relative to local firms, the larger the extent of high-quality FDI. The host country may shrink the technology gap and thus encourage high-quality FDI by imposing a tax on low-quality FDI production or providing a subsidy to imitation.

The thesis that foreign technology is implemental, or "appropriate", only when the labor force has built up the corresponding skills was incorporated into the model by Keller (1996)³. He distinguishes between technological information and human capital as two forms of knowledge. Here, it is assumed that both forms are required for sustained higher growth. In the model, a country chooses an outward-oriented policy regime because technological information is free and transferable to the domestic economy. The complementary human capital, though, is both costly to accumulate even in an outward-oriented regime, and needs largely to be home-provided. The results of the model suggest that even though technological information is available globally, it does not by itself increase the long-run rate of growth of the economy if domestic skills are not being accumulated at a higher rate thereafter. Furthermore, the rate of growth of

³ See also Glass and Saggi (2002) for analogous assumptions in the model.

output is forced down to the level consistent with the expansion of the human capital necessary to use new technology.

There is a widespread notion, advocated by IMF and World Bank-supported programs in developing countries that trade liberalization disseminates new technologies and goods to the domestic economy, and has beneficial effects on the level of final output and consumption. The main hypothesis was formulated by Bhagwati (1988) arguing that a greater volume of FDI will be attracted by export-promoting trade strategy (outward oriented) than by import-substituting one (inward oriented). The outward-oriented regime encourages FDI in the activities where the host country has comparative advantages. This regime would allow foreign investor to operate in the environment relatively free of distortions, and benefiting growth and efficiency of domestic firms.

In contrast, MNCs are exposed to tough competition from the world market and tend to use the production technologies that exploit host country's comparative advantages and relatively abundant factors of production. In outward-oriented economies, MNCs may employ technologies that are more in line with the host country's endowments, which are often local raw materials and cheap labor. In this case the host country may not enjoy much of a positive productivity spillover effect from FDI.

Incorporating the assumption of the necessity of minimal absorptive capacity in order to benefit from free trade into the model, Keller (1996) suggests that countries benefit from trade liberalization in the short-term because new goods and technologies become available domestically. Contrary to previous analysis, though, the fact that human capital accumulation is necessary to implement the new technologies implies that the long-run benefit from the move towards outward-orientation depends on whether the rate of human capital formation is increased relative to the pre-liberalization level. If that is not the case, then the faster technological transformation cannot be sustained, and the relative lack of human capital forces the growth rate of the economy back to its initial level. This underscores that the effect of 'openness' on country growth has an impact contingent on particular circumstances, particularly human capital accumulation as modeled in this paper. Countries ought to form expectations on what the switch to outward orientation can and cannot deliver based on contingent factors that the country has to offer or can bring about.

One of the important factors determining the benefits of outward-oriented economic policy is related to the linkages between foreign and domestic firms. A closer commercial tie between MNC affiliates and upstream supplier and downstream customers leads to a greater transfer of technical and commercial information between the two. With respect to vertical linkages, the efficiency benefits are associated the fact that MNCs place greater pressure on host country firms to meet higher standards of quality, reliability and speed of delivery (Blomström and Kokko, 1998).

While, in general, competition in the product and factor markets tends to reduce the profits of local firms, the models previously discussed in this chapter do not take into

account the intermediary sectors of the host economy. Markusen and Venables (1999) develop an analytical framework to assess positive and negative linkage effects to supplier industries where foreign presence may reduce input costs and raise profits. The assumption underlying the model is that multinationals influence local intermediate producers' productivity since the demand for local intermediary products increases as MNC enters the local market. As local suppliers of foreign affiliates become more efficient (through linkages effects) they may foster even more efficient local producers in the consumer product industry, potentially driving the MNCs out of the local market. This phenomenon is known as the 'virtuous cycle' of FDI.

It has also been pointed out that 'virtuous cycle' can easily become a 'vicious cycle' for local producers. This can happen when multinational firms overtake local producers and the productivity gap between foreign affiliates and local firms in the output sectors grows rather than shrinking. In this case, inter-industry spillovers will be negative. Therefore, FDI in the input sector may be beneficial to already more productive foreign enterprises in the output sector that are more fit to handle more expensive inputs (see also Perez, 1997 for the evolutionary model of FDI spillover effect which is determined by the technological gap between foreign and domestic firms and the level of competition).

Many of the spillover determinants discussed above have been explored in empirical work.

Empirical evidence from developed and developing economies

Kokko (1994) examines empirically whether larger or smaller technological gaps lead to greater or lesser spillover effects. Among the main conclusions is that the technology gap alone is not a good predictor of spillovers. Instead, he finds that more systematic market structure indicators should be used together with gap variables. In particular, those multinationals that have both large technology gaps with domestic firms and large market shares tend to be less beneficial for local industries. If foreigners chose to operate in isolation and stake out niches then very little interaction with local firms takes place.

The policy conclusions point to the need to add one more variable to the discussion of the determinants of spillovers: competition. Firstly, low level of competition leads to the situation when local firms do not have the ability to challenge foreign firms. This leaves local firms without the motivation to undertake costly efforts to learn from MNCs and absorb spillovers. Secondly, competition contributes to the dynamic benefits of FDI. If the industry is strongly competitive, it forces foreign firms to upgrade their technology in order to sustain their advantage in the market. Then, a positive "spiral effect" can take place, with successive rounds of technology upgrading spilling over sequentially into increasingly capable host country firms.

An example of the spiral effect and its importance for Latin America and South Asia was provided by Kokko (1992). In Latin America, during the Import Substitution Industrialization (ISI) phase, many industries faced limited competition because of trade

barriers and other institutional obstacles to competition. When the first MNCs entered the market, in the early 60s and 70s, they employed the same technology that they used in the US or Europe. Since there was not much competition, MNCs did not feel the need to adjust the technology. In the old terminology, they could afford to use ‘inappropriate technology’ because of the lack of competition. This created a major advantage for MNCs that reinforced their monopolistic position, allowing them to maintain their competitive advantages for the next three decades without needing to bring much new technology. As an outcome, few spillovers took place from the initial stock of technology and, furthermore, there was not much renewal of the initial stock of technology.

This is in a dramatic contrast to what took place in South East Asia. Here, MNCs entered a much less protected and much more competitive environment, which made them more cognizant about costs. For this reason, multinational firms typically chose to adjust their home-country technologies to the factor prices of the host countries. As a result, technology gap has narrowed. Since the technologies were adjusted to the local condition, domestic firms found it easier to absorb it. It added to the competitive pressure and brought another benefit – upgrading the affiliates’ technology over time. Gradually, as local firms learned to copy MNC’s technology, the multinationals were forced to bring in more technology to establish their competitive advantage. This introduced a dynamic positive effect, where the learning process is continuous.

One policy conclusion is that it may be not well advised to protect foreign multinationals, as this could disturb the positive spiral of the dynamic learning and upgrading. From this perspective, it might make better sense to promote the learning capabilities and skills of local industries. If local firms are able to learn from what foreign MNCs are doing, they also force foreign MNCs to ‘stay on their toes’ and introduce new technologies, preventing a situation where foreign companies exploit the local market.

An empirical study by Driffield (2001), done in the manufacturing sectors of the UK, confirms that ‘catching-up’ occurs in industries where foreign firms have a greater productivity advantage over domestic firms. It suggests that the most likely benefit in terms of FDI presence is conveyed via increased competition, which stimulates domestic firms to become more efficient.

In a cross-country regression analysis of FDI inflow in 69 developing countries Borenstein et al. (1998) find that FDI contributes relatively more to growth than domestic investment. However, the higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital, used as a proxy for the capacity to absorb advanced technologies. Similarly, the results of regression analysis using data on Mexican manufacturing industries show that there is a significant positive association between technology imports of foreign affiliates and labor skills and competition in the affiliates’ industries (Blomström et al., 1998).

Even though some authors argue that the availability of trained labor in the host country can work as a determinant of technology transfer for multinational firms, the level

of prior related knowledge is not the only determinant of absorptive capacity of the firm. Van den Bosch et al. (1999) show how organizational knowledge influences absorptive capacity. Here, two longitudinal case studies of traditional publishing firms, which move to the dynamic and knowledge intensive multimedia complex, are used to provide the ground for the following conclusions. In both cases, stickiness to the old socialization capabilities takes place, where customers are not ready to absorb new knowledge and negatively influence the aspiration of the firms. The higher the absorptive capacity of the firm, the more independent it can be in making their choice regarding the adoption of new knowledge. Therefore, there is a need for new organizational forms that facilitate the scope and flexibility of knowledge absorption.

At the same time, the process of globalization of innovation is driven largely by technology factors. As a result of interviews of foreign-affiliated R&D laboratories in the United States, Florida (1997) finds that the most important objective of foreign firms is to secure access to scientific and technical human capital. This motivation for FDI explains the recent pattern of R&D investment nesting primarily in the developed countries.

In countries that lack strong institutions of tertiary education and do not have large domestic markets, the level of FDI in R&D will probably remain low (Kuemmerle, 1999). On the other hand, Asian countries with large populations such as India and China will attract an increasing amount of FDI in the form of R&D facilities. In addition to a large market, these countries have a number of elite scientific training institutions that pre-select the most qualified human resources and make them accessible to multinational firms.

In this respect, the transition economies, stocked with a relatively high level of qualified human capital, should have experienced a high level of FDI in R&D leading to substantial spillovers. But they have not. FDI inflows in total remain relatively low for most of the transition countries, and the insignificant or even negative spillovers documented have been a main concern of the recent empirical studies (Damijan et al., 2003; Konings, 2001).

One of the reasons for such phenomena can be explained by the results of a study by Grunfeld (2003). It shows that absorptive capacity gained from internal R&D in the host country does not necessarily increase the incentive of MNCs to invest in R&D. This only happens when market size is small or absorptive capacity is weak. Otherwise, MNCs prefer to cut down on R&D. Grunfeld suggested for public policy to improve the absorptive capacity of firms if they operate in a relatively small market or country. The model predicts, for instance, that firms operating in a large market with high absorptive capacity will choose to invest less in R&D. Therefore, the larger the market is, the stronger the negative effect of R&D spillovers on R&D investment will be, and this effect may actually reduce welfare if absorptive capacity is increased.

The linkage effect of multinationals on the host country is more likely to be favorable when the good that they produce use intermediate goods intensively, when there are

large communication costs between headquarters and the production plant, and when the home and host countries are not too different in terms of the variety of intermediate goods produced (Rodríguez-Clare, 1996). If these conditions are reversed, then multinationals could even hurt the developing economy by creating enclaves within countries.

The influence of a change in trade regime from inward to outward-orientation on the extent of spillovers was empirically tested by Kokko et al. (2001) in a case study of Uruguay. He finds that during the import-substitution regime, foreign firms brought more technology to Uruguay and there were more positive productivity spillovers to domestic firms. However, after a change in trade regime to more export-orientated, MNCs introduced less new technology and relied more on their marketing skills. The shift did not lead to productivity spillovers, but did have a positive impact on the propensity of domestic firms to export.

Transition economies differ both from the developed and developing economies. On average, FDI flows into transition economies is much smaller than in developed as well as developing countries (see Figure 1). Historically, most transition economies started experiencing FDI presence only in the early 90s, while most of the developed and developing countries have a much longer history of foreign presence in their economies. Macroeconomic instability and institutional changes were among the main factors that impeded FDI inflows in the early stages of transition. The level of economic development, the amount of FDI and motivation behind FDI flows varies greatly from country to country even inside a group of transition economies (see Figure 4).

Noteworthy is the relative abundance of human capital, which sets the transition economies apart from developing countries at large. Evidence suggests this is likely to promote learning and spillovers of knowledge from foreign to local firms. However, human capital alone might not be sufficient for positive spillover effects to take place. These distinguishing features of transition economies motivate us to look specifically at studies on FDI spillovers in transition economies.

Transition economies: earlier contributions and topics for future research

The benefits from foreign investment in five transition countries in Central and Eastern Europe⁴, but such benefits are internalized by foreign owned firms have recently been examined empirically by Torlak (2004). While it is found that foreign-owned firms internalize the main benefits, domestic firms may learn from foreign companies to some extent and in this way improve their performance. But, before they are able to start learning from their foreign counterparts, they may be forced to exit the market, being unable to resist the competitive pressure MNCs bring.

The importance of competition on the growth and development of firms in twenty-four transition economies have been studied by Carlin et al. (2004). The phenomenon of the

⁴ The studied countries are Czech Republic, Poland, Hungary, Romania and Bulgaria

shift from an economic system without competition to a market economy is used to examine the factors that influence innovation by firms and their subsequent growth. The evidence of importance of a minimum of rivalry in both innovation and growth is found. The presence of at least a few competitors is found to be effective both directly and indirectly. The effect is stronger for limited rivalry (one to three competitors) than for more than three competitors. It has also been found by Carlin et al. (2004) that new private firms in transition economies are more heavily engaged in innovation than are firms that pre-existed the reforms.

To the best of our knowledge, only Kinoshita (2001) has considered the role of absorptive capacity in transition economies. Analyzing firm level panel data on manufacturing firms operating in Czech Republic, she finds that both foreign joint ventures and foreign presence in the sector have no significant effect on productivity growth. Only when foreign presence interacts with R&D does it have a positive and significant effect. It implies that the indirect effect of R&D via the development of absorptive capacity is more important than the direct effect of innovative R&D in increasing productivity growth within the firm. Her policy recommendation is to engage local firms in R&D investments in order to enhance their absorptive capacity and to maximize the degree of technology spillovers from FDI. The benefits of spillovers will be greater in industries where local firms are competitive in research activities.

The influence of FDI on the labor productivity of domestic firms in Hungary was evaluated empirically by Schoors and van der Tol (2002). Both intra-industry effects and inter-industry spillovers via linkages were measured using input-output data. They find that spillover effects are stronger between sectors than within sectors, and FDI has positive spillover effects in user sectors, but negative spillover effects in supplier sectors. Policy-wise, this suggests transition economies would do well to attract FDI in export-oriented manufacturing sectors, which produce consumer goods, since this form of FDI has the most significant effect on the labor productivity of local firms.

Konings (2001) looks for FDI productivity spillovers in three transition countries: Poland, Romania and Bulgaria. He finds that foreign firms are more productive only in Poland. On average, no positive spillover effect is found in the three countries taken together. In Bulgaria and Romania, he finds negative effects of FDI presence on the productivity of domestic firms, but no evidence for significant positive effects in Poland.

Following the methodology based on using input-output tables as a proxy for linkage effects, Smarzhinska (2004b) investigates the presence of spillover effects via backward and forward linkages in the manufacturing sector in Lithuania. The results are consistent with the presence of productivity spillovers taking place through backward linkages, stressing the importance of contacts between foreign affiliates and their local suppliers in upstream sectors. At the same time, no evidence of intra-industry spillovers was found, nor is there any indication of spillovers stemming from multinational presence in sectors supplying intermediate inputs.

Topics for future research

For a number of variables characterizing the local economy, the results found in the empirical literature on transition economies coincide with previous studies on developed and developing economies. Specifically, competition, linkages with intermediate producers in the host country and absorptive capacity are found to be important determinants of FDI spillover effects in transition economies. Intra- and inter-industry spillovers bring mixed results in many studies on transition economies, motivating further research in this area.

One of the main challenges in the future research evaluating the impact of FDI on the host country empirically is in the methodological field. While the production function approach is dominant and considered to be a traditional one in evaluating FDI spillover effects, it is based on strong assumption about the efficiency of firms. An alternative methodological framework is presented in Chapter 3 of this thesis. It presents empirical evidence on the role of foreign presence in the performance of domestic manufacturing firms in five Central and Eastern European countries. Data Envelopment Analysis (DEA) was used to estimate a frontier that was built for each sector with similar technology common to the five transition countries in the sample - Bulgaria, Estonia, Poland, Hungary and Romania. This study applies a truncated regression and bootstrap technique in a second stage post-DEA analysis. Some evidence is found to support the hypothesis that foreign presence has overall positive spillover effects on the performance of domestic firms.

Further, in Chapter 4, a Malmquist Productivity Index is used to estimate technical and efficiency change, which are used as a dependent variable of a proxy of firm's performance. This chapter contributes to the methodology for evaluating the impact of FDI on the host country by taking into account the impact of FDI both on technical and efficiency change. The empirical analysis of the economic development with regard to FDI in Ukraine suggests that foreign presence has significant and positive impact on the efficiency change of domestic firms in the same industry in Ukraine. The impact on the technical change of domestic firms, however, remains negative.

1.4.2 Foreign investor (MNC) characteristics

The earlier studies that have noted the importance of MNC strategy for spillovers have mainly dealt with three issues: the technology imports of affiliates, their trade strategies, and the role of the foreign ownership share. The first of these issues is discussed e.g. by Blomström et al. (1994) and Sjöholm. (1999), who argue that higher technology imports create a larger potential for spillovers. They find that affiliates typically select to import more technology to host countries and industries where the local innovative capability is relatively high and where the competition from local firms is relatively strong.

The distinction between local market and export oriented affiliates has recently been examined by Javorcik (2004). Using data for that are oriented towards the domestic market generate more spillovers than those that

are export-oriented. Similarly, Kokko et al. (2001) examine how MNC affiliates established during different trade regimes affect the local economy. Studying the case of Uruguay, they find a positive spillover effect from MNC affiliates established during the import-substituting trade regime, before 1973, but no evidence of technology spillovers from the more export-oriented subsidiaries established after 1973. Yet, the presence of export-oriented foreign affiliates seems to raise the likelihood that local firms become exporters, presumably because of the diffusion of knowledge about foreign market conditions, foreign preferences, export marketing, logistics, and similar issues. However, both authors caution against import-substituting policies: although import substitution might promote technology spillovers, the gains are concentrated to sectors where the host country has no comparative advantages.

The conclusions from studies looking at the ownership structure are also inconclusive. In theory, wholly foreign-owned affiliates should be willing to import more technology, since they are not obliged to share it with any other firm (Ramachandran 1993). At the same time, the technology spillovers from joint ventures may be more comprehensive, since the local partner gets direct access to all of the knowledge used in the venture. Testing these hypotheses empirically, several authors have concluded that the degree of foreign ownership affects neither the productivity of subsidiaries, nor the degree of spillovers (Blomström and Sjöholm, 1999; Dimelis and Louri, 2002; Javorcik and Spatareanu, 2003). However, in those cases where joint ventures are mandated by the local government, it may be more appropriate to interpret these contributions as evidence of the importance of host country policy rather than MNC strategy.⁵

Looking more directly at the MNC affiliates' technological strength, it seems reasonable to group the determinants of capability into three groups: i) home country variables, ii) MNC strategy and subsidiary-headquarter relations, and iii) host country variables. Home country characteristics matter because the intangible assets of MNCs are often related to the policies and comparative advantages of the home country, in line with the arguments of Porter (1990) and Lall (1992). *Ceteris paribus*, it is therefore reasonable to expect stronger capability in MNC affiliates originating from more advanced countries. In some cases, where the innovative assets of the home country are weaker than those of the host economy, the FDI could be of a technology-sourcing type, in which case it is not realistic to expect spillovers to the host economy, but rather reverse spillovers to the investing MNC and perhaps the home country as well (Driffield and Love 2003).

The role of MNC strategy and subsidiary-headquarter relations has mainly been discussed in the international business literature, often under the heading "autonomy". Starting with White and Poynter (1984), it has been common to distinguish between different types of affiliates depending on their role in the MNCs' international production network. The simplest type of affiliate is the marketing satellite that sells the par-

⁵ Indirectly, MNC behavior is also incorporated in the technology gaps models, since a large gap occurs only if the affiliate has decided to enter at a relatively advanced technology level.

ent's products in the host country, perhaps providing customer services as well, but without engaging in local production. The "miniature replica" manufactures a range of the parent MNC's products in the host country, mainly for sale in the host country's market. In the economics literature, this type is referred to as a horizontal affiliate, and it is typically motivated by potential savings related to transport and trade costs (e.g. tariffs). It is distinct from vertical investments, which are based on the geographical separation of the different links in the production chain, with cost considerations and cross-country differences in factor prices determining the location of affiliates. In the categorization of White and Poynter (1984), there are two or three vertical affiliate types. One is the rationalized manufacturer that produces in the host country but sells to the world market. Another is the product specialist, which has comprehensive responsibility for developing and manufacturing products for the MNC's worldwide network as well as for the world market. The most advanced affiliates, finally, are the strategic independent units, which have the freedom to establish new product lines and to develop new markets. While they are often parts of a vertical production chain, it is also conceivable that some may be entirely disconnected from the MNC's other activities. One motive for such investments could be diversification.

An ability of subsidiary to move from the simplest type to more advanced forms typically takes the subsidiary through a creative transition (Papanastassiou and Pearce, 1994) and involves higher affiliate autonomy as well as higher innovative capability. The emergence of "technological-creativity-based independence" at the subsidiary level provides an enormous potential for MNC localized competences (technological, managerial, marketing), but at the same time should not be "disruptive and undermine the synergistic value of existing attributes" of the current group scope of MNC (Pearce, 1994). In his study Pearce (1994) pointed out that the attempt of creative subsidiaries to enrich their knowledge scope should be balanced within the MNC groups' technological trajectory through the logical product evolution.

An example may be the step between miniature replicas and rationalized manufacturers. On the one hand, it is reasonable to assume that rationalized manufacturers require somewhat different technical skills than the parent (since it is vertically differentiated from it), which suggests a relatively high level of capability. However, the technologies used by affiliates are normally older and more standardized than those employed in the parent's own operations, as described in product life cycle models, which tends to reduce the need for independent capability (Vernon 1966). Moreover, vertical affiliates are strategically important for the MNC's production network, and it is likely that rationalized manufacturers are tightly controlled by their parent to avoid delays, quality problems, and other complications that might affect the entire production chain. Similarly, it is unclear exactly what innovative capability is required by horizontal affiliates. They produce similar goods as the parent company, which implies relatively high capability, but their technologies are not necessarily of the latest vintage, and they are rarely involved in product and technology development. Hence, it is hard to predict which of these two affiliate types has the higher innovative capability.

Another proxy used to capture the difference in the role affiliates play in the host country is a degree of ownership. The degree to which foreigners commit their investment has been considered by many authors as a determinant of spillover effects. Here, the hypothesis is that the higher the degree of foreign ownership, the stronger the commitment the MNC has to transfer technology to the host country and therefore the higher the spillover effect will be.

A theoretical model by Ramachandran (1993) examines the incentives of the transferor and transferee of technology. This model predicts that a subsidiary will get more technological resources than partially owned or independent firms. For the partially owned firms, the results are ambiguous and suggest that greater share of ownership by the holder of the license does not necessarily result in a greater appropriation of profits and technology transfer to the host country.

The empirical results are ambiguous, however.

Empirical evidence from developed and developing economies

In their study, Blomström and Sjöholm (1999) tested empirically whether the degree of foreign or local ownership affects the level of labor productivity of foreign affiliates or the degree of spillover effects to the domestic firms in Indonesia. No evidence of such relationship was found. Furthermore, it was suggested that it is not the degree of ownership but competition that is important for spillover effects.

Different results have been provided by Dimelis and Louri (2002). They studied the case of the Greek economy and found that productivity is improved with the entry of foreign affiliates which are either owned fully or at least in major part by foreign firms. Furthermore, the benefits for domestic firms, especially for the lower productivity local firms, are larger when spillovers are stemming from foreign affiliates that are minority foreign holdings. This finding is in line with the literature suggesting that foreign investors tend to put more resources into technology transfer to their wholly-owned projects than to those owned partially.

When an MNC enters through mergers and acquisitions, the technology transfer occurs gradually, while Greenfield investments introduce new technology instantaneously. However, firms that are partially owned by foreign companies have greater incentives to establish linkages with local suppliers and producers, while foreign companies installed via greenfield investment may depend more on their bonds with headquarters.

Examining the determinants of overseas R&D activities by 231 Japanese firms in the electronics and electrical engineering industry, Belderbos et al. (2001) find that firms have increased their manufacturing presence abroad through acquisitions. This result suggests that technology sourcing, i.e., acquiring access to complementary innovative capability of foreign firms, has been an important motivation for the expansion of R&D activities overseas by Japanese firms. Nevertheless, the analysis of firms that operated as M&A found that this mode of entry has a significant negative effect on the number of overseas innovations.

The study by Kuemmerle (1999) found that greenfield is the dominant mode of entry for FDI in R&D for US and Japanese firms. However, about 20% of FDI in R&D was carried out through acquisitions. Evidence from interviews conducted for this study suggests that acquisitions do not necessarily lead to the transfer of the core R&D employees as long as the acquiring firm maintains a certain level of continuity regarding organizational culture and incentive systems at the acquired firm.

Some authors argue that FDI occurs when firms seek to exploit firm-specific capabilities. Most FDI into manufacturing and marketing units falls into this category of FDI, which is called home-base-exploiting type of FDI. Home-base-augmenting is another type of FDI that relates to the category of firms that invest abroad in order to access unique resources and in order to capture externalities created by local institutions and firms.

The results of the recent study by Kuemmerle (1999) provide evidence that FDI in R&D has risen considerably over the last 40 years. When firms invest in R&D sites abroad in order to augment their knowledge base they tend to establish facilities close to universities. By contrast, when foreign affiliates are focused on exploiting their knowledge base, firms establish facilities close to existing manufacturing facilities and markets. In this paper, Kuemmerle also finds support for the argument firstly put forward by Florida (1997) that FDI in R&D occurs primarily between a few highly industrialized countries.

Moreover, R&D abroad is not only country specific, but also highly industry specific. Cantwell and Santangelo's (1999) find that science-based and science-related technological activity, embodying a greater extent of tacit and non-codified knowledge, require as a rule a closer face-to-face interaction. However, mature and non-core technologies appear less context-dependent and are easier to transfer across borders. Cantwell and Santangelo's (1999) findings also confirm that the main factors driving the occasional geographical dispersion of the creation of highly localized technologies (e.g. R&D laboratories) are either locally embedded specialization which cannot be accessed elsewhere, or company-specific global strategies that utilize the development of an organizationally complex international network for technological learning.

Transition economies: earlier contributions and topics for future research

Empirical study by Pye (1998) conducted in six Central European countries finds that investors are primarily motivated to enter transition economies on the basis of host country specific market factors, although the opportunity to gain first mover advantages or comparative labor cost advantages were also important elements for the investment decision.

Using Romanian firm-level data, Javorcik and Spatareanu (2003) examine whether foreign ownership share in investment projects affects the extent of spillovers from foreign direct investment. The evidence is consistent with positive intra-sectoral spillovers resulting from wholly-owned foreign affiliates, but not from projects with joint domestic and foreign ownership. Further, the data indicate that the presence of par-

tially foreign-owned investments is correlated with higher productivity of domestic firms in upstream industries, suggesting that domestic suppliers benefit from contacts with multinational customers. The results suggest that wholly-owned foreign subsidiaries use newer or more sophisticated technologies than jointly owned investment projects and thus may have higher requirements vis-à-vis suppliers.

On contrary, Smarzhinska (2004b) reports that spillovers are associated with projects with shared domestic and foreign ownership but not with fully owned foreign investments, using data on Lithuania.

Different development levels of different economies, altering the way they absorb the beneficial effects of FDI is provided as optional explanation for the variation of the empirical results on foreign share and spillovers. It has been put forward by Dimelis and Loury (2002) that in less developed economies any degree of foreign presence may exert a significant influence, while in more developed economies the effects are diversified. The offered explanation challenges future research on more transition economies, avoiding a use of single summary estimates and employing diverse methodological techniques.

Noteworthy is the fact that there are not many studies that look at the characteristics of MNC affiliates in transition economies. The importance of this type of analysis and the deficiency of the empirical contributions on the character of technology and knowledge that multinational firms bring with them to transition economies is a strong motivation to conduct further research in this field. In this thesis, the determinants of innovative capability in a sample of MNC subsidiaries operating in the European transition economies are studied in Chapter 2. It finds that capabilities in product and process technology appear to be determined by a different set of variables than capabilities in marketing and management. The most independent affiliates hold high innovative capability in product and process technology, but are less prominent in marketing and management technology. Affiliates that are closely integrated with their parent company exhibit the opposite pattern. These differences may have some impact on the kinds of spillovers generated by different kinds of foreign direct investment projects.

1.4.3. Other possible environmental characteristics

The FDI spillover effect is complementary to national (regional) specialization in the host country. The local (national and regional) system of innovation is the institutional network of each country / region that supports the initiation, modification and diffusion of new technologies (Freeman, 1987, 1995). Looking at National Systems of Innovation (NSI) in historical perspective, Freeman points out that

“... during the 1950s and 1960s, the evidence accumulated that the rate of technical change and of economic growth depended more on efficient diffusion than on being first in the world with radical innovations and as much on social innovations as on technical innovations”. (Freeman, 1995, p. 9)

Comparing the development of the NSI in Japan and the Soviet Union, Freeman points out, regarding the Soviet System, that “to commit greater resources to R&D did not in itself guarantee successful innovation, diffusion and productivity gains.... three-quarters of the massive Soviet R&D resources were going into defense and space research. This amounted to nearly 3% of GNP, so that only about 1 % remained for civil R&D. This civil R&D/GNP ratio was less than half of most West European countries”. (Freeman, 1995, pp. 11-12). On top of that, the linkages between R&D laboratories and enterprises were not properly established and the knowledge created in the military R&D units did not spin off to civil industries. These features influenced the unique sectoral patterns of tacit capability development in Former Soviet Union economies over time.

While the phenomenon of generation, transmission and diffusion of technology has been increasingly internationalized over the last decade (Archibugi and Michie, 1995) the assessment of the commercial value, or innovative level, of technology transferred abroad calls for a deeper understanding.

When it is relatively expensive for MNC to constrain the supply of appropriable technology to the host economy will benefit from the FDI spillovers more (Blomström et al., 2001). When it is relatively cheap to constrain those supplies, host economies will benefit less. On the other hand, if the costs of adoption of foreign technology for local firms are large relative to the underlying innovative level of technology, there will be relatively few realized FDI spillovers. Multinational firms use patents to protect highly valuable technology and make it more expensive for local firms to adopt it.

The benefits of strong and weak IPR regimes in the host country for MNCs and the local economy are an essential part of the model that was developed by Markusen (2001). As a result, both the MNC and the host country benefit from strong institutions of contract enforcement, but only when it leads to a mode shift from exporting to production for the local market. Exporting firms dissipate rents and lead to a higher product price in the host country, so production for the local market results in a consumer-surplus gain. Contract enforcement leaves host-country welfare unchanged or reduces welfare, however, if a subsidiary was chosen prior to the policy change, where rents are transferred from the local agent to the MNC. Other results include the fact that the MNC is better off and the agent worse off if the MNC is bound by a contract than if it is not. MNCs thus benefit from a strong commitment to the ‘rule of law’, and benefit as much from their own commitment as they do from bindings on local agents.

Developing countries can benefit from more investment that follows stronger legal protection for investors. However, there is clearly some validity in the developing countries’ view that such protection only enriches the MNCs, and requires the poor countries to pay more for pharmaceuticals, software, and other products. Results of Markusen model (2001) show that the choice of which view dominates depends on the initial situation, and whether or not inward investment is occurring anyway in the absence of strong investor protection.

Empirical evidences from developed, developing and transition economies

Focusing on R&D investment abroad of 32 largest MNCs in pharmaceuticals and electronics industries Kuemmerle (1999) finds that US companies invested first in Europe, then in Japan, then in the rest of the world. European companies invested first in other European countries, then in the US and then in Japan but only to a very limited degree in the rest of the world. Japanese firms started to invest heavily in FDI in R&D only about ten years ago but did so simultaneously in the US, Europe and in the rest of the world. Here, the 'rest of the world' means primarily Canada, Australia and a small number of Asian countries.

Liu (2002) evaluates the effect of FDI presence in the Shenzhen Special Economic Zone. This region is characterized by relatively high propensity of FDI in China. He finds that the relation between FDI and both productivity and the rate of productivity growth of its recipient industries is generally insignificant. In contrast, a significant and positive relation between FDI in manufacturing industry and both productivity and the rate of productivity growth of its component industries is found, implying a significant role of the linkages effect in this region.

Planned economies suffered from the lack of strong internal network coordination, especially in a global economic environment, due to their low level of internationalization (Tunzelmann, 2004). The network alignment theory is applied by von Tunzelmann (2004) to test the hypothesis that the impact of FDI on growth differs depending on the degree of development of three types of network alignments: network of functions, resource network and geographical network. International trade and FDI, as the main indicators of involvement in the global economy, were largely missing in the planned economies due to their political and economic isolation. With the demise of the Soviet Union, the internal network linkages between research units and producers weakened or broke down as well. In the light of this, there has been a propensity to rely on FDI in the transition economies to recover lost R&D and network capabilities. Instead of relying on FDI, Tunzelmann suggests that firms in transition economies should place more emphasis on National Systems of Innovation as a core of their strategy, since this would help to generate absorptive capacity in these countries.

An attempt to map the institutional change in 25 transition countries over time has been made by Campos (2000). Even within the sample of transition economies it is possible to distinguish institutional difference between some groups of countries. The rule of law, for example, is found to be the most important institutional dimension both for the sample as a whole and for its capacity to differentiate Central and Eastern European countries from the block of former Soviet Union economies. The institutional differences of the host country are an important determinant of the FDI spillover effect especially in transition economies. The lack of empirical studies on this issue is mainly due to the difficulty in assessing the quality of institution in cross-country dimension quantitatively. The study by Campos (2000) may serve as a starting point for further research on institutional aspect of FDI spillover in transition economies.

It has been argued that spillovers are stronger within a small geographical unit (Jaffe et al., 1993). The assumption that FDI spillovers can be related to a geographic cluster or industry has been empirically tested by Jensen (2002). Examining the role of FDI in the Polish food processing industry, no horizontal spillovers from multinational to domestic firms were found. Inherited networks, in particular combined with physical space, are the most dominant causes of spillovers. The lack of shared language in interaction between foreign and domestic firms together with regional policy (especially towards attracting FDI to the Special Economic Zones in Poland) are among the main reasons mentioned for the absence of spillover effects at the regional level.

Torlak (2004) finds weak evidence of intra-industry spillover effects in Poland, Hungary, Romania and Bulgaria. The exception is the Czech Republic. Higher domestic firms' productivity and regional foreign presence are better explained by the fact that foreign companies are attracted to the regions with the highest productivity in order to benefit from agglomeration economies, than by productivity spillovers from foreign to domestic firms.

Smarzhinska (2004a) examines the impact of IPR regime on the composition of FDI in a sample of transition economies (countries of Eastern Europe and former Soviet Union). Investors in those sectors that heavily rely on protection of intellectual property are deterred by a weak IPR regime in a potential host country. Here, index capturing the strength of patent rights was used as a proxy for IPR regime. There is also some evidence that weak IPR protection may discourage all investors, not just those in the sensitive sectors. It has also been found that through all sectors the lack of IPR protection deters investors from undertaking local production and encourages them to focus on distribution of imported products.

Topics for future research

It can be argued that the additional determinants of the FDI spillover effect such as regional characteristics, IPR regime, and institutional differences have been considered important in a number of studies on transition economies. Yet, one variant on such determinants deserves further consideration. This includes different dimensions of institutional differences, e.g. contract enforcement, the rule of law, the level of corruption and political situation in general and regarding FDI in particular. Chapter 5 examines whether spillovers from foreign to domestic firms occur at the level of the region. The total factor productivity of domestic firms in the manufacturing sectors in Ukraine is estimated using Malmquist Productivity Index (MPI). The influence of FDI at the regional level on the performance of domestic firms is estimated in terms of efficiency and technical change, computed as a product of decomposition of MPI. In addition, to see if the characteristics of the region influence the level of spillovers from foreign firms are checked. The results suggest that no clear evidence that domestic firms gain or lose from the presence of multinational firms in the eastern region both in terms of technical change. The regions in the West of Ukraine benefit from spillovers in terms

of technical change and negative effects is significant for the efficiency change of those firms in the western regions.

This chapter has reviewed the literature on the main determinants of spillover effects from FDI and their empirical implications for developed, developing and transition economies. It finds substantial areas where further research can add to our understanding of the experience of transition. The next chapter empirically examines some characteristics of foreign affiliates and local economy that help to identify main determinants of innovative activity of foreign affiliates operating in transition economies.

1.5. Overview of further empirical studies and its contribution to the existing literature on FDI spillovers

In the preceding discussion the results of our econometric contribution introduced later in the thesis have been reviewed. Here, the input of the empirical studies of the thesis to the existing literature on FDI spillovers is discussed in a more systematic manner.

In Chapter 2 it was found that different types of innovative capabilities of foreign affiliates differentiated with respect to knowledge in marketing, management, product and process are determined by different factors. Technological standard of the host industry and competition from local firms in the host country affects the decision of MNCs on the innovative capabilities in transition economies (see previous theoretical discussion on it in 1.4.1 and 1.4.3). During the period under study, the skill requirements in the most technologically advanced industries appeared to be too high for the level of skills available in the four transition economies. Hence, subsidiaries in high technology industries recorded lower levels of independent capability. For marketing and management capability, the pattern is almost the opposite. The highest levels of capability are recorded in subsidiaries that are closely tied to the parent company with high foreign ownership shares and substantial exports back to the parent company. The most independent affiliates possess high innovative capabilities in product and process technologies but are weak in marketing and management technologies. Affiliates that are closely integrated with their parent company exhibit the opposite pattern. While most of the econometric studies reviewed in the current chapter consider FDI as a homogeneous unit (see previous discussion in 1.4.2), Chapter 2 provides empirical ground to reconsider this assumption if not to implement an opposite one in future research. Namely, this study provides evidence of heterogeneity of foreign affiliates in terms of innovative capabilities. These differences may have some impact on the kinds of spillovers generated by different kinds of foreign direct investment projects. Therefore the findings of Chapter 2 seek to motivate future empirical studies on FDI spillovers to take into account this aspect of the diverse behavior of foreign affiliates. These results have been taken into account in further empirical studies of the current thesis.

For some industries and countries relative shortage of marketing and management knowledge can be more important than formal R&D expenditures, which are not necessarily reflected in productivity growth. Firms in transition economy, with a history of working in a planned economy, can benefit more from foreign presence in terms of rising efficiency of using existing resources and exploring new markets rather than from technological knowledge. Chapter 3 is aimed to contribute to this aspect of the effect of foreign presence. Namely, by employing semi-parametric methodology to evaluate spillovers from FDI in term of efficiency of domestic firms. Additionally, a methodological alternative is used in the post-DEA analysis (truncated regression) in combination with a bootstrap procedure to estimate confidence intervals in a test for various intra-industry spillover effects in this study. Firm-level data on the performance of foreign and domestic firms in five transition countries have been analyzed. It was found that foreign firms are more scale efficient than domestic firms but there is no strong evidence that foreign firms are more technically efficient than their domestic counterparts. In line with the results from Chapter 2 this fact provides some support to the existing argument (see previous discussion in 1.4.1) that foreign firms are not automatically more efficient than domestic firms but that they are guided by the economic environment in which they operate.

The results of Chapter 3 lead to the conclusion that large foreign presence is associated with improved performance of domestic firms. However, strong conclusions about spillover effects could not be made with the data available in this study. Due to the data limitations we were unable to demonstrate the dynamic mechanism that is necessary in order to more reasonably connect the foreign firms' presence with the efficiency of their domestic counterparts. The next chapter evaluates the dynamic effect of FDI on the host country by estimating the Malmquist Productivity Index and taking into account the impact of foreign presence both on technical and efficiency change.

Finding an empirical proximity to measure different types of foreign knowledge has been a hard challenge for scholars working in this field (see previous discussion in 1.4.1). Chapter 4 is one of the first steps in this direction. It seeks to clarify the influence of foreign presence in the industry on domestic firms in terms of both efficiency change and technological change in the setting of the transition economy of Ukraine. Here, the technological transfer of product and process technologies from abroad is assumed to be associated with technological change of domestic firms, pushing them closer to the new technological frontier. Organizational knowledge is more related to the concept of efficiency where firms learn how to produce the same amount of output using less inputs (input-oriented model) or produce more with the same set of inputs (output-oriented models).

Results of the study presented in Chapter 4 suggest that FDI differently influences efficiency and technical change of domestic firms in the Ukraine. Foreign presence positively influences efficiency change but exerts a negative and significant effect on technical change. The outcome implies that foreign presence through competition disturbs the existing equilibrium in the industry and stimulates domestic firms to become more

efficient. At the same time, a negative influence of FDI on technical change of domestic firms may suggest that FDI causes a segmentation of the market where foreign companies are working in enclaves.

The distinction between the impact of FDI on both technical and efficiency change of domestic firms, instead of accounting traditionally for the impact on productivity, allows to see the results of previous studies, especially those that found a negative spillover effect of FDI (see previous discussion in 1.4.1), in a different perspective. Previously, the negative spillovers were mainly explained by the crowding out effect of foreign presence. Chapter 4 provides an evidence that negative spillovers can also be viewed as an outcome of dominating negative influence of FDI on technical change of local firms.

There is also a set of additional environmental characteristics that were marginally neglected in the previous studies on FDI spillovers (see section 1.4.3 of the thesis). Among such characteristics are: institutional differences among the studied units in terms of the state of intellectual property rights, infrastructure, entrepreneurship, level of corruption or trust, rule of law, etc. Chapter 5 goes beyond the existing literature presented in section 1.4.3 by examining the regional aspect of spillovers from foreign to domestic firms. Furthermore, in diverse parts of the country, characterized by different attitude to FDI, the impact of foreign presence is hypothesized to have different effects on the technical and efficiency change of domestic firms of the region. Taking region as a unit of analysis, Chapter 5 provided additional information on the impact of FDI in two historically diverse parts of one transition country - Ukraine. Particularly, there was found no clear-cut pattern of the spillover effect from foreign presence in the Eastern regions of Ukraine. At the same time there is a positive spillover effect on the firms operating in the Western regions of Ukraine in terms of technical change and negative effect on the efficiency change there. Different impact of foreign presence on the performance of firms in two parts of Ukraine might reflect strong institutional divergence of the West and the East and the nature of FDI in two regions.

II. Innovative Capability in MNC Subsidiaries: Evidence from Four European Transition Economies⁶

2.1. Introduction

Most governments provide various incentives to prospective foreign investors, ranging from help with information about local business opportunities to tax holidays, employment subsidies, and land grants. The main theoretical motive for incentives is that foreign direct investment (FDI) is eventually expected to add some value to the local economy, either directly through job creation and tax revenues, or indirectly, via technology or productivity spillovers to local firms. In fact, technology and productivity spillovers have sometimes been identified as the most important benefits of FDI, particularly for developing countries and transition economies where domestic technologies are less advanced than those employed by large foreign multinational corporations (MNCs). When foreign MNCs set up a subsidiary, they are expected to bring some amount of the firm-specific intangible assets that allow them to compete successfully with local firms that have superior knowledge of the local market and business environment. Some of these intangible assets – knowledge and skills related to product and process technologies as well as management, marketing, and other aspects of firm operations – can be expected to spill over to local firms over time, as a result of employee turnover, linkages, or simple demonstration effects.

A substantial body of literature, including case studies of specific technologies as well as more aggregated econometric analyses, has supported the idea that spillovers may provide significant productivity benefits for local firms. However, in recent years, there have also been a number of studies casting some doubt on the hypothesis that all or most host countries may expect to benefit from technology spillovers (Aitken and Harrison 1999, Görg and Greenaway 2004). For instance, Konings (2001) reports that foreign presence has no significant impact on the productivity of local firms in transition economies. Similarly, Damijan et al. (2003) conclude that FDI does not generate any positive intra-industry spillovers for domestic firms. It appears particularly worrying that studies on transition economies do not appear to yield any positive evidence of spillovers, considering the high hopes regarding international integration – the most obvious expression of which may be cross-border investment flows – expressed in many of these countries.

One reason for the mixed results could be methodological: most of the studies finding significant spillovers are cross-section analyses, whereas panel data models have systematically found less significant spillover effects. In the cross-section studies, foreign investors may have been attracted to the industries that were most productive to begin

⁶ This Chapter is based on the paper (with A. Kokko) "Innovative Capability in MNC Subsidiaries: Evidence from Four European Transition Economies." *Stockholm School of Economics Working Paper 224, 2006*

with, which would give a spurious correlation between foreign presence and local productivity and lead to systematic over-estimation of spillovers. Conversely, in the panel studies, it is typically assumed that spillovers materialize instantaneously or with a very short lag, which is clearly not the case and results in systematic under-estimation of spillovers. Another reason is that the capability of local firms to absorb spillovers is likely to vary between host countries and industries. It can be assumed that spillovers are more likely when the technological capability of local firms is not too inferior compared to that of foreign affiliates: in those cases, local firms can use existing knowledge to adapt and adjust foreign technologies to their own use. The level of competition between foreign and local firms will also matter. Incentives to learn from foreign firms will clearly be strongest when the foreign and local firms are in direct competition with each other, so that passivity will result in lost market shares and profits.

Yet another reason for differences in spillovers is that the behavior and strategy of foreign subsidiaries may vary depending on their role in the multinational corporation. It has, for instance, been suggested that export oriented affiliates may provide less scope for technology spillovers than import substituting local market oriented affiliates. While local market oriented affiliates typically bring with them technologies that are weak or missing in the host country, export oriented affiliates are more likely to focus on activities and technologies where the host country already has comparative advantages. In these cases, the competitive assets of the MNC may be superior marketing knowledge (related, for instance, to knowledge about foreign preferences or access to existing distribution networks) rather than superior production technology. As a result, there is perhaps no reason to expect positive technology spillovers to local firms (although some of the knowledge related to exporting may well spill over). More generally, it can be asserted that the MNCs' decisions regarding the amount and kind of technology transferred to subsidiaries will determine the potential for spillovers to local firms.

The purpose of this chapter is to explore in more detail how the innovative capability of foreign subsidiaries varies across industries in a small sample of transition economies. We examine how the MNC affiliates' ability to take part in innovative activities is related to various subsidiary and host country characteristic. One motivation for exploring this question is that an affiliate possessing a greater innovative capability is also likely to have greater potential as a source of spillover benefits. A subsidiary that has no innovative capacity may still facilitate the diffusion of imported technology to the rests of the economy, but it is less likely that this technology will be well suited to local conditions.

The chapter is structured as follows: following this introduction, section 2 reviews some earlier studies of subsidiary roles and formulates some hypotheses regarding the impact of subsidiary and host country characteristics. Section 3 presents the data and variables used for the empirical test, section 4 summarizes and discusses results from the regression analysis, and section 5 provides some concluding comments.

2.2. Theoretical framework and previous empirical findings

As it was illustrated in the previous Chapter (see paragraph 1.4.1), the presence of foreign firms does not create spillovers automatically, but does create the potential for such effects to take place. At the same time there is much less discussion in the economics literature about how differences in the behavior of MNC affiliates may influence the outcomes. Yet, it is easy to argue that the strategy and behavior of the MNC will matter (see previous discussion in 1.4.2). For instance, it is hard to disregard the differences between those MNCs that establish affiliates with substantial innovative capability, and those that rely more on the parent MNC's resources and the innovation decisions made at the headquarters. Although there may be spillover effects in both cases, the potential is arguably larger in the former case: there is simply more localized knowledge that may spill over.

In the recent literature, growing attention has been given to the role of the subsidiary as an important part of the mechanism for transferring appropriate knowledge from MNC headquarters. In the new generation of overseas subsidiaries, both the creation and application of technology is increasingly seen as a result of interaction with the local environment (Kogut and Zander 1993; Zander, 1997).

One approach to studying the wide range of different roles of foreign affiliates in the host country is to group affiliates according to the level of autonomy that they enjoy. Foreign affiliates can be classified as 'rationalized manufacturers' when they produce in the host country but sell to the world market; 'product specialist' meaning they have comprehensive responsibility for developing and manufacturing products for the MNC's worldwide network as well as for the world market, or 'strategic independent units', which have the freedom to establish new product lines and to develop new markets or have a so-called 'world mandate' (White and Poynter, 1984; Birkinshaw and Hood, 1998). Such entrepreneurial subsidiaries, which also tend to have either world or regional product mandates, adopt operations which enable the parent company to get into a much wider range of resources as an integrated part of its global activity.

Reconsidering White and Poynter's (1984) classification of foreign affiliates with regard to the FDI spillover literature one may hypothesize that different kinds of foreign direct investment projects have different impact on the kinds of spillovers. For example, 'rationalized manufacturers' are mainly export-oriented foreign affiliates. Empirical studies provide evidence that foreign firms that produce for the export and not for the local market do not generate productivity spillovers, but export spillovers to domestic firms instead (see Kokko, 2001). MNCs introduce less new technology and rely more on their marketing skills. This type of affiliates also tends to establish fewer linkages with domestic firms, reducing the potential for knowledge to spillover to domestic firms. While 'product specialists' bring to the host country new products technology, the knowledge is usually highly codified and well-protected. On contrary, 'strategic independent units' and so-called 'world mandate' highly autonomous for-

eign affiliates are expected to rely more on the local conditions in their decision to bring new technology and organizational knowledge. If there is a strong need for a new product or process development this type of affiliates are capable of bringing necessary capabilities to transfer or develop this knowledge within the host country (see also previous Chapter for the literature review on the MNC affiliate characteristics, paragraph 1.4.2) .

The MNC's choice of affiliate type depends on the technological characteristics of the industry (e.g. to what extent the value chain can be divided into separate components), the strategic objectives of the MNC, cost considerations (tariffs, transport costs, differences in factor prices) and host country characteristics, such as market size and development level (Birkinshaw and Hood 1998). It is also possible that an affiliate's status may change over time, in response to changes in its economic environment. Several studies have examined such changes in the role of the affiliate and highlighted some of the affiliate and host country characteristics that may contribute to upgrading: these factors are also likely determinants of the affiliate's innovative capability. One of the key factors seems to be the stock of resources accumulated by the affiliate. These include the technological and managerial skills embodied in employees, as well as various organizational assets (Nelson and Winter 1982, Teece 1989, Rugman and Douglas 1986, Dörrenbächer and Gammelgaard 2004). While such skills and assets are difficult to observe, they are probably positively related to the age and the size of the affiliate, as well as to any R&D activities it may carry out. The mode of entry may also matter, in the sense that a recently acquired affiliate may have more firm specific assets than a recently established greenfield affiliate.

Among the host country characteristics, the most important determinant is probably the general development level of the host country. In particular, improvements in general market structure, infrastructure, and education are likely to encourage upgrading of affiliates (Rugman and Douglas 1986, Egelhoff et al. 1998, Walsh et al. 2002). Birkinshaw and Hood (1998) also emphasize the role of government policy in the form of subsidies and tax concessions. In addition, Holm et al. (2003) have emphasized the role of local competition as a driving force for the development of affiliates' capabilities, confirming some of the conclusions of the studies of affiliates' technology imports.

Summarizing the findings from the earlier literature, it therefore seems appropriate to posit that the innovative capability of MNC affiliates depends on three sets of determinants. Firstly, the role of the affiliate in the MNC's international production network is important. While there is no single proxy to describe the affiliate's position in the network, it is likely that features like entry mode, foreign ownership share, trade orientation, and degree of diversification can be used to distinguish between different types of affiliates. Secondly, some other subsidiary characteristics, like size, age, and industry of origin are probably determinants of capability. Finally, host country and host industry characteristics are important determinants of competition and local technological

capability. This study seeks to clarify the importance of some of these determinants of the innovative capability of MNC affiliates operating in transition economies.

2.3. Data sources, empirical model and variables

On the basis of the theoretical discussion in the previous section, it can be expected that the MNCs' decisions regarding the innovative capabilities of their subsidiaries depend on three broad sets of variables. Firstly, the subsidiary's role in the MNC's international production network is one important determinant of how much autonomy it is allowed by the parent MNC, and how much independent innovative capability it needs. Affiliates that are tightly integrated into international production networks – so called “rationalized manufacturers” – are more likely to depend on the parent company (or some specialized technology producer in the company group) for technical knowledge, while more sophisticated and independent affiliates – e.g. “product specialists” – may require their own innovative capability. Secondly, the innovative capability of the affiliate will depend on local conditions, including the development level of the host industry and the competitive pressure exerted by local firms. Affiliates in weakly developed industries, where labor productivity is low, are less likely to have innovative capability than affiliates operating in sophisticated host country industries. Similarly, affiliates facing little or no competition may not feel the need to invest in innovative capability, whereas subsidiaries that face pressure from local firms may be forced to develop such capabilities. Thirdly, some affiliate characteristics are likely to determine whether the affiliate is able to maintain substantial innovative capability. For instance, larger and older affiliates may have better opportunities to develop innovative capabilities.

The data set used to explore these hypotheses covers information on foreign-invested enterprises and industry characteristics in four transition countries – Slovenia, Poland, Hungary and Estonia. There are three main data sources. Firm level data are drawn from a EU-funded survey of foreign-owned enterprises operating in transiting economies, which was conducted in 2001-2002.⁷ Industry level data are from national accounts statistics (at the 2-digit ISIC, 2nd rev. level), and country level data are from the World Development Report 2003.

The innovation survey is based on a written questionnaire sent in 2001-2002 sent to about 1,700 manufacturing enterprises with foreign direct investment. Replies were received from 342 enterprises, giving a response frequency of about 20 percent, with some differences between the four countries included in the survey. The questionnaire asks about the innovative capabilities and activities in foreign affiliates in 2000, and contains information about various firm characteristics, such as age, form of establishment, and number of employees (for a more detailed description of the survey, see

⁷ EU Fifth Framework Project: “EU Integration and the Prospects for Catch-Up Development in Central and Eastern European Countries: The Determinants of the Productivity Gap”.

Mannik et al. 2004). The data from the national statistical authorities cover industry characteristics like value added and employment in domestic as well as foreign-owned enterprises during the period 1995-1999. The country data, finally, reflect differences between the four countries when it comes to economic size, average income level, and average education expenditures.

The information from these three sources can be combined to test a model where the autonomy and innovative capability of a subsidiary is determined jointly by its role in the MNC and various firm and environment characteristics, as in equation (1) below.

$$\text{Innovative capability} = f(\text{Subsidiary role, Subsidiary characteristics, Environmental characteristics}) \quad (1)$$

The information from the innovation survey makes it possible to specify several proxies for innovative capability. In the survey, affiliates are asked whether innovations and developments in product and process technology, marketing, and management are undertaken a) by the affiliate itself only, b) mainly by the affiliate itself, c) mainly by the foreign owner, or d) by the foreign owner only (see further Hamar and Stephan 2006). Although autonomy and capability can be considered distinctly separate theoretical concepts, the design of the survey does not allow us to separate between them in the empirical analysis: the responses combine information about formal autonomy – i.e. the mandate to engage in innovation – and capability or ability to undertake innovative activities. Yet, the responses allow us to distinguish between those subsidiaries that have autonomy and own innovative capability in each of the four areas, and those that are mainly dependent on the parent company for their development. This means that we can define four alternative dependent variables. Each of these is a binary variable, taking on the value one (1) when the subsidiary reports that it is itself wholly or mainly responsible for developments in the specific field in question, and the value zero (0) when developments are mainly directed from the parent company or other subsidiaries.⁸

Ex ante, there is no reason to expect that each of these alternative dependent variables should be determined by the same factors. For instance, export-oriented subsidiaries supplying intermediates to the international production network of a multinational corporation may require substantial independence in management issues, but decisions regarding product technology may be centralized to the parent company: this type of decisions are likely to be of strategic importance for the entire MNC. It is therefore not surprising that some of the correlations between the four alternative dependent vari-

⁸ For product and process technologies, possessing innovative capability means that the subsidiaries develop and improve their products and processes on their own or mainly on their own. Regarding marketing, firms have innovative capability if they have their own market research capabilities; for innovative capability in management, subsidiaries need to take the responsibility for operational and strategic management and planning on their own or mainly on their own.

ables are relatively low. Looking at Table 1, it seems that the capabilities in product and process technologies may largely be determined by the same factors, but that these are distinctly different from the factors determining capabilities in marketing and management technologies. While these variables are intended to focus on the concept “innovative capability”, it should also be noted that they are measured subjectively, which could be a problem if there are systematic differences between how affiliates in different industries or countries rate their own capability.

Table 1.

Correlation matrix for dependent variables

<i>Area of technological capability</i>	Product	Process	Marketing	Management
Product	1.00			
Process	0.59	1.00		
Marketing	-0.30	-0.28	1.00	
Management	-0.31	-0.32	0.49	1.00

Source: Questionnaire for Foreign Investment Enterprises

Regarding the explanatory variables, one problem is that there is no explicit information about the specific role of each affiliate within the MNC to which it belongs. However, we can use some of the information in the innovation survey to distinguish between different types of affiliates. In particular, this applies for those firm-specific variables that reflect strategic considerations, such as foreign ownership share, export orientation, and mode of entry. Two extreme or stylized firm types can be outlined. The first type is the wholly-owned affiliate that was established through a greenfield investment and that exports a substantial share of its output to other parts of the MNC network. The second type is the minority owned affiliate that was established through the acquisition of an existing company and that sells a variety of products to local customers. While the former lies close to a “rationalized manufacturer” that is well integrated into the international production network of the MNC, the latter may have a more independent position. Many other combinations of affiliate characteristics are of course possible, and it is therefore useful to explore what independent effects some of these main characteristics have. In addition, we have a number of firm specific variables, like affiliate size and age, that are not directly related to the affiliate’s role in the MNC network but rather to its ability to maintain a high level of innovative capability. Hence, the following variables describe the characteristics of the affiliate:

- **Minority.** Dummy equal to 1 for minority owned subsidiaries (foreign share between 10 and 50 percent). Expected to have positive effect on innovative capability, since minority owned subsidiaries will have only limited access to the technological assets of the parent MNC.
- **Greenfield.** Dummy equal to 1 for subsidiaries established through greenfield investment (rather than acquisition of existing firm or plant). Negative expected effect

on innovative capability given that acquired affiliates are more likely to have innovative capabilities inherited from pre-FDI period.

- **Diversification.** Number of separate lines of business of the affiliate (logged). More diversified subsidiaries are likely to require stronger innovative capability.
- **Exports to owner.** The share of the subsidiary's total sales directed to its foreign owner. Subsidiaries with high exports to the parent MNC are likely to belong to international production networks and may have little independence regarding technical decisions.
- **External exports.** The share of the subsidiary's total sales directed to other foreign buyers. Subsidiaries selling substantial shares of their output to independent foreign buyers need high capacity in marketing and management, but the requirements regarding independent technical capability are unclear, depending on whether export competitiveness is based on the subsidiary's own innovative skills or on the parent's technical expertise.
- **Size.** Number of employees (logged). Larger subsidiaries are expected to be relatively more independent and should therefore possess stronger innovative capabilities.
- **Age.** Number of years since the establishment of the firm as foreign-invested enterprise. Regardless of other firm characteristics, older subsidiaries are more likely to have developed their own innovative capabilities.

Table 2 summarizes some of these firm characteristics for the 342 foreign-owned enterprises in the data set. On average, the subsidiaries are relatively large enterprises, with over 400 employees, although there are clear differences depending on the size of the country: in the two small countries, Estonia and Slovenia, firms are generally smaller than in the two larger economies Poland and Hungary. Most firms were established as greenfield ventures (except in the case of Estonia) and most are directing more than half of their output to export markets (except in Poland, which has the largest domestic economy). The average age of firms is also very similar, which is not surprising considering that the transition process commenced at roughly the same time in all countries (with the exception of Hungary, where economic reforms started well before the fall of communism). Furthermore, it can be seen that the majority of companies report possessing autonomy and innovative capabilities in either product and process technology, marketing or management, although there are differences between these four areas, as well as between the four countries. For instance, while 89 percent of the subsidiaries in Poland report holding independent capability in management-related issues, the same is true for only 41 percent of subsidiaries in Slovenia.

Table 2.

Descriptive statistics: Foreign Investment Enterprise (FIE) characteristics

Number of firms	69	146	81	46	342 (total)
Share of firms (%) with innovative capability in					
Process technology	54	53	52	63	55
Product technology	83	62	64	83	73
Marketing	64	54	56	59	58
Management	41	89	53	72	64
Age (years)	6.45	6.66	8.36	7.43	7.11
Greenfield (%)	55	63	67	43	57
Size (no. of employees)	217	533	412	235	406
Export share (%)	74	33	52	57	49
Diversification (no. of business lines)	3	3	5	12	4.7

Source: Questionnaire for Foreign Investment Enterprises

To capture various host industry characteristics, we have defined the following variables using information from national statistical sources (all variables refer to industry j in country k):

- **Productivity.** Average gross output per employee in the 2-digit industry of the subsidiary in 1999 (logged). Proxy for labor productivity and the level of sophistication of each industry (including the capital/labor ratio and the quality of the labor force available in that industry). Subsidiaries in high-productivity industries are expected to require stronger innovative capacities, and may be better able to recruit skilled workers in order to maintain that capacity.
- **Gap.** The ratio of the average labor productivity in foreign subsidiaries to that in locally-owned firms in 1999. A large gap indicates that the technologies used by foreign subsidiaries and local firms are different. This may be a sign of a dual industry structure, where the product characteristics of foreign and locally-owned firms are dissimilar, and where there is little competitive pressure on foreign subsidiaries to upgrade their products and processes. This dissimilarity may be related to the production technology, but it may also derive from differences in price and quality characteristics. The hypothesis is that smaller gaps suggest tougher competition, which requires more innovative capability. The gap variable is based on national accounts data for all foreign invested enterprises in the host country/industry rather than the 342 firms in the present sample.
- **Convergence.** The change in the gap variable between 1996 and 1999. A diminishing gap indicates that local firms are catching up to foreign subsidiaries. This implies tougher competitive pressure, and should require stronger innovative capabilities in affiliates.
- **Growth.** The growth rate of industry output between 1996 and 1999. Rapid output growth is likely to be connected to technical progress. The hypothesis is that firms in growing industries will require more innovative capability.

- Technology level. Dummy variables distinguishing between low, medium, and high technology industries, as defined in OECD (Hatzichronoglou, 1997). While the productivity variable captures one dimension of industry development, it does not fully reflect the industry's technology level in transition economies and developing countries – the highest productivity levels are often recorded in medium-technology industries, since there is insufficient capability to operate the most advanced technologies. One reason for this somewhat paradoxical finding is the international division of labor within multinational corporations: the most sophisticated production stages are often located in the most advanced economies, while plants in less developed economies focus more on assembly and other simple operations. At the same time, high technology industries may require the strongest innovative capabilities. These two contradictory effects make it hard to pose a clear hypothesis regarding the variable Technology.

Table 3.

Descriptive statistics: host industry characteristics (averages for low, medium, and high-tech industries)

Country	Technology level	Productivity 1999 ('000 Euro)	Gap	Convergence (1999/1996)	Growth (1996-1999)
Slovenia	Low	66.29	1.39	0.85	0.06
	Medium	94.90	1.17	0.92	0.18
	High	117.27	1.62	1.09	0.24
Poland	Low	71.49	1.69	1.05	0.37
	Medium	51.79	2.43	1.09	0.47
	High	69.78	1.52	0.95	0.47
Hungary	Low	55.29	2.04	1.08	0.57
	Medium	65.82	2.29	1.24	0.58
	High	58.37	3.45	1.18	0.86
Estonia	Low	50.03	1.85	1.08	0.42
	Medium	44.70	1.67	0.87	0.31
	High	73.78	1.93	0.61	0.48

Source: National Statistical Offices in Slovenia, Poland, Hungary and Estonia

Table 3 summarizes some of these host industry characteristics, distinguishing between low, medium, and high technology industries. One of the main points to note is that there are substantial differences in the competitive environment facing the MNC subsidiaries. The local productivity differences are significant – for instance, Slovenian medium-tech firms are more than twice as productive as Estonian medium-tech firms – and the size of the productivity gap between local firms and subsidiaries varies widely between industries. The general pattern is that the subsidiaries record higher productivity than local firms in all countries and industry groups, that local firms are closest to the subsidiaries in Slovenia, and that the convergence rate appears to be fast-

est in Estonia. It is also notable that it is not always the high-tech industries that record the highest local productivity. The likely reason is that the underlying competitive advantages for high-tech manufacturing are still relatively weak in the transition economies, and that the firms operating in these sectors focus on relatively simple operations – e.g. assembly – while the more complicated parts of the production process – such as research and development – take place in other countries.

In addition, we have made some estimations with the following host country characteristics, to control for macro level differences in the host environment.

- GNP/cap. Gross national product per capita in Euros. Proxy for development level of host country. More developed host countries are likely to provide better conditions for creating innovative capabilities.
- Education expenditure. Education expenditures as share of GNP. Countries with higher education investments are likely to provide better conditions for creating innovative capacities.
- GNP. Proxy for the size of the economy. Firms in larger economies are likely to focus more heavily on the domestic market, and may require stronger innovative capabilities.
- Country. Dummy for countries, to capture differences related to various cross-country differences. Not used together with above.

Table 4.

Descriptive statistics: host country characteristics 1999

Country	Population (million)	GDP/Capita (USD)	Population density (pop / km ²)	Education exp. (% of GNP)
Slovenia	2	9890	98	5.7
Poland	39	3960	127	7.5
Hungary	10	4650	109	4.4
Estonia	1	3480	34	7.2

Source: UNCTAD country database.

Table 5.

Main explanatory variables: correlation results

Variable	Size	Age	Export to owner	Export external	Diversi- fication	Greenfiel d	Minority	Technol- ogy- intensity	Produc- tivity	Gap	Conver- gence	Growth
Size	1.00											
Age	0.07	1.00										
Export to owner	-0.04	-0.07	1.00									
Export external	0.08	-0.03	-0.30	1.00								
Diversification	0.06	-0.06	0.01	0.15	1.00							
Greenfield	-0.17	-0.18	0.15	-0.17	-0.19	1.00						
Minority	-0.02	-0.02	-0.23	0.02	-0.04	-0.02	1.00					
Technology-intensity	0.08	-0.08	0.03	-0.04	-0.08	-0.06	-0.05	1.00				
Productivity	-0.09	-0.04	0.13	-0.16	0.06	-0.05	-0.12	-0.28	1.00			
Gap	0.14	-0.03	0.00	0.09	0.06	0.11	-0.03	0.05	-0.44	1.00		
Convergence	0.07	-0.01	-0.03	-0.04	-0.02	0.08	0.14	-0.02	-0.24	0.24	1.00	
Growth	0.04	-0.06	0.17	0.18	0.00	0.09	-0.02	0.21	-0.33	0.65	0.04	1.00

Table 4 summarizes some of the data on these variables. In 1999, Estonia was the smallest and least developed of the four transition economies in the sample, while the other small country, Slovenia, recorded the highest per capita income and development level. The larger economies, Poland and Hungary, recorded per capita income levels somewhat above those for Estonia. With only four countries in the sample, however, it should be noted that the variables for country characteristics are not likely to be particularly strong. As an alternative, we therefore replace the country level variables with country dummies in some of the regressions.

Table 5 provides a correlation matrix for the independent variables. The correlations are generally low, and the only variables that exhibit a worryingly high correlation are Gap and Growth. We will return to this observation in the analysis of the regression results.

2.4. Regression results discussion

Since the dependent variables (innovative capability in product and process technology, marketing, and management) are binary, distinguishing between those affiliates that report having their own innovative capabilities from those that do not, it is appropriate to use a binary estimation method: we use a probit model that is estimated by the maximum likelihood method.⁹ Table 6 presents the estimation results.

Firm level characteristics, such as age, entry mode, size, export orientation and degree of diversification of the subsidiaries.

Industry level characteristic reflecting the technical sophistication and competitive environment in the host industry.

Country dummies and dummies for the technology level of the industry.

Looking first at equation (6a), which examines the determinants of innovative capacity in process technology, it can be seen that only two firm-level variables have any significant impact. Firstly, foreign minority ownership appears to be connected with significantly higher innovative capability. The reason is probably that minority-owned subsidiaries require a greater degree of independence regarding process innovation, since the MNCs are likely to be unwilling to allow them full access to the latest and most profitable technologies. These technologies are typically reserved for use in the parent company and in wholly owned affiliates where the risks of leakages of information to outsiders are minimized. It is also possible that the acquisition decisions of foreign MNCs typically presume

⁹ As a control, we have also made some ordered probit estimations. These estimations exploit all the information about innovative capabilities in the surveys, allowing the dependent variable to take on values from 1 to 4, where 1 is the case where all developments are undertaken and initiated by the parent, and 4 is the case where innovations are the responsibility of the subsidiary itself. The results do not differ much from those presented below, and are therefore not shown separately.

Table 6.

Regression results: determinants of innovative capability in MNC subsidiaries

Equation	6a	6b	6c	6d	6e	6f	6g	6h
Dependent variable	Process	Product	Marketing	Management	Process	Product	Marketing	Management
<i>Firm characteristics</i>								
Size	0.07 (1.38)	0.09 (1.65)*	-0.01 (0.31)	0.02 (0.25)	0.07 (1.38)	0.09 (1.65)*	-0.02 (0.32)	0.02 (0.24)
Age	0.11 (1.07)	0.03 (0.33)	0.02 (0.88)	0.01 (0.36)	0.11 (1.07)	0.03 (0.33)	0.02 (0.88)	0.01 (0.36)
Export to owner	-0.08 (0.05)	-0.24 (3.21)***	0.33 (4.15)***	0.24 (2.62)***	-0.08 (0.09)	-0.24 (2.25)***	0.33 (4.17)***	0.25 (2.66)***
Export external	-0.10 (1.23)	-0.004 (0.00)	0.12 (1.59)	0.01 (0.17)	-0.11 (1.30)	-0.004 (0.00)	0.12 (1.68)*	0.02 (0.23)
Diversification	0.29 (2.59)***	0.23 (2.35)**	-0.05 (0.52)	-0.10 (1.04)	0.29 (2.67)***	0.24 (2.41)**	-0.05 (0.60)	-0.11 (1.10)
Greenfield	-0.36 (1.57)	-0.44 (2.24)**	0.16 (1.81)	-0.07 (0.31)	-0.35 (1.55)	-0.44 (2.23)**	0.17 (0.95)	-0.07 (0.33)
Minority	1.07 (3.15)***	0.93 (3.37)***	-0.59 (2.56)***	-0.96 (3.59)***	1.07 (3.14)***	0.93 (3.36)***	-0.59 (2.57)***	-0.96 (3.59)***
Medium tech	-0.38 (1.50)	-0.57 (2.30)**	-0.05 (0.22)	0.54 (2.22)**	-0.38 (1.49)	-0.56 (2.30)**	-0.04 (0.16)	0.54 (2.22)**
High tech	-1.05 (3.27)***	-1.12 (3.74)***	0.28 (1.02)	0.86 (2.84)***	-1.05 (3.28)***	-1.12 (3.74)***	0.29 (1.04)	0.87 (2.85)***
<i>Industry characteristics</i>								
Productivity	-1.40 (2.23)**	-1.17 (1.86)*	1.00 (1.60)	1.34 (1.88)*	-1.41 (2.22)**	-1.18 (1.87)*	0.97 (1.56)	1.34 (1.88)*

Table 6 (continued)								
Equation	6a	6b	6c	6d	6e	6f	6g	6h
Gap	-0.67 (2.36)***	-0.80 (2.90)***	-0.28 (1.06)	0.23 (0.72)	-0.68 (2.37)***	-0.80 (2.91)***	-0.29 (1.11)	0.23 (0.73)
Convergence	-0.02 (0.16)	0.04 (0.27)	0.31 (1.56)	0.37 (0.91)	-0.03 (0.18)	0.04 (0.26)	0.31 (1.58)	0.37 (0.90)
Growth	0.70 (1.43)	0.88 (1.83)*	1.06 (2.29)**	0.13 (0.25)	0.71 (1.44)	0.89 (1.85)*	1.06 (2.28)**	0.21 (0.23)
<i>Country variables and country dummies</i>								
GNP	-0.10 (0.54)	0.14 (0.84)	0.20 (1.24)	0.71 (3.70)***				
GDP / capita	-0.43 (1.02)	-0.43 (1.23)	-0.09 (1.28)	-0.92 (2.64)***				
Education exp / capita	1.80 (2.56)**	0.97 (1.55)	0.16 (0.28)	1.07 (1.77)*				
Poland					-0.42 (1.25)	0.32 (1.01)	0.39 (1.29)	1.81 (5.14)***
Hungary					0.64 (1.99)**	-0.05 (0.18)	0.13 (0.43)	0.65 (2.02)
Estonia					0.36 (0.74)	0.42 (1.02)	1.00 (0.25)	0.96 (2.32)**
Cons	1.04 (0.91)	1.13 (1.02)	-2.56 (2.32)**	-2.70 (2.21)**	1.04 (0.91)	1.13 (1.02)	-2.56 (2.32)**	-2.70 (2.21)**
R2	0.20	0.20	0.15	0.33	0.20	0.20	0.15	0.33
Obs	293	293	285	292	293	293	285	292

The dependent variable is a binary number indicating innovative activity in process, product, management and marketing. All variables are normalized by division with the sample means. Estimated coefficients are shown together with the absolute value of z-statistics in parentheses. *, ** and *** denote significance at the 10, 5, and 1 per cent levels of significance (two-tailed test)

that the target firm holds some technical capability. Secondly, the degree of diversification of the subsidiary has a significant positive coefficient. A reasonable explanation is that subsidiaries with many product lines simply need the capability change their production processes independently of the parent company: the coordination and communication costs required to centralize these decisions are likely to be substantial. Neither size, age, market orientation, nor entry mode appear to have any significant role as determinants of innovative capability in process technology.

Looking at the environmental variables, it should first be noted that the productivity level of the host industry seems to exert a negative impact on the dependent variable. In other words, subsidiaries in industries with higher labor productivity are less likely to have independent innovative capacity and rely more on their parents for inputs of process technology. One reason could be that the transition economies have no clear comparative advantages in the most sophisticated industries, meaning that the subsidiaries in these industries find it hard to develop their own innovative capabilities. This hypothesis is supported by the observation that the dummy for high tech industries records a significant negative coefficient: subsidiaries in high tech industries are significantly less likely to hold independent innovative capability in process technology than subsidiaries in low-tech industries.

Another notable observation is that the *Gap* variable records a significant negative impact: in those industries where local firms are much less productive than the foreign subsidiaries, there is weaker innovative capability in subsidiaries. This result is most likely related to competition. Subsidiaries that are far ahead of their local competitors may have reached this position by relying to a great extent on technologies transferred from the foreign parent MNC. Moreover, as long as the gap remains large, the subsidiaries are able to maintain their competitive position without having to develop any innovative capability. When affiliates are pressured by their local competitors – i.e. when the gap is small – they are more likely to invest in innovative capability. However, the degree of productivity convergence between local firms and foreign affiliates between 1996 and 1999 does not appear to have any impact on the estimation. We hypothesized that convergence should encourage foreign affiliates to strengthen their innovative capability, and the lack of empirical support for this assertion may be due to the short time period in question. Other studies (Carlin et al., 2004) have argued that the growth rate of the industry should also have a positive influence on the motives for investing in innovative capability. In the present sample, there is no strong support for this argument: the coefficient of growth is consistently positive, but not significantly different from zero.

The weak effect of the *Growth* variable may also be due to some multicollinearity with *Gap* (as the two variables exhibit a simple correlation of 0.65), but dropping *Gap* does not change the results for *Growth*.

Of the country level variables, only Education Expenditure has a significant impact, suggesting that countries with higher investments in education will host subsidiaries with higher innovative capability. It has already been noted that there is only small

variation in the country specific variables, given that our sample includes only four countries. The results for the country specific variables should therefore be interpreted with caution. As an alternative, columns (6e) - (6h) present results where the country-specific variables (GNP, GNP/cap, and Education expenditure) have been substituted with simple country dummies. As can be seen from column (6e), none of the other coefficient estimates are affected in any significant way by this substitution. Regarding the country dummies, Hungary records a significant negative coefficient, indicating that subsidiaries in Hungary are less likely than subsidiaries in Slovenia (the base case) to hold innovative capability in process innovations, controlling for other firm and industry specific variables. One possible reason is that foreign affiliates in Hungary are more closely integrated with the international production networks of their parent companies, and that they are therefore more dependent on technologies developed for the entire production network.

Turning to the determinants of innovative capability in product technology, it can be seen in column (6b) that the estimated effects of minority ownership and diversification are very similar to those for process technology: both characteristics raise the likelihood that the subsidiary will have independent innovative capability. Several of the other firm-level variables also record significant coefficients. Most notable is that subsidiaries established as greenfield ventures and subsidiaries with high shares of exports to their foreign owner are less likely to have innovative capability in product technology. The negative effect of the greenfield variable could be related to pre-existing innovative capabilities in the acquired subsidiaries – most greenfield affiliates were established after the early 1990s, and have had relatively limited time to develop their own capabilities in product technology. The negative impact of intra-MNC exports may be related to the degree of integration into international production networks. To the extent that foreign affiliates manufacture products that are used as intermediates by the parent company or sold as part of the parent companies product assortment, they will arguably have less autonomy regarding product development and other aspects of product technology: these are instead strategic decisions that are made by the MNC's headquarters. It is particularly interesting to note that there is no comparable effect from external exports. The lack of significance for the external export variable suggests that the group of external exporters is a mix of subsidiaries with independent innovative capability and subsidiaries drawing on product technology from the parent MNC.

There is also a tendency for larger affiliates to hold more innovative capacity in product technology. However, this effect is not particularly strong, and the estimated coefficient is significant only at the 10 percent level.

The industry variables are also quite similar to those for process technology. Subsidiaries have less innovative capability in the most sophisticated industries, whether we define the degree of sophistication on the basis of average labor productivity in local firms or as the technology intensity of the industry. Evidently, the transition economies in question did not have the best conditions for developing innovative product tech-

nologies in the most advanced industries during the period in question. The impact of competition appears to be strong also for product technology, judging by the negative significant coefficient of the *Gap* variable. As discussed earlier, a smaller gap is likely to reflect tougher competition, which arguably motivates subsidiaries to invest more in innovative capacity. In addition to these variables, the growth rate of industry output also appears to have a positive impact on innovative capability in product technology. A likely reason is that a growing industry provides good opportunities for generating a reasonable rate of return on investments in new products.

Interestingly, the subsidiaries' capabilities in marketing and management appear to be determined by entirely different factors than those governing process and product technologies. Equation (6c) summarizes the results for marketing capabilities. The most significant firm characteristics are exports to owner and degree of foreign ownership. Affiliates exporting a large share of their output to the parent are much more likely than other affiliates to possess independent marketing capability, while minority owned affiliates are much less likely to have the same capability. The positive connection between export orientation and marketing capability could be driven by the need to systematically process market information when a major part of sales lies outside the domestic market. However, it would be reasonable to expect that this need is strongest when sales are directed to independent foreign customers rather than the MNC's own production network. In equation (6c), this is not the case: the coefficient for external exports is positive, but not quite significant at conventional levels (although it becomes significant in equation (6g), where country dummies are used instead of country characteristics). One possible explanation for this non-intuitive result is the correlation between marketing and management capability in the sample. Tightly integrated subsidiaries seem to benefit from substantial transfers of management skills from the parent, as shown in equation (6d), and it is common that management training also includes marketing skills. The weaker marketing capability in minority-owned subsidiaries is probably related to the competitive advantages of foreign versus domestic firms in transition economies. Marketing had no prominent role in the socialist past of the transition economies, and the availability of relevant skills is still limited. Foreign MNCs, by contrast, typically operate in industries where product differentiation and marketing are important. It is conceivable that MNCs are more prepared to transfer these skills to their wholly or majority-owned affiliates than to minority-owned affiliates. Similarly, greenfield subsidiaries are more likely than acquired subsidiaries to hold independent capacity in marketing. None of the other firm characteristics have any significant impact on marketing capability. It is worth noting that this also holds for the degree of diversification of production: it would be reasonable to expect that the most diversified subsidiaries operate in sectors with differentiated products, where

Among the industry characteristics, productivity, convergence, and growth all have positive coefficients, but only growth has an effect that is significant at conventional levels. All of these variables probably reflect some of the shift in the production struc-

ture of transition economies from intermediates and producer goods to differentiated consumer goods. Industries with higher labor productivity, higher overall growth rates, and faster convergence are probably all biased towards differentiated products. The fact that the gap variable has no significant impact, unlike for product and process technologies, could also be interpreted in this light. While a large gap may indicate that there is limited competition from domestic companies, it is also likely that it reflects the high degree of product differentiation in those industries where foreign firms have their strongest advantages. For these product groups, marketing may be a necessity even if there is little immediate competition from local firms.

Equation (6d) shows the results for management capabilities. The pattern of determinants is very similar to that for marketing, with a positive impact of exports to owner and a negative effect of minority foreign ownership. However, it is less clear how these results should be interpreted. Whereas the positive impact of exporting on marketing capability can easily be rationalized, it is not obvious why exporting subsidiaries should also be more independent when it comes to strategic management. Similarly, it is not clear why minority-owned affiliates should hold less independence in management. The likely reason is that these two variables distinguish those affiliates that are most closely integrated into the MNC's international production network, and they also receive substantial support in the form of management capability in order to fulfill their role in the network. As noted above, this transfer of management skills may also spill over to marketing skills.

Looking at industry characteristics, it is possible to discern some interesting differences compared to the equation for marketing capability. For the management variable, it seems clear that subsidiaries hold more independent capacity the more advanced the industry is, whether we use labor productivity or technology level dummies as indicators of how advanced the industry is. Arguably, more sophisticated production processes require stronger management control at the subsidiary level. This contrasts with the results for marketing autonomy, where variables related to competition for market shares – growth and convergence – were found to be more important. All of the country variables are significant, and country size and education expenditures have the expected positive coefficients. Surprisingly, GDP per capita records a significant negative coefficient, which is counterintuitive. This result is driven by the relatively low score for Slovenia regarding subsidiary autonomy in management. As noted earlier, the small number of country observations makes it difficult to generalize from the country variables.

2.5. Summary and concluding comments

This chapter has explored the determinants of innovative capability in a sample of MNC subsidiaries in four transition economies: Estonia, Hungary, Poland, and Slovenia. We looked at four different indicators of innovative capability reflecting the

autonomy and capacity of the subsidiary in product and process technology, marketing and management. These variables were regressed on a set of firm specific variables and industry characteristics reflecting, among other things, the role of the subsidiary in the parent MNC's international production network, the technological standard of the host industry, and the competition from local firms in the host country.

The main finding from the regression analysis is that capability in product and process technology seems to be determined by a different set of variables than capability related to marketing and management knowledge. A rough generalization would be that the most independent affiliates – those that are diversified, oriented towards the local market, established through acquisitions rather than greenfield investments, and where the foreign MNCs' only hold minority ownership – are also those that have the strongest innovative capability in product and process technology. This conclusion needs to be tempered with a comment about technology levels. During the period under study, the skill requirements in the most advanced industries appeared to be somewhat too high for the level of skills available in the four transition economies. Hence, subsidiaries in high technology industries recorded lower levels of independent capability. For marketing and management capability, the pattern is almost the opposite. The highest levels of capability are recorded in subsidiaries that are closely tied to the parent company, with high foreign ownership shares and substantial exports back to the parent company.

These differences are probably related to the existing skills and capabilities available in the host countries, as well as to character of various types of knowledge. Arguably, product and process technology is more tangible and codifiable than knowledge in marketing and management. This means that much of product and process development can be centralized to the parent company or specialized R&D affiliates, from where it is transferred to those subsidiaries that are closely integrated in the MNC's international production network. Subsidiaries that are not so closely tied to this network – e.g. because they are minority owned or acquired – may not have equal access to the resources of the parent, and are forced to create their own capability. Marketing and management skills, by contrast, are more difficult to transfer in a codified form, and those subsidiaries that are closely connected to the parent MNC may receive substantial assistance to develop these capabilities. Those affiliates that are more loosely connected to the parent MNC seem to have weaker capabilities in these areas.

The industry variables also have different effects on the two kinds of capabilities. For product and process technology, it seems that local competition is one of the determinants of the decision to invest in innovative capability. The variables reflecting local labor productivity and the productivity gap between the subsidiary and competing local firms both have significant negative coefficients. This suggests that the need to maintain innovative capability is related to local competition: when local firms are able to challenge the subsidiaries (either because the industry is relatively simple, with low labor productivity, or because the gap between subsidiaries and local firms is small) subsidiaries are forced to invest in developing their own technological capacity.

The gap does not appear to have any impact on marketing and management capabilities, and the impact of local productivity on these skills is actually positive. A likely interpretation is that more sophisticated industries (with differentiated goods) require stronger capabilities in these areas, irrespective of how the competition from local firms looks.

The finding that there are different types of innovative capabilities that vary across firms and industries in a reasonably systematic manner is highly interesting from a policy perspective. The present results suggest, for instance, that the host country faces somewhat of a trade-off between different capabilities depending on the position of the subsidiary in the MNC's production network. While wholly foreign-owned, export oriented affiliates tend to create substantial capabilities in marketing and management, they seem to rely to a relatively large extent on the parent company for product and process innovations. Local market oriented joint ventures tend to possess stronger capabilities in product and process technologies (excluding high technology sectors), but may be less successful in establishing modern marketing and management skills. These differences can be expected to have some impact on what kinds of spillovers different kinds of FDI projects may generate. In the European transition economies, where the domestic skills and capabilities in "hard" technology are relatively strong while "soft" technologies (read marketing and management) are weaker, it is possible that the closely integrated MNCs might provide some of the skills that are in shortest supply, even if they have less autonomy when it comes to product and process technology.

III. Foreign Presence and Efficiency in Transition Economies: Two-Stage Semi-Parametric Model with Bootstrap Application

3.1. Introduction

At the outset of the transition the hope was that foreign direct investment (FDI) would improve economic outcomes in Central and Eastern Europe both directly and indirectly. Given the relatively low levels of domestic investment and weak marketing capabilities of most transition economies, FDI was expected to boost economic growth and employment by accelerating investment, transferring new technologies and bringing up-to-date organizational and marketing skills to the host economies. It has been difficult, however, for researchers to evaluate whether such expectations have been borne out by experience. Studies on the impact of FDI have employed various econometrical techniques and yielded mixed results.

Following Hirschberg and Lloyd's (2002) criticisms of the parametric methods traditionally used to measure the indirect impact of FDI empirically, a non-parametric technique, Data Envelopment Analysis (DEA), is used in this chapter to compute a single efficiency score. Additionally, we apply a methodological alternative in the post-DEA analysis developed by Simar and Wilson (2007). Truncated regression is used in combination with a bootstrap procedure to estimate confidence intervals in a test for various intra-industry spillover effects in this study.

It is found that foreign firms are more scale efficient than domestic firms, but there is no strong evidence that foreign firms are more technically efficient than their domestic counterparts. Thus, the average technical efficiency of foreign firms is found to be higher than the average efficiency of their domestic counterparts only in four out of ten sectors. This fact provides some support to the existing argument that foreign firms are not automatically more efficient than domestic firms, but that they are guided by the economic environment in which they operate. Therefore, in the second stage of the analysis some environmental characteristics have been identified.

In this study, foreign firms are found to be more efficient than domestic counterparts in Hungary and Poland and less efficient in Bulgaria, Romania and Estonia. These findings arguably reflect some differences in local economic conditions. Furthermore, the results of post-DEA analysis suggest an overall positive effect from foreign presence on the technical efficiency of domestic firms in all five countries. While foreign multinational companies typically have the option to employ modern and highly efficient technologies in their foreign subsidiaries, they sometimes select older and less efficient technologies that do not give them any clear efficiency advantages above local firms. This is most likely to occur when there is limited competition, when tech-

nology transfer costs are high, or when uncertainty is large due to institutional problems.

The structure of the chapter is as follows. Section one presents a brief overview of the FDI spillover literature, discussing its implications for transition economies and methodological discussion. Section two describes the data used. In section three, the empirical model and the results on technical efficiency as well as scale efficiency are presented, followed by an analysis of the main determinants of efficiency in section four. The main conclusions are drawn in the final section.

3.2. FDI Spillovers in transition economies: overview of the methodology and empirical evidences

While there is no clear-cut, systematic pattern in the FDI spillover literature (see Chapter 1 for the literature review), most recent studies on developed countries find positive evidence of spillover effect from foreign companies' presence (Haskel et al., 2002, Keller and Yeaple, 2003), while studies on developing countries find negative or no spillover effects (Aitken and Harrison, 1999; Blomström and Sjöholm, 1999).

Transition economies are distinct from both groups of countries and characterized by relatively developed human capital but poor infrastructure and weak market institutions. The relative abundance of human capital, which sets the transition economies apart from developing countries at large, is likely to promote learning and spillovers of knowledge from foreign to local firms. However, human capital alone may not be sufficient for positive spillover effects to take place.

As Kogut and Zander (1993) put it "... multinational corporation arises not out of the failure of markets for the buying and selling of knowledge, but out of its superior efficiency as an organizational vehicle by which to transfer this knowledge across borders". However, intra-MNC technology transfer costs "derived from the efforts to codify and teach complex knowledge to recipient" (Kogut and Zander, 1993) are usually underestimated and likely to be substantial (Teece, 1981). In transition economies low levels of competition and weak intellectual property protection regimes amplify the cost of knowledge transfers and reduce the motivation of foreign firms to transfer technologies in high-tech industries.

However, in the new market-oriented environment, it has not been easy to efficiently utilize the resources accumulated before transition by technologically intensive domestic firms. Some studies suggest that slow privatization is one of the factors that has caused inefficiency in the transition economies in general, and in high-tech industries in particular (Adamchik and Bedi, 2000). The planned economy era left many outdated institutions in its wake, mutually embodied in organizations and 'rules of the game' (North, 1990). The attitude of traditional domestic firms to the competitive pressures exerted by foreign firms, and therefore the impact of foreign presence, is largely determined by the degree of adjustment or reform of the institutional frame-

work. Unfortunately, assessing the quality and impact of a country's institutions poses formidable methodological challenges: there is no readily available way to quantify and measure such variables empirically.

Empirical studies on spillover effects in transition economies are not numerous, and those that exist provide divergent results (see Chapter 1 for an overview of the empirical results of studies on transition economies). Djankov and Hoekman (2000) find a statistically significant negative intra-industry spillover effect of foreign participation on domestic firms in the Czech Republic from 1992 to 1996. This finding is consistent with the results found by Konings (2001) investigating Bulgaria and Romania, where foreign firms on average do not even perform better than their domestic counterparts. By contrast, in Poland foreign firms are more productive than domestic firms, but no evidence of spillover effects to domestic firms is found.

Various studies looking at determinants of FDI spillovers other than horizontal linkages in transition economies come up with contrasting results. Yudaeva et al (2003) find that, in Russia, the stock of human capital in regions where foreign firms operate is one of the factors that help domestic firms to benefit from the entry of foreign firms. They also find that there are positive spillovers from foreign-owned firms to domestic firms in the same industry, but negative effects on domestic firms that are vertically related to foreign-owned firms. The opposite holds for Lithuania (Smarzhinska, 2004a). Here positive productivity spillovers from FDI taking place through contacts between foreign affiliates and their local suppliers in upstream sectors, while horizontal spillovers are insignificant. Mode of entry is also found to be important: spillovers are associated with projects with shared domestic and foreign ownership, but not with fully owned foreign investments.

Sinani and Meyer (2004) look at the role of size, trade orientation and ownership structure of domestic firms in Estonia in determining spillover effects from technology transfers from abroad. Finding a positive spillover effect of significant magnitude, they conclude that small, non-exporting and outsider-owned firms benefit more from spillovers than do other types of domestic firms.

While the quality of the data, identified determinants and conclusions on FDI spillovers are diverse, the methodology used in these studies varies very little. This study holds that some of the difficulties in capturing spillover effects econometrically may lie in the methodology commonly employed to measure the performance of firms.

The most accepted approach in measuring spillover effect is parametric estimation of production functions (largely Cobb-Douglas functions) with different proxies added to capture the spillover effect. The favored proxy is the foreign share of production, employment, or capital, as in Caves (1974), and Blomström, Haddad and Harrison (1993). However, finding a correlation between the foreign share of an industry and the productivity level or growth rate of domestic firms does not prove spillovers: the causal links are unclear and there may be endogeneity problems. These two main problems have been tackled differently in different econometric studies on spillovers.

Spillovers were identified not merely by foreign share, but by correlation with the presence of multinationals in downstream sectors or upstream industries, namely vertical and horizontal spillovers (Smarzhinska, 2004a). Different tools were employed to control for fixed and random effect (Konings, 2001), and the semi parametric estimation method suggested by Olley and Pakes (1996) was implemented to account for endogeneity of input demand and corrected to take into account the fact that the measures of potential spillovers are industry specific while the observations in the data set are at the firm level (Smarzhinska, 2004a).

The parametric techniques used in these studies are based on the assumption that all firms in the sample are efficient. Efficiency and scale are usually held constant so a change in TFP reflects a corresponding change in technology. Yet, in reality, productivity varies as a result of differences in production technology, differences in the technical efficiency of the organization, and the external operating environment in which production occurs. To the best of our knowledge, Hirschberg and Lloyd (2002) was the first spillover study to take this into account in their application of a two-stage model with DEA analysis applied to a one-year dataset of firms operating in various provinces in China. With a point of departure in their methodology, we have extended it by using the Simar and Wilson (2007) approach in the second stage bootstrap procedure (see section 4 for more details on methodology). Here, efficiency is believed to be the best indicator that reflects the influence of foreign presence in transition economies. It is due to the assumption that organizational knowledge of foreign firms is superior to the state of existing knowledge of domestic firms, which used to operate in a planned economy. This knowledge is not always tacit and can easily spill over to domestic firms, in contrast to codified knowledge on technology that may be well protected by patents and licenses.

The possibility for cross country comparison with DEA models was first proposed by Caves et al. (1982) “allowing utilities from different countries to support the DEA envelope” and applied in many recent studies: Kumar and Russell (2002), Edvardsen and Førstund (2003), Jamasb and Pollitt (2001). International comparisons are often restricted to comparison of operating costs because of the heterogeneity of input costs. As a precondition for international comparisons they focus on improving the quality of the data collection process, auditing, and standardization within and across countries. Our data have been collected by international standard accounting reports made by companies at the end of each year. This source was used by other authors for cross-countries comparison - see Konings (2001) and Damijan et al. (2003).

3.3. Data description

Firm level data for 1998 was obtained for five transition economies – Bulgaria, Estonia, Hungary, Poland, and Romania - from the Amadeus database. Table 1 outlines the share of foreign investment enterprises (FIEs) of the total number of firms in our data-

set for each country. Foreign investment enterprise is defined as an economic unit that has at least a 10% share of foreign capital.

In order to carry out the DEA analysis, firms were divided into peer groups with identical economic activities identified by the NACE rev.1 standard industry classification. This enables us to estimate efficiency score based on comparable inputs and outputs. To obtain a feasible production plane, where output quantity can be produced from the associated input quantity, three inputs were specified – capital, number of employees and materials. Total sales variable was taken as a desirable output for all firms.

Table 1.

Descriptive statistics on the foreign presence *by country*

	<i>Bulgaria</i>	<i>Estonia</i>	<i>Hungary</i>	<i>Po- land</i>	<i>Roma- nia</i>
No. of all firms	514	88	64	335	736
No. of FIEs	57	6	7	10	196
FIEs in no. of firms (%)	11.09	6.82	10.94	2.99	26.63
FIEs in employment (%)	17.78	36.89	3.97	15.62	33.57
FIEs in sales (%)	19.92	28.41	9.07	27.28	30.32
FIEs in tangible assets (%)	28.11	40.01	5.65	17.72	25.14
FIEs in materials (%)	21.43	18.00	10.23	27.94	26.68

Some governments in Central and Eastern Europe tried to set wages taking into account many factors, including marginal productivity, compensating wage differentials, social factors, and other considerations such as effort. However, as distorted prices made it difficult to measure output, wages bore almost no relation to differences in productivity or skills (Jackman and Rutkowski, 1994). In order to eliminate possible cross-country differences in wage mechanism the number of employees was taken as a proxy for human capital.

While the relation between wages and productivity may still be weak in some countries of our sample, the privatization process has been important to improve the organization, productivity, and efficiency of existing firms in transition economies. “The

pattern and speed of privatization of state enterprises will affect the speed of adjustment of the pre-existing enterprises” (Sachs, 1997). To capture possible organizational differences private and public ownership a dummy has been constructed using information from Amadeus firm-level data on the type of ownership.

Prices on the inputs are assumed to not vary greatly among five countries: Bulgaria, Estonia, Poland, Hungary and Romania and between two types of firms – foreign and domestic. Therefore, the technology available to a firm at a given point in time (1998) defines which input-output combination is feasible. It is assumed that a firm does not influence its own output and that sales are consequently determined exogenously by the market. However, firms can minimize inputs to obtain a given output. In the absence of market prices, DEA endogenously generates “shadow prices” of inputs and outputs for aggregation. In the second stage of the analysis 2-digit industry data was obtained from the WIIW (The Vienna Institute for International Economic Studies) Database on Foreign Direct Investment in Central and Eastern Europe ¹⁰.

The deterministic assumption used in DEA models that all observed units belong to the attainable set requires robust procedure of outliers detection (Simar, 2003). Since envelopment estimators are very sensitive to extreme observations they can behave dramatically in the presence of super-efficient firms, which can be viewed as outliers. Explanatory data analysis procedure recently proposed by Simar (2003), which is more robust to the super-efficient observations and do not envelope all data points, was used. It was found that the distribution is qualitatively similar among the ten industries, albeit it is more extreme in some industries like “Sawmilling of wood, manufacture of semi-finished wood products, etc” and “Wooden and upholstered furniture” (see Column (5) of Table 2), where few super-efficient observations and relatively many super-inefficient firms are observed. Since the situation where many firms have not adapted to the market economy is very close to the reality of transition economies, the outliers were identified simply by calculating two standard deviations from the mean of three ratios – sales per labor, capital (tangible assets) per labor and materials per labor. This procedure allowed excluding only observations with extraordinary size, firm that experience an individual shock at that particular point of time and allowed to avoid possible errors in the recording information. In total, 1910 observations in all five countries remained, including 299 FIEs. On average the number of FIEs in each country account for about 10 percent of the total number of firms, but their share varies in the contribution to employment, capital, sales and materials (Table 1).

3.4. First stage: efficiency results discussion

Efficiency score for each firm j out of the sample of n firms is estimated for each industry, across all five countries. Therefore, ten models for each sector, where firms are

¹⁰ All variables expressed in national currency were converted into current US dollar term.

grouped by similar technology and validate the common technological frontier are estimated. Since the manufacturing industry in transition economies presented in the sample are traditional industries and do not easily expand in terms of output, the Farrell (1957) input oriented technical efficiency measure is used:

$$D_i(y, x) \equiv \max_{\theta} \{ \theta : (x/\theta, y) \in T_s \} \quad (1)$$

where T_s is a technology set in each sector. Therefore ten separate input-oriented models were estimated for each industry, where technical efficiency estimates are reciprocals of Farrell-type efficiency:

$$\overline{TE}_i \equiv \frac{1}{D_i(x, y)}, \in [0, 1] \quad (2)$$

The estimates of technical efficiency $\overline{TE}_i$ indicate the extent to which it is possible for a firm to reduce its inputs without reducing output and where 1 indicates the firm on the frontier with a maximum efficiency.

This model incorporates a dual approach with a correction for slacks (Coelli, Rao, et al, 1998, Coelli, 1996) and variable returns to scale (VRS), as suggested by Banker, Charnes and Cooper (1984). Taking scale efficiency into account means that technical efficiency is estimated under the assumption that not all firms are operating at the optimal scale. The relationship between VRS and CRS can be expressed as:

$$VRS \text{ Technical Efficiency Score} * \text{Scale efficiency} = CRS \text{ Technical Efficiency Score} \quad (3)$$

Taking further into consideration the VRS efficiency score, we exclude the efficiency obtained from the scale. It is important for our analysis to leave out scale efficiency in order to give a representative comparison of two sets of firms – foreign and domestic. Further analysis of the scale efficiency alone for foreign and domestic firms yields information about the behavior of firms in transition economies (see columns 7-9 in Table 2).

Table 2 summarizes the results for each industry, where the scores for domestic enterprises (DEs) are reported in the first row and the following row contains the results for the foreign investment enterprises (FIEs). Table 2 (column 6) shows that foreign firms are on average more scale efficient than domestic firms, implying that domestic firms have better possibilities to improve their efficiency by scaling up their activity. At the same time there are more domestic than foreign firms operating on the most productive size scale. Table 2 (columns 7-9) also shows that most of the industries operate under increasing returns to scale, with the exception of “Printing and publishing” and “Rubber and plastic products”. Economic theory provides two possible reasons for firms to face diseconomies of scale.

Table 2.

First stage: Technical and scale efficiency score for the domestic and foreign firms in ten manufacturing sectors

Industry	Technology Intensity Group	Type of ownership	Number of obs.	Aggregate		Share of firms operating at different scale, %		
				TE	SE	IRS ^a	DRS ^b	MPSS ^c
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sawmilling of wood, manufacture of semi-finished wood products, etc	Low-Tech	DEs	155	0.28	0.38	82.35	17.65	0
		FIEs	34	0.13	0.42	85.16	10.32	4.52
Clothing, hats, gloves, fur goods and household textile		DEs	165	0.28	0.38	67.74	29.03	3.23
		FIEs	31	0.41	0.50	76.97	21.21	1.82
Fish and meat industry		DEs	136	0.29	0.35	70.59	23.53	5.88
		FIEs	17	0.46	0.57	75	20.59	4.41
Structural clay products, cement, lime plaster and other building materials	Medium-Tech	DEs	126	0.23	0.37	96	4	0
		FIEs	25	0.28	0.27	98.41	0	1.59
Hand tools; metal furniture, table ware, packaging products and other finished metal goods		DEs	120	0.31	0.37	50	43.75	6.25
		FIEs	16	0.19	0.37	64.17	27.5	8.33
Printing and publishing		DEs	236	0.39	0.45	61.43	32.86	5.71
		FIEs	70	0.50	0.49	80.51	14.41	5.08
Wooden and upholstered furniture		DEs	82	0.07	0.31	38.46	61.54	0
		FIEs	13	0.05	0.45	37.8	59.76	2.44
Rubber and plastic products		DEs	109	0.41	0.42	85.71	9.52	4.76
		FIEs	21	0.39	0.48	84.4	9.17	6.42
Basic and specialized industrial chemicals	High-Tech	DEs	182	0.39	0.28	61.54	38.46	0
		FIEs	26	0.22	0.30	62.09	36.26	1.65
Basic electrical equipment		DEs	150	0.45	0.35	78.26	17.39	4.35
		FIEs	23	0.36	0.35	86.67	9.33	4

^a IRS - Increasing returns to scale, ^b DRS - Decreasing returns to scale, ^c MPSS - Most productive scale size

A specific process within a plant may not be able produce the same quantity of output as another related process. Or alternatively, as output increases, the cost of transporting the good to distant markets can increase sufficiently to offset any economies of scale. More detailed industry-level study is needed to identify the factors causing the presented pattern of economies of scale.

Table 2 (columns 5-6) reports aggregated DEA scores proposed by Färe and Zelenyuk (2003) based on the “within-group” weights. The main idea of the method is to estimate weighted efficiency separately for a group of foreign firms in each sector:

$$\overline{TE}_f = \sum_{n=1}^{N_f} (\overline{TE}_f^n * \frac{Y_f^n}{\sum_{n=1}^{N_f} Y_f}) \quad (4)$$

and a group of domestic firms:

$$\overline{TE}_d = \sum_{n=1}^{N_d} (\overline{TE}_d^n * \frac{Y_d^n}{\sum_{n=1}^{N_d} Y_d}) \quad (5)$$

The estimates of technical efficiency are weighted by the share of the individual output (sales in our case) of total output in the group of foreign and domestic firms.

Column (3) in Table 2 shows that domestic firms in the sample obtain higher efficiency scores than their foreign counterparts in six out of ten industries. At the same time foreign firms are more scale efficient in eight out of ten industries in a sample¹¹. Due to the nature of the construction of the DEA frontier, only a few firms obtain very high efficiency scores - see column (7) of Table 2. This pattern of allocation makes the examination of the distribution of scores industry by industry impractical. However, having built a common frontier for all countries in ten sectors separately, Kernel density estimation may be applied to picture the distribution of the efficiency scores (Figure 1) country by country in all ten sectors taken together.

The plot “All observations” in Figure 1 depicts the distribution of the efficiency scores of all firms across all sectors and all countries, in contrast to the normal distribution. DEA efficiency scores tend to have a bimodal distribution, as shown by the two peaks at about 0,2 and 0,95. It suggests that there are large numbers of firms with very low efficiency as well as with high efficiency in our sample. This may be an indication of a deep transitional structural change, where some firms adapt well to the changing environment while others, mainly traditional plants with outdated management, perform poorly.

¹¹ The scale efficiency scores were as well aggregated as in Färe and Zelenyuk (2003) for foreign and domestic

firms respectively: $\overline{SE}_f = \sum_{n=1}^{N_f} (\overline{SE}_f^n * \frac{Y_f^n}{\sum_{n=1}^{N_f} Y_f})$, $\overline{SE}_d = \sum_{n=1}^{N_d} (\overline{SE}_d^n * \frac{Y_d^n}{\sum_{n=1}^{N_d} Y_d})$

Figure 1. Cross-Country and Cross-Industry DEA Technical Efficiency Score Distribution (Kernel Density Estimates)

Separate figures are built in order to investigate the country-specific distribution of efficiency and the position of foreign firms with respect to the common frontier. The cross-country plots suggest that there is a different pattern of behavior for foreign and domestic firms in different countries. It is only in Poland and Hungary where foreign firms relatively speaking outperform domestic ones. In Romania, Bulgaria and especially in Estonia, foreign firms are significantly less technically efficient.

On the one hand, foreign companies have the strongest advantages compared to domestic firms in relatively more backward countries like Romania and Bulgaria. Here, there would be no need for FIEs to transfer costly new technology to outcompete domestic firms. Nevertheless, foreign firms are found to be even less productive than their domestic counterparts in these countries. On the other hand, previous studies have shown that host country conditions are crucial in determining the behavior of foreign firms (Kokko, 1994). The level of competition, the abundance of educated human resources, the gap between the productivity of foreign and domestic firms, infrastructure, institutional set up of intellectual property right protection, and the like (see part one for this chapter for the references) are among the most important host country characteristics identified in the literature. It may be that this set of factors was more encouraging for foreign firms to be more efficient than their domestic counterparts in Poland and Hungary than in Romania and Bulgaria. It may also suggest that in the early stages of transition in Romania and Bulgaria the overall environment was not conducive for foreign firms to do better. The relatively small Estonia, unlike the rest of transition countries, relied heavily on FDI especially in the early stages of transition, since early 90s. As a result, already by the late 90s, domestic firms managed to close the efficiency gap with foreign firms.

Moreover, industry-specific features can determine the conduct of foreign subsidiaries' performance. In order to characterize the technological intensity of the industry, three subgroups were formed according to the taxonomy drawn from Hatzichronoglou (1997). Low- and medium-tech groups are represented in one plot, due to the similar pattern of distribution of efficiency scores in both groups (Figure 1). Clear evidence of bimodality with different peaks for foreign and domestic firms suggests that in low- and medium-tech sectors there is a higher density of foreign firms with low efficiency. At the same time, there is comparable density of firms that are very close to the efficiency frontier and those that are very far from the frontier¹². A different mode of distribution is observed in high-tech industries. A relatively high density of inefficient firms is evident both for foreign and domestic firms (Figure 1).

¹² As suggested by Simar and Zelenyuk (2006b), Schuster -Silverman reflection method can be used to provide consistent estimator in cases when the standard Kernel density estimators (KDE) are inconsistent at the boundary (e.g. in case when there are many observations at 0 and 1 points). In our case, the results of this test give qualitatively similar to standard KDE pattern of distribution between foreign and domestic firms and therefore are not reported in the chapter.

The estimated technical efficiency score distribution of foreign firms is very similar to the distribution of the domestic firms in the high-tech sector, even with a lower density of highly efficient firms. Superior ability to transfer knowledge from headquarters is widely perceived to give a competitive advantage to foreign relative to purely domestic firms, but the cost of the transfer is sometimes largely underestimated.

It may also be pointed out that in the “Printing and publishing industry” both domestic and foreign firms enjoy the highest scale efficiency, while in the “Building materials” industry they enjoy the least. *Inter alia*, this is because Building materials is one of the oldest and most traditional industries in transition economies. Most enterprises in the industry operate in mature markets with mature technology and old-fashioned management. By contrast, the printing and publishing sector is one of the most dynamic and open industries with a substantial share of foreign presence.

In order to identify other factors determining the difference in the efficiency performance of domestic and foreign firms, a post DEA regression analysis is carried out.

3.5. Second stage: Determinants of efficiency and FDI spillover effects

In the second step, the efficiency score obtained from the DEA analysis described in the previous section are regressed on environmental variables. The purpose of this step is to account for exogenous factors that might affect firms’ performance and cannot be directly taken into account in the first-step non-parametric model. The general model can be specified as following:

$$\delta_j^* = Z_j\beta + \tau_j \quad (6)$$

where δ_j^* indicates the estimated technical efficiency score of each firm j ($j = 1, \dots, n$). Since the estimates are bounded by unity in output-oriented models and both by zero and unity in input-oriented models, it is argued that DEA efficiency estimates are somehow censored. In order to make a coherent account for censoring problem Simar and Wilson (2007) proposed an approach based on *truncated regression* where error term τ_j is identically, independently distributed for all j with (σ_ϵ^2) . Further, Simar and Wilson (2007) point out that conventional approaches to inference employed in many studies, which rely on multi-stage approaches, are invalid due to complicated unknown serial correlation among the estimated efficiencies. The criticism applies equally to the use of naïve bootstraps, as in Hirschberg and Lloyd (2002). This method is shown to bring sound improvements to the estimates and was supported by the Monte Carlo experiment illustrations developed by the authors.

Following Simar and Wilson (2007) Algorithm 1 procedure, the method of maximum likelihood is used to obtain the estimate $\hat{\beta}$ of β as well as estimates $\hat{\sigma}_\epsilon$ of σ_ϵ in the truncated regression of equation (6). The bootstrap estimates were obtained by follow-

ing three steps in Simar and Wilson (2007) and the confidence interval was defined based on bootstrapped values of β and σ_e .¹³

Among determinants of efficiency of the firms (Z_j) are: type of ownership, wage rate, age, absorptive capacity of the firm. It is particularly interesting to investigate the function of foreign presence in the industry as a whole on the efficiency of domestic firms, or the so called intra-industry spillover effect.

The more detailed empirical model can be described as following:

$$TE_{jic}^{dom} = (Age, Wage, Absorptive Capacity, Ownership Type)_{jic} + (Foreign Presence, Technological Intensity)_{ic} + \tau_{jic} \quad (7)$$

where j -firms, i -industry, c -country, τ - error term and TE_{jic}^{dom} - domestic firms' estimated technical efficiency score. Here, the frontier was estimated for each industry separately, for production possibility set, which initially contains observations of both domestic and foreign firms (see previous section for details). In this stage, the technical efficiency of domestic firms is only used as a dependent variable in order to capture the spillover effect foreign presence has on domestic firms.

Table 3 presents the results of truncated regression estimations of the determinants of technical efficiency of domestic firms in the five transition economies included in the study.

Here, the bootstrap procedure described earlier was applied to estimate a confidence interval. The explanatory variables are grouped in three main categories:

- Firm level characteristics, such as age, wage rate, type of ownership dummy and firm-level absorptive capacity, which is proxied by the amount of intangible assets.
- Industry level characteristics reflecting the technological intensity and foreign presence.
- Country dummies.

Table 3.

Second stage: Intra-industry spillover effect estimates results¹⁴

¹³ The three steps used for a bootstrap procedure in Algorithm 1 (Simar and Wilson, 2006) are: 1. For each $j = 1, \dots, n$, draw τ_j from the $N(0, \hat{\sigma}_e^2)$ distribution with left-truncation at $(1 - Z_j \hat{\beta})$. 2. Again for each $j = 1, \dots, n$, compute $\delta_j^* = Z_j \hat{\beta} + \tau_j$. 3. Use the maximum likelihood method to estimate the truncated regression of δ_j^* on Z_j , yielding estimates $(\hat{\beta}^*, \hat{\sigma}_e^{*2})$. Then bootstrap simulation was repeated for these steps two thousand times for each model. The bootstrap values and original estimates of $\hat{\beta}$ are used to construct estimated confidence intervals reported in Table 4.

¹⁴ The dependent variable is a DEA efficiency score. Results of left-hand truncated regression with bootstrap

Group name	Variable	(1)	(2)	(3)	(4)
Environmental variables on the firm-level	Age	-0,003***	-	-	-0,003***
	Wage		0,003***	0,003***	-0,022***
	Absorptive capacity	-0,045	-0,043	-0,034	0,022***
	Private Ownership	0,261***	0,257***	0,253***	0,254***
Technology intensity dummies	Medium-Tech	-0,083***	-	-0,094**	-0,095***
	High-Tech	-0,253***	-	-	-0,263***
	Relative SE				
FDI presence indicators on the industry level	IA spill			0,168***	0,171***
	FSEmpl		0,590***		
	FSSales	0,471***			
	Bulgaria	0,096	0,100	0,009	0,009
Country dummies	Hungary	-0,037	-0,029	-0,024	-0,024
	Poland	-0,102	-0,080	-0,107	-0,110
	Romania	-0,194***	-	-	-0,243***
	Constant	0,464***	0,452***	0,842***	0,841***
	Number of obs.	1439	1439	1433	1435

Four main empirical models were constructed in order to test different proxies for FDI spillover effects. The definitions of all explanatory variables are presented in Appendix 1.

Among firm-level environmental characteristics taken into account, age tends to have significantly negative effect on the technical efficiency of domestic firms in all four models (Table 3). This reflects the fact that older firms are less efficient in transition economies. The slow pace of changes in management style is thought to account for this. As a result, these firms find it difficult to sustain technical efficiency in comparison to newer firms in the same industry; they do not adjust easily to the new conditions of the market economy.

Wage rate, as a reflection of the quality of personnel, does not turn out to be significant in most of the models, and for that reason it was omitted in some of them. Only in

procedure, where significance is 10, 5, and 1 per cent levels denoted with ***, ** and* respectively (two-tailed test). See Appendix 2 for definition of explanatory variables.

models (3) and (4) wage has a negative effect on technical efficiency. This may be seen as a result of wages being imperfect proxy for the quality of labor in transition economies.

The results of our study suggest that private firms are more efficient than public ones, providing indirect empirical support calls to reform the public domain in transition economies as a way of increasing efficiency. The absorptive capacity of domestic firms, as measured by the intangible assets of the firm, does not turn out to be significant in any of the models considered in the study. It suggests that the requirement for absorptive capacity is not significant for domestic firms in transition economies.

Furthermore, as shown in the first stage of this analysis, domestic firms are more efficient than foreign firms in six out of ten industries. At the same time, this result highlights the need for more accurate measurements of absorptive capacity that take into account not only the 'input side' of the learning process (measured by R&D expenditures or intangible assets) but also the 'output side', usually proxied by the number of patents, patent citations or sales of innovative products (Kinoshita, 2001; Criscuolo et al., 2002).

The foreign direct investment spillover effect hypothesis was tested with a few alternative proxies for foreign presence¹⁵. In all models, foreign presence on the industry level has a significant positive effect on the performance of domestic firms. This result suggests that even though foreign firms are not more efficient than domestic firms in all sectors of the economy (see the first stage of the model, section 3) their presence has a positive effect on the performance of domestic firms in the same sector. This result may reflect the facts that foreign firms are new to the market and do not quickly adjust. Unfortunately, the dynamic effect of foreign presence cannot be tested with the data available. However, the difference among the countries in the sample is not likely to be large, since foreign companies started operating only in the early 90s in most of the countries in the sample.

The intra-industry spillover effect, e.g. via competitive pressure and by using economies of scale more efficiently, can motivate domestic firms to perform better. Different proxies reflecting foreign presence were constructed in order to capture the influ-

¹⁵ Among not reported results are models using foreign share in total sales (SS), foreign share in total sales (SA), relative productivity (RP) and relative scale efficiency (RSE) variables (see Appendix 1 for the definition of variables). For variables SS and SA the data on foreign share in Bulgaria was missing, and for that reason some observations had to be dropped and not reported in the table. Nevertheless, the positive relation of foreign share and the efficiency score of domestic firms holds.

Also relative productivity variable RP constructed using industry data on from Germany as a baseline for comparison (Appendix 1). The variable takes a negative sign, suggesting that firms operating in transition economies are more efficient in those industries where local firms are relatively less productive than firms in the corresponding German industries. Relative scale efficiency (RSE) variable (Appendix 1) in the model is positively related with efficiency. This result suggests that the more scale efficient foreign firms are compared to domestic firms in the industry, the higher the technical efficiency of domestic firms. It supports the argument that the heightened competitive pressure that foreign firms bring into the industry generates positive spillover effect for domestic firms and forces them to be more efficient, even when foreign firms are less efficient than their domestic competitors. However, the coefficient for RSE variable is small.

ence of foreign firms on the efficiency of their domestic counterparts. In models presented in Table 3, variables relating to the activity of foreign firms were constructed from the initial firm-level dataset (see Appendix 1 for the definition of explanatory variables). In the models (1) and (2), foreign equity participation was averaged over all plants in a sector in a country, and then weighted by each plant's share of sectoral sales (1) and employment (2). Variables FSSales and FSEmpl increase as foreign share increases and sales (FSSales) and employment (FSEmpl) of foreign firms increase. The results suggest that a higher share of foreign sales and employment in the industry and country is positively related with better performance of domestic firms in those industries.

Similar proxies for foreign presence used in models (1) and (2) were constructed in previous studies by Aitken and Harrison (1999), Smarzynska Javorcik (2004a) and Caves (1974). Foreign share in the host-country's capital, employment and sales and its relation to the productivity of domestic firms in the sector is a traditional indication of intra-industry spillover effects.

Since knowledge-related assets have features of a 'public good' they have greater probability to spill over to domestic firms and increase their efficiency. This type of knowledge is related to innovative capabilities in research and development activities in foreign subsidiaries in transition economy. It can be expressed in many ways, including the amount of R&D expenditure of the subsidiary, patenting activity, or as a quantity of intangible assets that the firm acquires. In models (3) and (4), variable IAspill is constructed in order to capture the value of foreign knowledge existing in the industry in each country, which has a potential to spill over to domestic firms in this industry. As shown in columns (3) and (4) in Table 3, the IAspill variable is positive and significant, supporting the previous results. These results imply that industry share foreign knowledge expressed in the intangible assets of the firm has a positive relation with domestic firms' efficiency. Note that the IAspill variable should be interpreted with caution, because the amount of intangible assets that firm reports includes not only the value of R&D patents, but also trademarks, logos amongst others.

The argument that domestic firms in transition economies perform better in less productive industries is put forward with technology intensity dummies. The sign of the dummies suggest that domestic firms in the ten manufacturing industries in the sample are less efficient in high-tech and medium-tech industries than in low-tech industries. A possible explanation for this phenomenon is the fact that high-tech industries were highly subsidized before transition in most Eastern economies. However, during the transition period, budget flows were minimized and most of the technology-intensive firms and plants, which worked for administratively planned demand, had to switch to less efficient production in order to sustain themselves under the new market conditions. It also bears mentioning that the positive influence of foreign presence does not change the sign of the technology dummies in all models. This outcome suggests that foreign direct investment has a positive impact mainly in low-tech industries.

Country dummies do not turn out to be significant, with the exception of Romania, where domestic firms are significantly less efficient than in the other countries. The insignificance of country dummies supports the idea that the five countries chosen were correctly pulled together to build a common frontier.

The results of the study should be treated with caution. The assumption used in the DEA model about equal input factor prices for foreign and domestic firms is strong for some transition economies, where capital is locally scarce. While local prices for capital might be initially higher, motivating foreign direct investment to take place, the cost of technology transfer from abroad and adjustment to local conditions also involves costs that should be taken into account. Hence, even if differences exist, they may not be large in the long run. The conclusions are also limited by the method's inability to demonstrate the dynamic mechanism that is thought to connect the influence of foreign presence with the efficiency of domestic firms. More detailed analysis of FDI spillover effects, including inter and intra industry effects using firm-level panel data, is needed.

3. 6. Conclusions

This chapter tests several hypotheses about the performance of foreign firms in transition economies and the effect of foreign direct investment on domestically-owned firms competing with foreign subsidiaries. Foreign investment enterprises (FIEs) may serve as effective generators of knowledge externalities and can work as a competitive force, reducing the excess profits earned by domestic competitors and improving efficiency. To find empirical evidence of such influence, and to overcome the shortcomings associated with traditional parametric methodologies, a two-stage semi-parametric model was employed.

In the first stage, the technical and scale efficiency of foreign and domestic firms were estimated using Data Envelopment Analysis (DEA) separately for ten manufacturing sectors. We conclude that the average efficiency of foreign firms shows a weak tendency to be higher than the technical efficiency of their domestic counterparts, but more scale-efficient, on average, than domestic firms in most of the industries considered. However, in more advanced countries like Poland and Hungary in our sample the difference of the average efficiency is in favor of foreign firms. These results provide a ground to conclude that while foreign firms have the strongest advantages compared to domestic firms in relatively less developed countries, the host country conditions are crucial in determining the behavior of foreign firms.

In the second stage, a truncated regression was used to analyze the main determinants of foreign direct investment spillover effects. The analysis shows that older domestic firms are less efficient than younger firms. Wage rates and Intangible assets turn out to not be reliable proxies for the quality of personnel and absorptive capacity respectively in transition economies and do not prove to be significant in most of the models. The

foreign direct investment spillover effect hypothesis was tested with several alternative proxies for foreign presence and turns out to be significantly positive in all models.

The results lead us to conclude that a large foreign presence is associated with improved performance for domestic firms. However, strong conclusions about spillover effects cannot be made with the data available in this study. Because of data limitations we are unable to demonstrate the dynamic mechanism that is necessary in order to more reasonably connect the foreign firms' presence with the efficiency of their domestic counterparts.

This chapter has provided an alternative methodological framework for empirical evaluation of FDI spillover effects. Data Envelopment Analysis (DEA) was used to estimate technical efficiency a technological frontier was build for each sector with similar technology common for five transition countries in the sample. Following Simar and Wilson (2007), this study applied a truncated regression and bootstrap technique in a second stage post-DEA analysis. It finds some evidence that foreign presence has overall positive spillover effects on the performance of domestic firms and suggests the host country conditions are crucial in determining the behavior of foreign firms' performance. The next chapter evaluates the dynamic effect of FDI on the host country by estimating Malmquist Productivity Index and taking into account the impact of foreign presence both on technical and efficiency change.

Variables definition¹⁶

<i>Variable</i>	<i>Description</i>	<i>Formal definition</i>
RSE	Relative scale efficiency. Ratio of average scale efficiency of foreign to domestic firms in the industry	$RSE_{ic} = \frac{Mean(SE_{foreign})_{ic}}{Mean(SE_{domestic})_{ic}}$
IA spill	Average share of foreign intangible assets in total amount of intangible assets in each industry of a country	$IA_spill_{ic} = \frac{Mean(IA_{foreign})_{ic}}{Mean(IA_{total})_{ic}}$
FSEmpl	Foreign equity participation averaged over all plants in the sector, weighted by each plant's share in sectoral employment	$FSE_{ic} = \frac{\sum_{for_all_j \in ic} For_Share_{jic} * NO_of_Empl_{jic}}{\sum_{for_all_j \in ic} NO_of_Empl_{jic}}$
FSSales	Foreign equity participation averaged over all plants in the sector, weighted by each plant's share in sectoral output measured by sales	$FSS_{ic} = \frac{\sum_{for_all_j \in ic} Foreign_Share_{jic} * Sales_{jic}}{\sum_{for_all_j \in ic} Sales_{jic}}$
RP	Relative productivity as a ratio of value added per worker in transition economy to value added per worker in corresponding sector in Germany	$RP_{ic} = \frac{(VA/L)_{ic}}{(VA/L)_{iGermany}}$

¹⁶ Where j – firm, i – industry, c – country

Variable		Description	Formal definition
Absorptive capacity	ca-	Amount of intangible assets in domestic firm's possession normalized by the average amount of intangible assets at the industry level in a country	$NormIA_{jic} = \frac{IntAssets_{jic}}{Mean(IntAssets)_{ic}}$
IndustryFS		Share of sales by foreign-owned companies in total sales at the industry level (obtained from the national statistical office in each country)	$SS_{ic} = \frac{Sales_of_Foreign_Firms_{ic}}{Total_Sales_{ic}}$
Age		Number of years from the date of establishment to 1998	
Wage		Wage rate in absolute value	
Private ownership	Owner-ship	Private/Public ownership Dummy according to AMADEUS dataset classification	

IV. Foreign Direct Investment and Technical and Efficiency Change of Domestic Firms: Malmquist Productivity Index in test for FDI Spillovers¹⁷

4.1. Introduction

Foreign direct investment is considered as an important catalyst of economic development in transition economies. In Central and Eastern Europe during the last two decades Hungary and Poland have been among the leaders in terms of accumulated foreign investment. On the contrary, Ukraine until 2005 was one of the least successful countries in their policy towards FDI. One of the main reasons for the low success is political and macroeconomic instability in Ukraine right after the demise of the Soviet Union. In the last few years, and particularly after the Orange revolution and new President and Parliament elections, the policy is concerned about providing stable political and economic environment in Ukraine to facilitate FDI and technological transfer.

However, a decisive mechanism to select the type of FDI needed for transition economies is vaguely developed. One of the ways to evaluate the impact of FDI is indirectly via the spillover effect. A number of attempts have been made to estimate spillover effect in transition economies. The studies mainly looked at the productivity change of domestic firms and significance of FDI in this development. While productivity is an important characteristic of economic performance, it aggregates some factors that determine the change. Among them are technical change and efficiency change. This chapter attempts to disentangle these two indicators and measure the influence of FDI on both of them separately. The decomposition of the Malmquist productivity Index is employed for this purpose.

The main questions this study seeks to answer are whether domestic firms in major manufacturing sectors differ from their foreign counterparts in terms of productivity or total factor productivity (TFP) change, as well as in efficiency change and technical change. The chapter explores the general pattern of development of two types of firms expressed in TFP, efficiency and technical change. Another question considered in the study is whether foreign presence has different influence on efficiency change and technology change of domestic firms. Particularly, the chapter looks to confirm the hypothesis of intra-industry FDI spillovers, expressed in terms of two main components of TFP change: efficiency and technology change.

The chapter consists of six main parts: literature review (part 2), methodology description (part 3), data description (part 4), results discussion is provided in part 5 and conclusions are given in the last section – part 6.

¹⁷ This Chapter is based on the paper (with V. Zelenyuk) "Foreign Knowledge, What does it bring to Domestic Firms?: Malmquist Productivity Index in test for FDI Spillovers", Mimeo KIE, Kiev, 2006

4.2. Overview of Spillover Channels

The role of FDI in the diffusion of technology in a host economy can be seen from its direct and indirect impact. For transition economies, with its lack of domestic investments and marketing experience, FDI can directly encourage technological learning through the transfer of new technology and organizational skills to the affiliates in these countries. If FDI is to fill the technological gap then it becomes a priority to look on what kind of FDI is attracted. Namely, the quality, or type, of knowledge that foreign firms transfer to their affiliates becomes one of the important determinants of the effect of FDI on the host country.

Looking onto the impact of FDI indirectly, through technology spillovers from more advanced foreign investment enterprises (FIEs) to local or domestically owned enterprises, four main avenues can be identified (Aitken and Harrison, 1994, Blomstrom and Kokko, 1998). First, through the pressure of competition with the foreign affiliate intra-industry spillovers can be increased by stimulating local firms to introduce new products to defend their market share and adopt new management methods to increase productivity. The level of competitiveness of domestic firms is crucial here (Wang and Blomstrom, 1992, Glass and Saggi, 1998). Second, spillover effect takes place through cooperation between FIEs and upstream suppliers (backward linkages) and downstream customers (forward linkages) by introducing, for example, higher quality standards for both vertically and horizontally linked firms. Since in many cases foreign affiliates are export-oriented, local firms might gain via market access or export spillovers by being involved in distribution networks, etc. The level of embeddedness of foreign affiliates into domestic market is positively correlated with spillover effect of FDI (Rodríguez-Clare, 1996, Smarzhinska, 2004). Third, human capital can spill over from FIEs to other enterprises as skilled labour moves among employers (Haaker, 1999; Fosfuri et al. 2001). And forth, geographical proximity of local firms to FIEs can sometimes lead to demonstration or imitation effect (Das, 1987; Wang and Blomstrom, 1992).

It should be pointed out that not all types of FDI lead to 'positive' spillovers. In contrast, it can limit domestic producers to low value added activities or eliminate them altogether by relying on foreign suppliers (Cantwell, 1989, Dunning, 1994). FDI can also lead to a decline of overall growth rate of the host economy by reducing competition or 'crowding out' local producers.

Recent empirical studies provide evidence that technology is being transferred to firms in a sample of a few transition economies primarily through FDI, but no significant and sometimes negative spillover effect of FDI was found (Damijan et al., 2003, Djankov and Hoekman, 2000, Konings, 2001). This could be due to a number of reasons.

Multinational companies have a strong incentive to minimize spillovers and may be very effective at ensuring their firm specific assets and advantages do not spill over. In transition economies with a weak institution of property rights the incentives for for-

eign firms to invest in innovative capabilities are limited. Smarzhinska (2004) finds that weak protection of intellectual rights in transition economies deters foreign investors in technology-intensive sectors, encouraging investors to undertake projects focusing on distribution rather than local production.

There is a possibility that spillovers are some part of the 'residual' which appears in all growth equations but there is no developed statistical methods and/or the datasets to identify them (Görg and Strobl, 2001). It is argued that the studies finding significant spillovers are cross-section analyses, whereas panel data models have systematically found less significant spillover effects. In the cross-section studies, foreign investors may have been attracted to the industries that were most productive to begin with, which would give a spurious correlation between foreign presence and local productivity and lead to systematic over-estimation of spillovers. The low level of FDI flows and short-term experience of FDI presence can be one of the reasons for impeding spillovers in transition economies. On the other hand, there is often a lack of high-quality national panel data on transition economies.

Involvement of technology transfer with FDI in transition economies might also be insufficient to generate technological externalities and spill it over to the host economy. Traditionally, FDI spillovers are measured by production function or total factor productivity models, assuming that the influence of foreign presence should appear in productivity change of domestic firms.

There is much less discussion in economic literature on the different type of influence that FDI presence can have on domestic firms in different industries and countries. Teece (1977) argues that introduction of new product and processes by foreign firms may accelerate the diffusion of new technology in the host country. In a sample of four transition economies Kokko and Kravtsova (2006) find that innovative capability of foreign affiliates in product, process, marketing and management are determined by different factors. Among the tested factors are firm characteristics (size, age, export orientation, diversification, type of ownership greenfield/acquisition, minority/majority) industry characteristics (productivity, gap between foreign and domestic firms, convergence and growth in the industry), and some host country characteristics (education expenditures, level of GDP, etc.). The most independent affiliates are also those that acquire the strongest innovative capability in product and process technology. For marketing and management capability, the pattern is nearly the opposite. The highest levels of capability are recorded in subsidiaries that are closely tied to the parent company, with high foreign ownership shares and substantial exports back to the parent company. These differences can be expected to have some impact on the kinds of spillovers different kinds of foreign direct investment projects may generate.

Namely, we hypothesize that foreign innovative capabilities in marketing and management will spur competition in the industry and stimulate domestic firms to increase efficiency. While product and process capabilities tend to stimulate the technical change of domestic firms. This type of knowledge is more tacit (e.g. more codified)

and at the same time more protected by MNCs by means of intellectual property rights (e.g. patents). Therefore, foreign product and process capabilities are expected to have lower spillover effect on domestic firms, at least in a short-term. This effect is considered difficult to be captured effectively by empirical studies in transition economies also due to the time-dimension limits. In most of the transition economies in Eastern and Central Europe presence of FDI is accounted since the 1991 with the collapse of the Soviet Union.

For some industries and countries relative shortage of marketing and management knowledge can be more important than formal R&D expenditures, which are not necessarily reflected in productivity growth. The importance of innovative capabilities in organizational knowledge was pointed out by such authors like Dosi and Teece, 1998; Nelson and Winter, 1982; Teece, 1989. The firms in transition economy, with a history of working in a planned economy, can benefit more from foreign presence in terms of rising efficiency of using existing resources and exploring new markets rather than from the technological knowledge.

However, finding an empirical proximity of measure of different types of foreign knowledge has been a hard challenge for scholars working in this field. This study is one of the first steps in this direction. It seeks to clarify the influence of foreign presence in the industry on domestic firms in terms of both efficiency change and technological change in the setting of transition economy. Here, the technological transfer of product and process from abroad is assumed to be associated with technological change of domestic firms, pushing them closer to the new technological frontier. The organizational knowledge is more related to the concept of efficiency, where firms learn how to produce the same amount of output using less inputs (input-oriented model) or produce more with the same set of inputs (output-oriented models).

Brief Description of Ukrainian Economy

During the industrialization in 1930-s, many gigantic 'heavy industry' plants were built in the Central and Eastern parts of Ukraine. These plants were part of long supply chains in USSR planned economy. After the demise of the Soviet Union, its republics went through the stage of 'economic disorganization'. The well-established economic links were broken and most of the machine building plants ran inefficient, underutilizing their capacities (see Blanchard and Kremer (1997) for a theoretical description of this phenomenon).

In Ukraine, economic disorganization between firms was also joined with political inadequacy expressed in absence of economic reforms since the collapse of USSR (in 1991) up until 1994, the result of which was a severe budget crisis and one of the highest hyperinflations in economic history (10,156% in 1993). The period of 1994 to 1998 was a time of budget and monetary policy tightening, which has tamed down inflation to reasonable level. However, more or less substantial pro-growth economic reforms came only in 1998, which induced growth only in 2000. As a result of this

policy Ukraine for about a decade suffered from a dramatic plunge in the real GDP, down to about 40% in 1999 relative to that in 1990. Whilst before the collapse in 1991 and during more than seven decades of the USSR existence Ukraine has been one of the richest and most economically developed republics with relatively high level of education.

After reaching the trough of the crises in 1999, Ukrainian economy started experiencing relatively fast recovery, of about 8% annually, with the highest growth of 12.1% in 2004. Following price increases for oil and other commodities during this period the terms of trade improved significantly in most former Soviet Union countries. Even for non-primary commodity exporters, such as Ukraine, terms of trade have been improving at the rate of the rise in Chinese demand. The export of steel and similar products gave a boost to the Ukrainian economy comparable to the one rising oil prices gave Russia and the Caspian oil and gas exporters (EBRD, 2004).

The day-by-day improving economy started to attract more and more of foreign interests. In Table 1 the dynamics of development of FDI stock in major industries in Ukraine in 2000-2004 is presented. It should be pointed out that the share of foreign investment enterprises (FIEs) varies across industries by approximately 5-10 percent. The industry statistics shows that manufacturing of food products, beverages and tobacco is one of the most attractive industries in Ukraine for the foreign investments in 2000-2004. It reflects the reality where a lot of multinational corporations such as Coca Cola, KraftFoods, Nestle, etc. are present in the industry.

Here FDI reached the level of 1123.7 million US dollars. It is twice as much as the next most attractive industry for foreign investors – Manufacture of machinery and equipment. Noteworthy, Ukraine was the second biggest supplier (after Russia) of agricultural products during the Soviet Union. Natural resources for producing agricultural products are still a comparative advantage of Ukrainian economy among its neighbors. On the contrary, the supporting equipment for manufacturing of food products remained undeveloped relative to the level of more advanced countries.

Other industries that received most of FDI inflows presented in Table 1 mainly consist of export-oriented plants that managed to retain their traditional markets and old linkages.

The roots of FDI in these industries trace to Russia and a lot of investment comes from offshore zones (e.g. Cyprus and Virgin Islands has been among the largest foreign investors into Ukraine for many years).

The nature of this type of FDI is often based on capital that flew out from Ukraine during the early stages of transition and economic welfare effects of this type of FDI is widely debated in today's Ukrainian economic policy.

Table 1.

Foreign Direct Investment into Ukraine by industry, US dollars, million.

Manufacturing industry (NACE rev 1)		2000	2001	2002	2003	2004
Low-tech	Food products, beverages and tobacco	775.50	795.9	852.3	988.3	1123.7
	Textiles and textile products, leather and leather footwear	43.30	54	78.1	100.6	119.8
	Wood and wood products	79.80	52.3	73.4	99.4	130.1
	Pulp, paper and paper products; publishing and printing	n.a.	53.5	91.5	131.3	152.9
	Coke, refined petroleum products and nuclear fuel	24.40	180.1	194.9	186.6	213.6
Medium-tech	Other non-metallic mineral products	27.60	86.7	116.3	143.3	172.7
	Basic metals and metal products	150.10	172.7	280.6	338	425.4
High-tech	Chemicals, rubber and plastic products	137.80	232.8	217.7	319.3	471.9
	Machinery and equipment	347.60	345.6	469.6	597.3	676.4
Total FDI into Ukraine		3865.50	4406.2	5339	6657.6	8353.9

Note: OECD technology-intensity classification of industries is drawn from Hatzichronoglou (1997)

Source: National Statistical office of Ukraine

4.3. Methodology

To facilitate formal discussion, let $x_\tau^k = (x_{\tau,1}^k, \dots, x_{\tau,N}^k)' \in \mathfrak{R}_+^N$ be a vector of N inputs that each firm k ($k = 1, 2, \dots, n$) uses in period τ (for our case, $\tau = s, t$) to produce a vector of M outputs, denoted by $y_\tau^k = (y_{\tau,1}^k, \dots, y_{\tau,M}^k)' \in \mathfrak{R}_+^M$. We assume the technology of any firm k in a period τ is characterized by the output sets

$$P_\tau^k(x^k) \equiv \{y : y \in \mathfrak{R}_+^M \text{ is producible from } x^k \in \mathfrak{R}_+^N\}, \quad x^k \in \mathfrak{R}_+^N. \quad (4.1)$$

We assume that the technology in any period τ satisfies the usual regularity axioms of production theory (e.g., see Färe and Primont, 1995), so that we can use the output oriented Shephard's (1970) distance function $D_\tau^k : \mathfrak{R}_+^N \times \mathfrak{R}_+^M \rightarrow \mathfrak{R}_+^1 \cup \{\infty\}$, defined as

$$D_\tau^k(x^k, y^k) \equiv \inf\{\theta : y^k / \theta \in P_\tau^k(x^k)\}, \quad (4.2)$$

to get a complete characterization of the technology of firm k in period τ , in the sense that

$$D_\tau^k(x^k, y^k) \leq 1 \Leftrightarrow y^k \in P_\tau^k(x^k). \quad (4.3)$$

This function also conveniently serves as a criterion for measuring the relative distance from the frontier of the technology set to any point (input-output combination) that can be inside or outside of this set. While there are many directions to measure such a distance, the Shephard's output distance function does it in a radial fashion in the output space, i.e., along a ray from the origin in $\mathfrak{R}_+^M$ while keeping inputs fixed. Formally, if we let the technology frontier of $P_\tau^k(x^k)$, $x^k \in \mathfrak{R}_+^N$ to be defined (for period τ) as

$$\partial P_\tau^k(x^k) = \{y \in \mathfrak{R}_+^M : y \in P_\tau^k(x^k), \quad \lambda y \notin P_\tau^k(x^k), \quad \forall \lambda \in (1, +\infty)\}, \quad (4.4)$$

then a non-zero point inside the output set but not on its frontier, $y^k \in P_\tau^k(x^k)$, $y^k \notin \partial P_\tau^k(x^k)$ for $y^k \neq 0$, would result in $0 < D_\tau^k(x^k, y^k) < 1$. On the other hand, if the point is outside of the technology set (e.g., because it corresponds to technology in different period), but can be contracted to this set along the ray from the origin, i.e., $y^k \notin P_\tau^k(x^k)$, $\exists \lambda > 0 : \lambda y^k \in P_\tau^k(x^k)$, then we have $D_\tau^k(x^k, y^k) > 1$. Finally, the point on the technology frontier would be equivalent to the distance function equaling unity, i.e., $D_\tau^k(x^k, y^k) = 1 \Leftrightarrow y^k \in \partial P_\tau^k(x^k)$. Also, because we will use the distance

function in ratios, it is important to note that the only case when it equals zero is when no output is produced, i.e., $D_{\tau}^k(x^k, y^k) = 0 \Leftrightarrow y^k = 0$, and so in practice, such observations (if any) are just not considered.

These and other¹⁸ properties have made the distance function very popular in efficiency analysis, where it can be used to re-define the Farrell (1957) technical efficiency measure of firm k (in period τ) as

$$TE_{\tau}^k(x^k, y^k) = 1 / D_{\tau}^k(x^k, y^k), \quad y^k \in P_{\tau}^k(x^k). \quad (4.5)$$

We now turn to the measurement of productivity changes from one period (s) to another period (t). Following seminal work of Caves et al. (1982), the Shephard's (output) distance function can be used for defining the Malmquist productivity index (MPI),

$$M_u^k(y_t^k, y_s^k, x_t^k, x_s^k) \equiv \left[\frac{D_t^k(x_t^k, y_t^k)}{D_s^k(x_t^k, y_t^k)} \times \frac{D_s^k(x_s^k, y_s^k)}{D_t^k(x_s^k, y_s^k)} \right]^{1/2}. \quad (4.6)$$

for the case of output orientation. (The input orientation is similar and would involve Shephard's input distance functions.) Intuitively, MPI consist of two similar parts, both comparing the input-output combinations (for an observation k) between period t and s , but with respect to (w.r.t.) different technologies. Specifically, the first part makes the comparison w.r.t. technology in period s , while second one does it w.r.t. technology in period t . Because in general, such two indexes are not equal, a common practice is to circumvent the arbitrariness of choice by taking the geometric mean.

Since the seminal works of Caves et al. (1982) and Färe et al. (1994), the MPI became one of the most popular instruments in measuring productivity changes and its components. Perhaps the most popular decomposition of MPI, which we would use in our work, was suggested by Färe et al. (1994), and is given by

$$M_u^k(\cdot) \equiv EFCH_u^k(\cdot) \times TECH_u^k(\cdot), \quad (4.7)$$

where efficiency change is measured by

$$EFCH_u^k(\cdot) \equiv \frac{D_t^k(x_t^k, y_t^k)}{D_s^k(x_t^k, y_t^k)}, \quad (4.8)$$

¹⁸ For the list of properties of the distance function and proofs, see Shephard (1970) and Russell (1990, 1997).

and technological change is measured by

$$TECH_t^k(\cdot) \equiv \left[\frac{D_t^k(x_t^k, y_t^k)}{D_s^k(x_t^k, y_t^k)} \times \frac{D_s^k(x_s^k, y_s^k)}{D_t^k(x_s^k, y_s^k)} \right]^{1/2} \quad (4.9)$$

Intuitively, here the MPI is broken into two pieces. One piece represents comparison of efficiency levels between two periods and so is naturally called as efficiency change. The other piece consists of two terms. Both of these terms compare the frontiers but w.r.t. different points in time—one w.r.t. period s and the other w.r.t. period t —which are different in general, but the geometric mean reconciles the two. The value $(M_t^k(\cdot) - 1)$ gives a percentage-based measure of the change in productivity of firm k . If this number is positive (negative) then firm k experienced productivity increase (decrease) by this percentage, between periods s and t . The source of this change can be seen from the components. Specifically, the values $(EFCH_t^k(\cdot) - 1)$ and $(TECH_t^k(\cdot) - 1)$ give percentage-based measures of the change in efficiency and change in technology of firm k , respectively, where positive values indicate improvement (in efficiency or technology), while negative values indicate deterioration, by this percent value, between the two periods. Finally, if any of the components or the entire MPI is equal to unity this means no change in that component (efficiency, technology).

So far, we have considered the definition of MPI for an individual firm. The aggregate or industry MPI can be constructed using aggregation solution proposed by Zelenyuk (2006), according to which the aggregate MPI is given by,

$$\overline{M}_t(\overline{Y}_t, \overline{Y}_s, \overline{X}_t, \overline{X}_s) = \left[\left(\frac{\overline{TE}_t(t)}{\overline{TE}_t(s)} \times \frac{\overline{TE}_s(t)}{\overline{TE}_s(s)} \right)^{-1} \right]^{1/2} \quad (4.10)$$

where

$$\overline{TE}_\tau(j) \equiv \sum_{k=1}^n [D_\tau^k(x_j^k, y_j^k)]^{-1} \cdot S_j^k, j, \tau = s, t. \quad (4.11)$$

and

$$\overline{X}_\tau = (x_\tau^1, \dots, x_\tau^n), \overline{Y}_\tau = \sum_{k=1}^n y_\tau^k, S_j^k \equiv p_j y_j^k / p_j \overline{Y}_j. \quad (4.12)$$

Similarly, the aggregate efficiency change is given by

$$\overline{EFCH}(\cdot) = \frac{\left(\sum_{k=1}^n [D_t^k(x_t^k, y_t^k)]^{-1} \cdot S_t^k\right)^{-1}}{\left(\sum_{k=1}^n [D_s^k(x_s^k, y_s^k)]^{-1} \cdot S_s^k\right)^{-1}} \quad (4.13)$$

And the aggregate technology change is given by

$$\overline{TECH}(\cdot) = \left[\frac{\left(\sum_{k=1}^n [D_s^k(x_s^k, y_s^k)]^{-1} \cdot S_s^k\right)^{-1}}{\left(\sum_{k=1}^n [D_t^k(x_t^k, y_t^k)]^{-1} \cdot S_t^k\right)^{-1}} \times \frac{\left(\sum_{k=1}^n [D_s^k(x_s^k, y_s^k)]^{-1} \cdot S_s^k\right)^{-1}}{\left(\sum_{k=1}^n [D_t^k(x_t^k, y_t^k)]^{-1} \cdot S_t^k\right)^{-1}} \right]^{1/2} \quad (4.14)$$

We presented aggregate indexes and their components for the entire group ($k = 1, \dots, n$), but similar aggregation can be done for any sub-groups within this group. The particular values of the aggregate indexes are interpreted in a similar fashion as we interpret the individual indexes (i.e., percentage-based measures after subtracting unity), except that conclusions are made for the group (sub-group) over which it was aggregated.

After estimating the scores from MPI and its components we would also want to analyze the relationship of individual MPI to some potentially explanatory variables and we use regression analysis for this purpose. For the panel data context, the first-order approximation to a function that we expect is explaining behavior of MPI_{it}^k is given by

$$MPI_{it}^k = \alpha_k + Z_{kt}\beta + \varepsilon_{kt}, \quad k = 1, \dots, n, \quad (4.15)$$

where ε_{kt} is statistical noise, and Z_{kt} is a (row) vector of observation-specific variables for firm k in period t that we expect to influence productivity score of firm k , MPI_{it}^k , through the vector of parameters to be estimated: β (common to all k) and intercept α_k (be it random, fixed but different over k or common for all k) we get the random, fixed or pooled panel data models, respectively, which is also an empirical issue that we consider later.

It must be noted that the discussion so far have been under implicit assumption that the technology frontier is known and so obtaining the efficiency and productivity indexes was a matter of computation. Of course, in reality the true technology is not known and has to be estimated. Following Färe et al. (1994) (also see Kumar and Russell (2002) and Henderson and Russell (2005) for similar application), we use the data envelopment analysis (DEA) to estimate (individual) MPI and its components for each firm k .

4.4. Data description

The data used in this study consists of three datasets: firm level (Bureau van Dijk Amadeus database), data on accumulated stock on FDI in industry (Statistical Yearbook of Ukraine) and producer price index (PPI) (WIIW dataset). The firm-level database is collected by a commercial provider Bureau van Dijk and it is originally based on the annual accounts of companies operating in Europe, including Ukraine. For a firm to be included in the database at least one of the following criteria has to be fulfilled: operating revenue must be at least 1.5 million Euro, total assets must be at least 3 million Euro or the number of employees has to be larger than 15. Although these restrictions imply that many micro-units are not included in the dataset a number of medium and small size enterprises enter the data forming a random sample. The Amadeus dataset includes the information on company names and ownership information of each firm from external sources. It enables identifying private firms and state owned enterprises, foreign and domestic firms, and calculating a number of years from the establishment for each firm.

Noteworthy, the Amadeus data on firms operating in Ukraine, which has observations on all inputs and outputs needed to construct a Malmquist Index, starts only from 1999 financial year. Yet, this is the year when Ukrainian economy started recovering after almost a decade of stagnation and a sway of financial crisis in Russia in the preceding 1998 year (see the Brief Description of Ukrainian Economy section for the details). This is also the time when the National Statistical office of Ukraine initiates the transition from national to the international standards in presenting aggregated data, including the data on FDI. Furthermore, the proper merge of the firm-level data from Amadeus dataset with industry data from the National Statistical office of Ukraine is possible only since year 2000.

In order to estimate Malmquist Index for each pair of years observations were formed in a consecutive two-year balanced panel. At this step the sample has been reduced due to the unbalanced nature of the original sample. Our sample covers one third of all employment in manufacturing in 1999, while in the last 2003 the sample comprises half of total employment with a reasonable variation among the sectors.

To exclude inflation effect in the comparison of inputs and output of different years, the monetary variables were divided by the producer price index (PPI). The sector level price indexes were not available on a consistent basis for Ukraine and therefore an aggregate PPI for manufacturing sector with 1999 as a base-year was used. In the next step the outliers were identified and removed by trimming the tails of distribution of each variable at one percentile from each side of the distribution. Further descriptive statistics on the data used for Malmquist Index estimation is presented in Table 2.

Table 2

Descriptive Statistics on the Share of Foreign Investment Enterprises (FIEs) in Total Number of firms and in Total Sales by industry during 1999-2003

Manufacturing industry name	Total Number of firms				Share of FIEs in total Number of firms, %				Share of FIEs in total Sales, %			
	1999-2000	2000-2001	2001-2002	2002-2003	1999-2000	2000-2001	2001-2002	2002-2003	1999-2000	2000-2001	2001-2002	2002-2003
Food products, beverages and tobacco	305	932	1150	1085	6.56	3.22	5.04	5.53	14.80	5.25	7.44	8.32
Textiles and textile products	149	290	380	337	7.38	7.59	9.47	10.39	22.72	10.58	11.93	14.33
Leather and leather products	19	60	85	88	26.32	10.00	15.29	15.91	45.73	15.72	22.18	25.94
Wood and wood products	33	90	113	115	6.06	7.78	8.85	7.83	27.60	38.06	27.90	25.98
Pulp, paper and paper products; publishing and printing	18	29	24	30	38.89	27.59	33.33	26.67	19.41	32.99	50.71	28.42
Coke, refined petroleum products and nuclear fuel	49	119	150	144	18.37	14.29	13.33	14.58	48.38	32.45	31.11	31.32
Chemicals, chemical products and man-made fibres	17	49	71	71	11.76	8.16	9.86	8.45	2.95	20.01	22.30	19.83
Rubber and plastic products	102	269	341	326	6.86	2.60	2.93	3.37	23.42	8.84	12.48	12.54
Other non-metallic mineral products	94	189	243	223	17.02	11.64	9.88	11.66	41.18	44.32	27.72	44.46
Basic metals and metal products	137	254	338	339	8.76	5.12	4.44	4.72	25.66	8.13	9.56	7.54
Machinery and equipment n.e.c.	40	130	171	167	5.00	6.15	6.43	7.78	12.86	15.53	17.51	21.75
Total	963	2411	3066	2925	9.66	5.97	6.91	7.49	43.87	14.36	10.96	14.47

Note: FIEs- Foreign Investment Enterprises.

Source: Amadeus dataset

Table 2 shows the distribution of foreign firms among the industries during the studied period 1999-2003. The total number of firms is increasing in all industries in almost each consecutive pair of years, reflecting mostly the improvements in the coverage of the data along the time. However, from 2001 to 2002 seven out of twelve industries experience a drop in a number of observations in the dataset. The National Statistical office of Ukraine provides only limited aggregate data on the performance of foreign firms making it impossible to identify how representative the coverage of the foreign firms is in our sample. For this reason only aggregate data on the inflows of foreign investments is used in the second stage of the regression analysis as a proxy for foreign presence.

Noteworthy is that the share of foreign investment enterprises in total number of firms is varying around 7%, while the average share of foreign firms in total sales each year accounts for around 15% in the sample. This information indicates the fact that the population of foreign firms in terms of number of firms is smaller than its share in total sales. It suggests that there are many observations of the large-scale multinational corporations in our dataset. To get a correct picture on the general performance for two groups of firms – foreign and domestic - accurate aggregation of the index and its components is needed. The index and its components need to be weighted by each company's share in the total sales in the group (see previous section for a general discussion on the aggregation technique and methodology and the next section for the results discussion). For this purpose three inputs – cost of employees, materials and fixed assets (used here as a proxy for capital costs) - and one output – sales- were used to build a technological frontier for each industry. Output-oriented model (maximization problem) has been employed to estimate MPI and its components.

4.5. Results discussion

In this section we empirically investigate the impact of foreign presence on the productivity growth of domestic firms. First, the Malmquist productivity index was used to compute the TFP growth and its components (technical change and efficiency change) for each of foreign and domestic firms in each of eleven manufacturing industries.

The output-oriented DEA method was used to estimate the Malmquist productivity index (assuming separate frontiers for each industry). Using these estimates for each firm, the aggregated (group) Malmquist productivity index and its components for the two groups of firms—foreign and domestic—were obtained for each industry. Table 3 presents the results.

Table 3.

Results of aggregated TFP growth (Malmquist Productivity Index) and its components (Technical and Efficiency change) in total and by groups

Year	Aggregated Total			Aggregates for a Group of Foreign Firms			Aggregates for a Group of Domestic Firms		
	MPI	EC	TC	MPI	EC	TC	MPI	EC	TC
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Food products, beverages and tobacco									
1999/2000	1.150	0.714	1.610	1.378	0.803	1.717	1.119	0.701	1.596
2000/2001	1.009	1.487	0.678	0.958	1.532	0.625	1.012	1.485	0.682
2001/2002	0.942	0.746	1.264	1.016	0.654	1.554	0.937	0.753	1.245
2002/2003	1.098	1.776	0.618	1.068	1.963	0.544	1.100	1.761	0.625
Textiles and textile products									
1999/2000	1.046	1.048	0.998	1.500	1.256	1.194	0.958	0.988	0.969
2000/2001	0.996	1.106	0.900	1.015	1.067	0.951	0.990	1.105	0.896
2001/2002	0.972	1.151	0.844	0.938	1.224	0.767	0.975	1.143	0.853
2002/2003	0.991	0.587	1.689	0.942	0.523	1.801	0.995	0.595	1.673
Leather and leather products									
1999/2000	0.203	0.443	0.459	1.150	1.207	0.952	0.175	0.454	0.385
2000/2001	0.901	1.065	0.846	0.914	0.984	0.929	0.893	1.080	0.827
2001/2002	0.974	1.119	0.871	1.082	1.275	0.849	0.950	1.083	0.878
2002/2003	1.157	0.934	1.239	1.308	1.030	1.270	1.112	0.904	1.229
Wood and wood products									
1999/2000	0.494	2.388	0.207	1.171	2.536	0.462	0.406	2.262	0.179
2000/2001	0.943	1.030	0.915	0.853	1.116	0.764	0.981	0.992	0.989
2001/2002	0.869	1.268	0.686	0.829	1.346	0.616	0.888	1.255	0.707
2002/2003	1.064	0.982	1.083	1.181	1.025	1.152	1.027	0.963	1.066
Pulp, paper and paper products; publishing and printing									
1999/2000	1.326	0.355	3.735	0.839	0.231	3.628	1.541	0.407	3.783
2000/2001	1.186	2.764	0.429	1.075	2.467	0.436	1.246	2.923	0.426
2001/2002	0.839	2.612	0.321	0.854	2.622	0.326	0.824	2.604	0.317
2002/2003	1.480	0.748	1.978	1.158	0.578	2.002	1.660	0.846	1.962
Coke, refined petroleum products and nuclear fuel									
1999/2000	1.275	0.734	1.736	1.183	0.724	1.634	1.373	0.745	1.844
2000/2001	0.984	1.547	0.636	1.059	1.541	0.687	0.953	1.531	0.622
2001/2002	0.939	0.921	1.019	0.866	0.877	0.986	0.964	0.937	1.029
2002/2003	1.045	0.772	1.352	1.003	0.751	1.336	1.062	0.782	1.358
Chemicals, chemical products and man-made fibers									
1999/2000	0.693	1.020	0.679	0.700	0.958	0.731	0.695	1.027	0.677
2000/2001	0.991	0.678	1.463	0.964	0.677	1.424	0.998	0.677	1.474
2001/2002	1.022	1.073	0.952	1.086	1.184	0.918	1.003	1.043	0.961
2002/2003	1.138	1.124	1.012	1.147	1.055	1.088	1.135	1.139	0.997

Table 3 (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Rubber and plastic products									
1999/2000	1.025	0.694	1.477	0.933	0.623	1.498	1.058	0.720	1.470
2000/2001	1.102	1.226	0.899	1.161	1.282	0.906	1.090	1.213	0.898
2001/2002	1.000	0.254	3.945	1.097	0.341	3.216	0.982	0.245	4.012
2002/2003	1.071	1.142	0.938	0.986	1.129	0.873	1.082	1.144	0.946
Other non-metallic mineral products									
1999/2000	1.244	2.163	0.575	1.292	2.239	0.577	1.214	2.115	0.574
2000/2001	0.955	0.721	1.325	0.902	0.633	1.424	0.999	0.790	1.264
2001/2002	0.963	1.699	0.567	0.903	1.558	0.580	0.991	1.764	0.562
2002/2003	1.139	0.708	1.610	1.114	0.679	1.642	1.163	0.732	1.589
Basic metals and metal products									
1999/2000	1.091	0.878	1.243	1.167	0.931	1.253	1.069	0.861	1.241
2000/2001	0.984	0.833	1.181	1.060	0.910	1.165	0.979	0.829	1.182
2001/2002	1.002	0.730	1.372	0.916	0.690	1.328	1.011	0.735	1.375
2002/2003	1.036	0.383	2.704	0.913	0.310	2.946	1.048	0.390	2.687
Machinery and equipment n.e.c.									
1999/2000	0.975	1.799	0.542	1.204	2.188	0.550	0.948	1.754	0.541
2000/2001	0.938	0.943	0.995	1.004	1.018	0.986	0.926	0.929	0.996
2001/2002	0.977	1.489	0.656	1.013	1.505	0.673	0.965	1.477	0.653
2002/2003	1.156	1.109	1.042	1.173	1.098	1.068	1.148	1.107	1.037

Notes: the estimation and aggregation of MPI and its components were done using Matlab software.

At the first sight, Table 3 shows no clear-cut pattern of distribution of TFP change and its components between all industries. It is clear that there might be some industry-specific factors that influence the change of TFP in 1999-2003 years in Ukraine. Note that firms in traditional manufacture of basic metals and metal products industry had experienced a very slight fluctuation of TFP. Also, one can observe no fall in TFP during the five years in the industry for manufacturing of rubber and plastic products. Two more industries - manufacturing of food products, beverages and tobacco and manufacturing of pulp, paper and paper products, publishing and printing - experienced TFP growth in all of the years except 2002 relative to 2001.

It is worth noting that foreign firms experience higher total productivity change than domestic firms in most of the years (column (5) comparing to column (8)). The efficiency change is also higher in foreign firms than domestic counterparts in most of the industries (compare column (6) to column (9)). This difference is more noticeable for the first 1999-2001 years in more FDI-intensive industries and shows slight catching-up tendency by domestic firms later in 2002 and 2003.

In order to evaluate significance of the influence of foreign presence on efficiency change and technical change of domestic firms, we use two formal empirical models,

$$\text{Model 1: } \overline{EFCH}_{ts}^{k_{dom}} = f(\text{FDI_Spill}_t^i, \text{other variables}_t^k) + \varepsilon_t^k \quad (4.16)$$

$$\text{Model 2: } \overline{TECH}_{ts}^{k_{dom}} = f(\text{FDI_Spill}_t^i, \text{other variables}_t^k) + \varepsilon_t^k \quad (4.17)$$

Here, $\overline{EFCH}_{ts}^{k_{dom}}$ is estimated efficiency change score of domestic firm k expressed as $(\overline{EFCH}_{ts}^{k_{dom}} - 1) * 100$, where $\overline{EFCH}_{ts}^{k_{dom}}$ is a part of the decomposed MPI for domestic

firms: $\overline{EFCH}_{ts}^k = \frac{D_o^t(x_t, y_t)}{D_o^s(x_s, y_s)}$ (see formula 4.7 and 4.8).

Technical change $\overline{TECH}_{ts}^{k_{dom}}$ is similarly calculated as $(\overline{TECH}_{ts}^{k_{dom}} - 1) * 100$ where $\overline{TECH}_{ts}^{k_{dom}}$ is a part of decomposed MPI for domestic firms:

$$\overline{TECH}_{ts}^{k_{dom}} = \left(\frac{D_o^s(x_s, y_s)}{D_o^t(x_t, y_t)} \times \frac{D_o^s(x_t, y_t)}{D_o^t(x_s, y_s)} \right)^{0.5} \quad (\text{see formula 4.7 and 4.9}).$$

In the first stage, to construct the frontier, the set of inputs and outputs both for domestic and foreign firms in the same industry were used. Now, in the second stage, only the scores for domestic firms are used as dependent variables to estimate the effect of foreign presence on the performance of the domestic firms.

To measure foreign influence in terms of intra-industry spillover effect or horizontal linkages we use variable FDI_Spill_t^i as a proxy. FDI_Spill_t^i is expressed as a ratio of the level of FDI capital stock to the total employment on 2-digit industry level¹⁹. The FDI capital stock was weighted by total employment in the industry in order to avoid industry-specific scale effects. Alternatively, the spillover effect variable could be weighted by the employment or output in foreign sector in the industry. Unfortunately, State Statistical Office of Ukraine does not publish this information and, therefore, in some sense more crude proxy for the spillover effect was used in this chapter. In the Model 1 and Model 2 to be estimated, the FDI_Spill_t^i variable is also squared $(\text{FDI_Spill}_t^i)^2$ in order to control for the returns to scale in the relationship between the FDI in the industry and technical as well as efficiency change.

Another firm-specific explanatory variable is Size, which is firm-level variable representing the (logarithm of) number of employees. The variable Age is expressed as the (logarithm of) number of years to the date of establishment. The variable Intangible Assets is reflecting the value of intellectual property, trade marks, etc. The squared analogue of these variables has also been introduced to identify the quadratic nature of the relationship of the dependent and independent variables.

Firstly, we performed the F-test in order to infer the hypothesis “ H_0 : the panel data can be pooled” (i.e. that the individual intercepts are the same). The resulting F-statistic for Model 1 $F(3097, 5309) = 1.21$ and a corresponding p-value is 0.00. Therefore, with very high probability we reject the null-hypothesis and the panel structure should be

¹⁹ These data have been obtained from the Statistical Yearbooks of Ukraine. Due to the change of industry classification standards from domestic (Soviet) to international, it was practically impossible to obtain valid equivalent of FDI capital in period $t-1$ (year 1998) from the Statistical Yearbook of Ukraine.

preserved. Later, the Hausman test is used to identify which of two models – random or fixed effects is better to use in our case. The score of the test is 30.54 implying that fixed effects model (Column 3 of the Table 4) should be preferred.

Table 4. Results of the second stage regression analysis

Independent variables	Units of measurement	Dependent variable:			
		Efficiency change of domestic firms (Model 1)		Technical change of domestic firms (Model 2)	
		Fixed effects	Random effects	Pooled data	
(1)	(2)	(3)	(4)	(5)	(6)
FDI_Spill _t	$\frac{\text{Log}(\text{FDI_Capital}_{\text{industry}})}{\text{Total_NO_Empl}_{\text{ind}}}$	45.51*** (9.16)	22.90*** (2.62)	-13.42*** (1.73)	-13.46*** (1.73)
(FDI_Spill _t) ²	$(\frac{\text{Log}(\text{FDI_Capital}_{\text{industry}})}{\text{Total_NO_Empl}_{\text{ind}}})^2$	39.93*** (3.89)	29.02*** (2.57)	-37.18*** (1.92)	-37.11*** (1.91)
IA	$\text{Log}(\text{Size of intangible assets})$	-2.94** (1.25)	0.04 (0.17)	0.01 (0.08)	-
IA ²	$(\text{Log}(\text{Size of intangible assets}))^2$	0.01** (0.004)	0.00 (0.00)	-0.00 (0.00)	-
Age	$\text{Log}(\text{Number of years since the establishment})$	65.87 (41.21)	-16.96* (9.08)	4.69 (5.75)	3.66*** (1.09)
Age ²	$(\text{Log}(\text{Number of years since the establishment}))^2$	-39.30*** (14.74)	2.60 (1.62)	4.69 (5.75)	-
Size	$\text{Log}(\text{Number of employees})$	-9.25 (18.83)	-26.25*** (10.20)	-5.33 (6.97)	-1.57 (1.30)
Size ²	$(\text{Log}(\text{Number of employees}))^2$	-0.98 (2.10)	1.62* (0.96)	-0.20 (0.65)	-
Medium-Tech Dummy		-	-	39.39*** (2.72)	39.51*** (2.72)
High-Tech Dummy		-	-	43.67*** (3.20)	43.91*** (3.17)
Private Ownership Dummy		-	-	0.79 (2.89)	0.84 (2.89)
Const		164.39*** (58.06)	118.70*** (29.94)	36.37* (20.36)	27.74*** (6.92)
Number of obs.		8415	8415	8415	8415
Number of groups		3098	3098	-	-
R ²		-	-	0.10	0.10
F-test		1.21	-	0.93	-
p-value of the F-test		0.0000	-	0.9891	-
Hausman test		30.54	-		
p-value of the Hausman -test		0.0001			

Notes: *,** and *** denote significance at the 10, 5, and 1 per cent levels of significance. Estimated standard errors are presented in the brackets () below the estimated coefficients.

For the Model 2, the F-statistic is $F(3097, 5309) = 0.93$ and p-value is 0.99. Thus, we cannot confidently reject the null-hypothesis, which suggests that the panel data can be

pooled in this model. The OLS estimation results are presented in Columns 5 and 6 of Table 4.

The results imply that FDI has different effect on efficiency change and technical change of domestic firms. Foreign firms' knowledge mainly spills over to domestic firms inducing the increase in their efficiency levels. Recall that efficiency change is often referred to as the 'catching-up' phenomenon (see Färe et al., 1994). This implies that FDI may stimulate domestic firms to catch-up with the best practice in the industry, and this influence is large enough to be identified as statistically significant.

However, the sign for FDI spillover effect is negative and significant in Model 2, where technical change is used as a dependent variable. The squared term of the FDI variable is highly significant in both models. In Model 1 both linear and squared FDI variables are positive, implying increasing returns in parabolic relationship between efficiency change and foreign presence.

Noteworthy, the increase in the efficiency change of domestic firms accelerates with an increase of the percentage change of FDI in the industry. However, the picture for the technical change and FDI is the opposite: the relative increase in foreign presence accelerates the fall down of technical change in domestic firms in the industry.

Intuitively, this means that the increase in FDI is associated with decrease in capability of domestic firms shifting the technological frontier of the industry. These results are not surprising as foreign firms may come to transitional countries with superior technology and more advanced know-how about running businesses than what domestic firms have. The foreign entrance disturbs the existing equilibrium in the domestic market forcing domestic firms to catch-up, at least at the beginning, by improving their efficiency relative to the new technology frontiers. But the improvement in efficiency change comes at cost of negative influence of foreign presence on the technical change of domestic firms. As technological knowledge is highly tacit, any hypothetical influence of foreign presence on technical change of domestic firms should also be viewed with a time lag.

Note, however, that our general concluding result is opposite to the one from Könings (2001), where no significant and sometimes negative (crowding-out) effect of FDI on the productivity of domestic firms in three emerging economies of Central and Eastern Europe, Bulgaria, Romania and Poland was identified. Among possible explanations provided was that 'technological' positive externality from foreign technological transfer and negative 'competition effect' from foreign presence in these countries cancel out each other. In this respect, our results provide empirical support for the reverse argument. Namely, that pressure of competition and knowledge spillover induced by FDI may stimulate domestic firms to improve their performance in terms of efficiency, but no evidence of positive 'technological' externality is found.

Intangible assets introduced as a proxy for the absorptive capacity of the domestic firms does not show up to be significant in most of the models we estimated. It can be due to the fact that the proxy is not reliable or that many firms have low level of intan-

gible assets in our sample, which can be partly explained by the problem of poor property rights protection for such assets in Ukraine. In the Model 1, with fixed effects, the first term of intangible assets is negative, but the second is positive. It implies that, *ceteris paribus*, intangible assets have negative effect on efficiency change, but from the certain point, as the value of the assets increases, the positive effect of intangible assets on efficiency change is dominating.

Statistically insignificant variable have been dropped one by one and the evidence of robust estimates of the main variables in the Model 2 is presented in Column (6) of Table 4. The variable Age in the regression Model 2 becomes significant and positively related to the technical change of domestic firms in Ukraine. At the same time, it is negatively related to the efficiency change in Model 1 (Column (2) of Table 4), but it is insignificant. The square term though is strongly negative for the efficiency change. It suggests that the older the domestic firm the harder it is for this firm to catch-up with the advancement of the moving frontiers. This is an empirical support for a common perception that older firms, some of which are created back in the Soviet Union times, are those that adjust harder to the new market conditions and often have growing inefficiency gap with frontier-runners.

The variable Size is not significant, but negatively related to the efficiency change. It might be worth noting that the Size variable is closely correlated with variable Age, for most of the industries in Ukraine. Due to the specific features of planned economy, the scale economy was one of the targets in the planned capacity development at the firm level. Since most of the giant plants in manufacturing sectors were built in the past it is harder for them to implement changes, especially in terms of technology. Consequently, it can be suggested that negative relation of size and technical change and age and efficiency change in our study imply that old and big domestic firms experience less change in Ukraine.

Our results also suggest that domestic firms in the medium- and high-tech industries enjoy more from foreign presence in terms of technology improvements than their counterparts in low-tech industries (used as a basis in our analysis). Since a big share of FDI goes to the low-tech industry in Ukraine there is a greater competitive pressure put on the domestic firms, leading to the greater change in technology. Additionally, domestic firms in low-tech sector are much more backward in terms of technical change than in high-tech and especially in medium-tech industries.

Previous studies on efficiency in transition economies provide variety of evidence on the behavior of different firms in different types of industries.²⁰ In our case the private

²⁰ For example, in a sample of five transition economies Kravtsova (2007) found that foreign firms tend to have significantly higher levels of technical efficiency only in the low-tech industries, implying that in these industries the knowledge has a potential to spill over to domestic firms. On the other hand, Zelenyuk and Zheka (2006) found that in Ukraine domestic firms tend to be more efficient than foreign firms for the industries they considered. Evidence from Hirschberg and Lloyd (2002) study on China suggest that domestically owned enterprises are less efficient than foreign-owned counterparts and there is some support for the hypothesis that the technology. The proportion of the FDI capital in an industry has a positive impact on the relative productivity of enterprises in five of the eleven industries we study.

firms achieve higher technical change than the publicly owned domestic firms, but the difference is not significant.

4.6. Concluding Remarks

The amount of foreign direct investment in Ukraine remains to be at the low level comparing to other transition countries. Among manufacturing sectors Food industry gets the most inflows of foreign investment. The fact that low-tech industries seem to be more attractive for foreign firms suggests that cost saving may be one of the dominant incentives for FDI in Ukraine. This fact, although, leaves unclear the economic impact of foreign presence on the performance of domestic firms.

Traditional measure of spillover effect is to estimate the impact of foreign presence on productivity of domestic firms. In this study the performance of the firms was evaluated by nonparametric frontier. The movement of the frontier was associated with technical change and the movement towards the frontier represents the efficiency change. The impact of FDI on both efficiency and technical change of the domestic firms was evaluated.

It was found that domestic firms experience higher technical change in medium and high-tech industries than in low-tech sectors, where the foreign presence has been highest in Ukraine.

Results suggest that FDI differently influences efficiency and technical change of domestic firms in Ukraine. Foreign presence positively influences efficiency change, but makes negative and significant effect on technical change. The outcome results imply that foreign presence through competition disturbs the existing equilibrium in the industry and stimulates domestic firms to become more efficient. At the same time, a negative influence of FDI on the technical change of domestic firms may suggest that FDI causes a segmentation of the market, where foreign companies are working in enclaves. It happens when domestic firms are outcompeted by foreign firms and marginally crowded out of the market. Alternatively, domestic firms are forced to move down the quality ladder in the production, obtaining less profit. Consequently, it leads to the reduction in the investment in research and development, causing negative tendency in following the technical change in the industry.

V. Regional Dimension of the Impact of Foreign Direct Investment on the host economy: a case of Ukraine

5.1. Introduction

It is well established in the FDI literature that the entry or presence of foreign MNC affiliates does not benefit the host country automatically. In order for FDI to be a catalyst of economic development, rather than a detrimental force, some essential characteristics of both the local economy and the foreign firms have to be in place. Earlier studies have explored the importance of many market characteristics such as competition, technological gap between foreign and domestic firms, etc. Nevertheless, there are no studies, to the best of our knowledge, that try to exploit our improved understanding of firm-level dynamics in order to provide econometric evidence on how institutional heterogeneity might drive the performance of firms in different regions within a host country. This study goes beyond the existing literature by examining the regional aspect of spillovers from foreign to domestic firms. We hypothesize that the impact of foreign presence, in terms of the effects on technical change and efficiency change, may vary between different parts of the country, characterized by different attitudes towards FDI. In this study, we measure and evaluate technical change and efficiency change by decomposing a Malmquist Productivity Index.

Recent economic and political developments in Ukraine provide grounds to believe that there is a strong division between the East and the West of the country. Historically, the eastern part of the country has been under the influence of the Russian empire, while the western regions were part of Austro-Hungarian Empire and have been more strongly influenced by the West. Soviet rule did not remove the institutional differences between these two parts of one country. There is, for example, a striking difference when it comes to the attitudes towards FDI declared by the leading political parties in these two parts of Ukraine. While the pro-western political wing is more welcoming to FDI, the eastern block is more inward-oriented and prefers domestic investment as opposed to FDI, especially when foreign investment comes in a form of mergers and acquisitions (M&A). These regional differences are hypothesized to influence the pattern of behavior of foreign investors in the two parts of the country and may lead to diverse spillover effect.

Hence, the purpose of this chapter is to examine whether regional differences of the kind observed in Ukraine can lead to differences in the impact of foreign presence.

The chapter is set out as follows: section 2 discusses previous studies on FDI, regional aspect of FDI spillovers and empirical studies on transition economies, while section 3 presents an overview on FDI in Ukraine and its regions. Section 4 provides a data description followed by the discussion on the methodology strategy. In section 5 the main results are discussed and then main conclusions are drawn in section 6.

5.2. Literature review

Some economists argue that internationalization has reduced the importance of national borders and that “the advanced nations have come to share a common technology” (Nelson and Wright, 1992). However, the results of empirical analyses of technology creation and transfers across international borders are ambiguous.

The most recent World Investment Report (2006) indicates that the inflows of FDI into transition economies have been increasing in recent years and there are prospects for further growth of FDI in this region. At the same time, the pace of offshoring, including for R&D, is foreseen to increase in several countries in Eastern Europe, which have already experienced the large increase in such activities (Chapter 1, World Investment Report, 2006). These trends have resulted in optimistic expectations from some transition economies regarding the prospects for gaining positive spillover effect from advanced foreign knowledge. Nevertheless, there are also new potentially profitable opportunities in the primary sectors, which are forecasted by World Investment Report (2006) to attract more FDI into these sectors in the future, such as gas and oil in Russia and some Asian countries of CIS, steel and similar branches in Ukraine, etc.

Recent statistical analyses of FDI spillovers, particularly in transition countries, have yielded mixed results. Empirical studies by Djankov and Hoekman (1998), Damijan et al. (2001), and Konings (2001) provide evidence that technology has been transferred to firms in transition economies primarily through FDI, but no significant positive spillover effects of FDI have been found: in some cases, there is even evidence of negative spillovers²¹. Sinani and Meyer (2004) provide evidence from Estonia, where they find that while competition from both foreign and domestic firms promotes sales growth for domestic firms, domestic firms fail to catch up with foreign firms in most industries. These results imply that the absorptive capacity of domestic firms in these industries is below the minimum threshold necessary to modify and apply the advanced technology of foreign firms.

Among the main methodological explanations for these results, the possible differences between intra and inter industry effects have recently been examined by Smarzhinska (2004a). Since multinationals have an incentive to prevent information leakages that would enhance the performance of their local competitors in the same industry, it is more likely that local firms in the host country may benefit knowledge transfers through vertical linkages with foreign firms (Smarzhinska, 2004a). Different types of knowledge have different levels of susceptibility to spilling over. Marketing and management knowledge, for example, is less tacit than product and process technology, and is therefore will probably spill over to domestic firms under different conditions.

Some studies find that the presence of foreign multinational companies may raise the productivity of locally owned firms in other industries, presumably through various

²¹ Negative spillover effect, or ‘crowding out’; is related to situation when less efficient domestic firms are forced to leave traditional market after the entrance of foreign competitors.

linkages, but only if they are located in close proximity of the foreign multinationals (Sjöholm, 1999). The geographical proximity of foreign firms to the local market is one of the important determinants of FDI spillover effects (Torlak, 2004; Audretsch and Feldman, 1996). Spillovers are found to be regionally confined and decrease with distance. This is not surprising, since key channels for FDI spillovers such as labor turnover, demonstration effects, competition and cooperation with upstream suppliers (backward linkages) and downstream customers (forward linkages) - are geographically restricted in many industries.

Furthermore, the farther the traditional suppliers from MNC abroad, the higher the probability that foreign affiliates will seek to install linkages with local suppliers (Rodrigues-Clare, 1996). Here, high transport costs and the ease of establishing linkages with local supplier are important determinant factor for the local economy to benefit from foreign presence. There is a greater prospect for domestic firms to internalize organizational knowledge by interacting with foreign firms that operate in the same region or district (either as suppliers or customers). It is also more likely that spillovers will occur if the foreign affiliate is oriented towards the local market (see Kokko and Kravtsova, 2006 for the more extended discussion on the determinants of innovative behavior of foreign affiliates in transition economies). The type of technology may also matter. Product and process technology in the high-tech industries are more difficult to transfer to the affiliate as well as being better protected by MNC affiliates in transition economies.

Geography or location may be important for other reasons than those related to proximity to foreign-invested enterprises. It is commonly assumed that the country is the appropriate economic unit for the analysis of spillovers (as well as other economic phenomena) because national borders define areas where formal institutions are the same. The distinction of market supporting institutions into formal and informal has been provided by North (1990) and generally include such formal institutions like chamber of commerce, credit registries, moneylenders, land inheritance norms, disclosure requirements on companies, judicial systems, competition laws, etc. However, informal institutions, such as norms and habits, e.g. the way the above-listed formal institutions work in practice and the attitude of people to them, reciprocity among business partners, culture, ethical norms and values, etc. may also differ and influence economic performance. Earlier empirical studies of the effects of FDI have not paid much attention to the institutional environment, and particularly not to informal institutions. It is interesting to note that Gerschenkron (1962) pointed out that an essential feature of the former Soviet Union was the resistance of important parts of the society to changes, which prevented the country from closing the gap with more advanced economies. This historical feature led to a vital need for the creation of "new institutional instruments" designed to support structural and technological change in countries now transiting from planned to market economies.

The importance of institutional development has been widely discussed in the institutional economics literature (North, 1990, Stiglitz, 1999). There is a strong agreement

that both formal and informal institutions matter in developing an effective market economy (for empirical evidence, see Acemoglu et al, 2004, Svejnar, 2002, Havrylyshyn and Rooden, 2003; a recent literature review is found in Havrylyshyn, 2006) and at the same time there is no consensus on the path of institutional changes (see the conclusions of the World Development Report, 2002). Transition economies already have a unique path from the rest of the world as they evolve from plan to market economy, where not only each country, but also each region has its own way of institutional development.

The insights regarding the importance of the institutional economics framework have not left any strong mark on the academic analysis of the effects of FDI. There is very little discussion about how differences in the institutional characteristics, especially at the regional level, may influence the outcomes of foreign presence. Among a few examples is Smarzhinska (2004), who finds that weak institutional protection in Eastern Europe and the former Soviet Union deters foreign investors in those sectors that are technology-intensive and therefore rely heavily on intellectual property rights. Moreover, a weak intellectual property rights regime encourages investors to undertake projects focusing on distribution rather than local production. Another study by Altomonte and Colantone (2005) provides empirical analysis of the regional disparities in the growth of regions in Romania. They find that the spillover effects from FDI are unbalanced across regions, with positive spillovers detected only in the best performing areas and some evidence of crowding out of domestic firms in the lagging regions. They observe a heterogeneous behavior of foreign firms over time and that the presence of MNEs tends to exacerbate regional disparities, magnifying different initial conditions across regions. Carrington's (2003) findings from spatial analysis of spillover effect also clearly distinguish between convergence and divergence movements within European countries. Here the economic convergence of regions and spillover effects depend on such factors as location, previous economic performance and, importantly, on both formal and informal institutions in the region. Carrington predicts that the enlargement of the EU towards Central and Eastern Europe, where the market institutions are historically different, can be expected to deepen the regional disparity within the EU.

Nevertheless, the cross-country analysis of the importance of informal institutions in the economic development would be difficult to carry out due to the fact that formal institution would also be different among countries. In this sense Ukraine can serve as a unique empirical ground, where a country is clearly divided by informal institutions. Social, historical and cultural differences between regions, and differences in attitudes towards FDI may obstruct the assimilation of new technologies by domestic firms and affect the overall impact of foreign presence on the local economy. Previous evaluations of spillover effect via commonly used econometric methods were not very sensitive to the institutional differences between countries and regions, which are hard to be captured by the empirical eye.

Summarizing the results from earlier literature, it seems appropriate to posit that the spillover effect of FDI depends on a set of host country characteristics. The value of

the technology that foreign firms bring with them is crucial to the economic impact it will have on domestic firms. Foreign firms are not eager to bring the newest technology if there is no compelling reason to do so stemming from the host economy. High levels of competition, a strong national system of innovation and general institutional features at the country and regional level are important determinants of spillover effects from FDI. While it may be impossible in practice to disentangle the effects of informal institutions from other differences between countries, it may be possible to detect the importance of informal institutions by exploring the impact of FDI across regions in a given country (where the formal institutional setting is fixed). This study seeks to clarify the importance of some of these determinants at the regional level. Hence, we specify two groups of regions with presumably different general attitudes towards FDI, and evaluate the impact of foreign presence on the technical and efficiency change of domestic firms in these regions.

5.3. Foreign vs. domestic knowledge: two sides of one economy

As in the case of the most post-Soviet countries, the first statistics on FDI inflows into Ukrainian are published right after the demise of USSR, in 1992. The main trends of the development of FDI inflows into Ukraine and seven neighboring countries – Russia, Belarus, Poland, Slovakia, Hungary, Romania and Moldova – are presented in Figure 1.

Figure 1. Foreign Direct Investment Inflow into Ukraine and its Neighboring Countries, 1990-2004

Source: WIIW database, 2005

Figure 1 shows Ukraine near the bottom of the pile with the third lowest trend of FDI inflows, above only two other post-Soviet countries – totalitarian Belarus and relatively small agricultural Moldova. The highest level of FDI in the 90s was seen in Hungary and Poland, where rapid economic reforms with strong reliance on openness to FDI were introduced early in the reform process. Figure 1 also shows that in the lat-

est few years, Russia and Romania have the steepest slopes in boosting FDI inflows compared to other neighboring countries of Ukraine.

Among the main reasons for such a low level of investment in Ukraine, particularly in the first few years of independence, was a highly unstable macroeconomic environment marked by hyperinflation (Ukraine had the second highest level of inflation of all post-Soviet Union countries), deep structural change in vital sectors of the economy (entailing the break up of old linkages, high unemployment and privatization) and low levels of internal capabilities to invest in the domestic economy. Bottleneck in domestic investment, mainly due to the inability of the state to support the key sectors in the economy, displaced hopes onto investments from abroad. These hopes for FDI were associated, first and foremost, with bringing newer technology and management knowledge from more advanced market economies that will eventually spillover to domestic firms in Ukraine. Being declared as wanted on all levels of political and economic establishments, FDI do not hurry to go to Ukraine.

Ukraine's presidential election in November 2004 brought a pro-western president, Viktor Yushchenko, to power. At the same time, it showed a clear division of people's ideas about the direction Ukraine should adopt – see Figure 2.

Figure 2. Ukraine divided after President Election in 2004

Source: <http://www.globalsecurity.org/military/world/ukraine/images/041124-election.gif>

Figure 2 shows that nine regions on the East and South of Ukraine supported the pro-eastern block of Viktor Yanukovich, and the rest of the country's fourteen regions supported the "orange revolution" and Mr. Yushchenko. The same pattern of division holds for the Parliamentary election held in March 2006, where the vast majority of

people in the same nine regions on the East supported a party led by Mr. Yanukovych (Regions' Party).

Such a strong division of votes reflects deep institutional difference, which also influence day-to-day economic activity in both eastern and western parts of Ukraine and particularly in regards to attitudes to FDI. While openness to FDI is declared as welcome by both parties, attitudes were revealed to be different after the privatization of a big steel plant, "Krivorizhstal," and its purchase by a foreign holding company in 2005. This step was supported by the pro-Western government but severely criticized by its opponents in the East.

The damaging nature of "home-base exploiting" type of FDI is emphasized by the Regions' Party, which stresses that reliance on domestic investment as the most appropriate mean to the strategic goal of economic development in Ukraine.

At the same time, the break down of FDI inflows by regions shows that FDI stocks are higher in the nine regions of the East than in the rest of Ukraine (here, the financial capital Kyiv-city was excluded from both West and East, due to the possible bias to FDI as most of headquarters of foreign companies are located there) – see Table 1.

Table 1 shows that, during period 2000-2004, inflows of FDI into Ukraine were slowly growing in all regions. The vast majority of FDI stays in Kyiv-city. The inflow of FDI in the capital city is greater than that in all fourteen regions in the West of Ukraine together. FDI into Eastern regions is greater and growing faster than in Western Regions during the observed period.

Such lopsided distribution of FDI can be traced to the economic specialization patterns of the regions. Historically, the industrialization of Ukraine was carried out unevenly, leaving the East of Ukraine more industrialized than the West. As a result, the East contributes more to country's GDP than the West (see Table 3). It is possible to assume that foreign investors are more interested in industrialized regions and in the financial capital Kyiv, where the possibility to obtain high value added and appropriate infrastructure is greater. In spite of the protectionist politics of the dominant political forces in the East, foreign companies with more advanced technologies still prefer to invest there.

Although offshore bank havens and is widely believed to originate from illegal business in Ukraine itself.

Table 1.

The regional differences by some economic indicators within Ukraine

Region	Foreign direct investment (USD million)		Value added per capita (at actual prices; UAH)		Per capita fixed capital investment (at actual prices; UAH)	
	2000	2004	2000	2004	2000	2004
West total	1237.1	2360.8	5308.1	18658.3	5308.1	18658.3
Vinnitsya	22.6	65.8	203.5	671.3	203.5	671.3
Volyn	49	97.4	263.6	1019	263.6	1019
Zhytomyr	27.9	82.2	180.3	631.1	180.3	631.1
Zakarpattia	92.2	244.3	260.1	892.7	260.1	892.7
Ivano-Frankivsk	40.1	120.9	418.7	1140.6	418.7	1140.6
Kyiv	340.8	522.2	521.6	1992.3	521.6	1992.3
Kirovohrad	19.6	107.2	235.6	1249.9	235.6	1249.9
Lviv	150	358.2	394.3	1411.4	394.3	1411.4
Poltava	214.2	210.1	864	1834.5	864	1834.5
Rivne	45.6	71.1	309.1	1667.8	309.1	1667.8
Sumy	35.9	135	451.3	880.8	451.3	880.8
Ternopil	21.4	37.2	173	564.3	173	564.3
Khmelnyskiy	15.6	66.5	314.5	1254	314.5	1254
Cherkasy	101.8	122.3	229.2	1769.3	229.2	1769.3
Chernivtsi	8.9	24.5	150.8	720.4	150.8	720.4
Chernihiv	51.5	95.9	338.5	958.9	338.5	958.9
East total	1278.7	3370.5	4171.6	13547.6	4171.6	13547.6
Autonomous Republic of Crimea	147.2	331.2	376.8	1376.2	376.8	1376.2
Dnipropetrovsk	186	821	611.4	1694.2	611.4	1694.2
Donetsk	305.3	529.7	591.7	1545.6	591.7	1545.6
Zaporizhzhya	221	486.2	599.2	1457	599.2	1457
Luhansk	31.4	146.2	393.3	1199.6	393.3	1199.6
Mykolayiv	46.2	75.8	356.1	1590.5	356.1	1590.5
Odesa	207.6	517.8	543.2	2129.8	543.2	2129.8
Kharkiv	98.8	387.6	467.7	1778.9	467.7	1778.9
Kherson	35.2	75	232.2	775.8	232.2	775.8
<i>Cities (taken out of the West and East groups in the calculation)</i>						
Kyiv	1309.1	2861.1	1462.9	5307	1462.9	5307
Sevastopol	15.2	66.5	332.8	1123.5	332.8	1123.5

Source: National Statistical office of Ukraine

At the same time, the relatively high stock of FDI in the Eastern regions comes. The analysis of cross-country patterns of development of FDI inflows into Ukraine reveals some interesting facts. Figure 3 shows that among the main foreign investors in Ukraine, alongside major economies like United States (13,81% of total FDI stocks on the end of 2004), the United Kingdom (10,72%) and Germany (7,5%) are offshore havens such as Cyprus (12,40%), Virgin Islands (6,51%) and Russia (5,48%).

This situation is not unique to Ukraine; a similar story could be told about a number of post-Soviet countries. It is usually associated with money laundering via offshore banking havens. Illegal business opportunities have not been appropriately controlled by the state, and criminal business was widespread in Ukraine during the first years of transition. High levels of official corruption have been reported by many international observers.

The high level of FDI inflows from offshore banking centers like Cyprus and the Virgin Island most probably have originate from Ukraine or Russia and come back to the owner in form of FDI - a practice known as “roundtripping FDI”.

Figure 3. Country breakdown of the main foreign investors in Ukraine by 2004

Note: FDI capital stock on 2004 is used as a measure

Source: WIIW database, 2005

While the most profitable investments are assumed to take place in more industrially developed regions, this type of investment can be assumed to contribute to the lead Eastern Regions have in FDI levels.

For the Ukrainian economy, the main difference between the two types of FDI – that which originates in more developed countries and that which originates in offshore banking centers – concerns the knowledge intensity and the potential to generate spillover effects. While the two types of FDI might have comparable direct effects – in terms of job creation, technology transfer, and influence on the current account – the indirect effect on the overall economy is different.

One strand of evidence concerns the influence of FDI on the growth of domestic firms, known as the ‘spillover effect’. In order to compete with local firms, foreign companies bring appropriate knowledge and technology. This knowledge, having some public good features, has the potential to spill over to local firms in the host economy. While the theoretical nature of the effect is well-defined, the methodology for its empirical analysis is varied and contested. Different determinants of such effects stemming from the behavior of the foreign firms and levels of local economic and institutional development must be taken into account.

The manufacturing sector of Ukraine has been chosen as the empirical case because much FDI into the manufacturing sectors (and especially into export-oriented sectors) comes from offshore bank havens and is suspected to originate from illegal activities inside Ukraine itself – in other words, some FDI may constitute money laundering. For instance, the official government media representative Ukrinform notes that: “According to State Tax Administration Vice Chairperson Mykola Katerynychuk, ..., 65 percent of their (metallurgical plants) exports were through commercial deals which involved offshore zones. In this way, ... , this scheme allows financial-industrial clans to launder huge sums of money.” This is expected to impact the way FDI influences domestic firms in the host economy. The share of investment consisting of money laundering that returns to Ukraine via FDI is hypothesized to have low technological value and therefore weak spillover effects on the performance of domestic firms. Due to the confidentiality reasons it is hard to trace the origin of FDI and its destination on the firm level and even industry level. While ‘round tripping investments’ might be spread over all regions of Ukraine it is possible to assume that most of them will reside in the regions with most attractive economic and institutional environment and therefore influence the pattern of spillover effect. For example, so called special economic zone in Donetsk Region (one of the biggest regions in the East of Ukraine) on 01.06.2007 has accepted 63 projects with foreign investments equal to 845,1 million USD. About 40 percent (338,2 million USD) of this capital comes from Cyprus offshore zone²².

To further depict the difference in the overall economic development of the regions and two parts of Ukraine, the East and the West, the overview of aggregate indicators such as value added and total investment per capita is spelled out in Table 1. The dynamic trends of value added per capita presented in Table 1 indicate that Eastern regions have relatively stronger positions in the economy of Ukraine. The per-capita in-

²² This data has been obtained from the official web-site of Donetsk Regional State Administration - <http://www.donoda.gov.ua>

vestment presented in Table 1 shows though that western regions got relatively more investment per capita. Noteworthy is that in the absolute terms Donetsk and Dnepropetrovsk are among the regions that received most investments on the East and even Ukraine in total, taking the lead over the most attractive regions on the West – Kyiv, Lviv and Poltava region (note also that investment into Kyiv-city itself has been excluded from the data due to the special status of the capital, where the bias of investment is assumed to be present). As a matter of fact, the above-mentioned regions are also the headquarters of two strong and opposite political forces in Ukraine (see previous section on the political division of Ukraine).

Historically, the Eastern regions are endowed with large scale manufacturing plants, which were built during Soviet times and even earlier. Throughout the last few decades, the capacity of the plants has been exploited without much-needed capital investment. As a result, the technology used by old scale-economy factories for the most part is obsolete.

The general lack of R&D-intensive investments in Ukrainian economy, particularly needed in the primarily industrially developed East, is not clearly represented in the available aggregate output statistics. The results in Table 3 indicate that the East remains economically strong part of Ukrainian economy. In 2003 the value-added contribution of all Western regions was US\$15,632.2 mln., while the total value added per capita in the Eastern part was almost 40% greater and reached US\$21,665.6 mln. (Table 1).

The novel methodology for FDI spillover effect estimation applied in this chapter extends traditional measurements. Domestic firms' development is evaluated not only by total factor productivity growth, but also by technical and efficiency change. This becomes possible by using the Malmquist index (see methodology part in the next section).

5.4. Data analysis and model estimation

The data used in this study consists of three datasets: firm level (Bureau van Dijk Amadeus database), data on accumulated stock on FDI in industry (Statistical Yearbook of Ukraine) and producer price index (PPI) (WIIW dataset). Despite the fact that detailed description of the datasets used here is presented in the previous section of this chapter, further regional features of the firm-level Amadeus data used for the Malmquist Index have been highlighted in Table 2.

Table 2.

Descriptive statistics on the number of foreign and domestic firms in total number of firms by industry in the East and West of Ukraine

Industry	Total No of firms	FIEs, %	West, %	East, %	Total No of firms	FIEs, %	West, %	East, %	Total No of firms	FIEs, %	West, %	East, %	Total No of firms	FIEs, %	West, %	East, %
	1999-2000				2000-2001				2001-2002				2002-2003			
Food products, beverages and tobacco	305	6.56	54.43	42.62	932	3.22	62.88	33.91	1150	5.04	65.91	31.22	1085	5.53	65.62	31.34
Textiles and textile products	149	7.38	53.02	37.58	290	7.59	52.76	35.52	380	9.47	57.63	32.37	337	10.39	58.75	30.86
Leather and leather products	19	26.32	84.21	0.00	60	10.00	78.33	10.00	85	15.29	82.35	8.24	88	15.91	84.09	6.82
Wood and wood products	33	6.06	36.36	30.30	90	7.78	37.78	31.11	113	8.85	38.94	29.20	115	7.83	39.13	28.70
Pulp, paper and paper products; publishing and printing	18	38.89	11.11	88.89	29	27.59	44.83	51.72	24	33.33	45.83	54.17	30	26.67	43.33	53.33
Coke, refined petroleum products and nuclear fuel	49	18.37	22.45	59.18	119	14.29	34.45	48.74	150	13.33	36.67	48.00	144	14.58	35.42	49.31
Chemicals, chemical products and man-made fibres	17	11.76	41.18	35.29	49	8.16	36.73	46.94	71	9.86	43.66	42.25	71	8.45	46.48	39.44
Rubber and plastic products	102	6.86	48.04	46.08	269	2.60	50.56	41.26	341	2.93	51.91	40.76	326	3.37	51.23	40.80
Other non-metallic mineral products	94	17.02	14.89	84.04	189	11.64	27.51	62.96	243	9.88	31.28	57.61	223	11.66	30.49	57.85
Basic metals and fabricated metal products	137	8.76	26.28	59.12	254	5.12	31.89	54.33	338	4.44	38.76	50.59	339	4.72	38.35	50.44
Total	923	9.86	42.47	49.19	2281	5.96	50.90	40.20	2895	6.94	54.30	37.55	2758	7.47	54.06	37.38

Notes: FIEs – Foreign Investor Enterprise; West - Western Regions of Ukraine; East - Eastern Regions of Ukraine (see Figure 2 for the definition of the East and the West). *Source:* Amadeus dataset, 2005

Table 2 shows that foreign investment enterprises (FIEs) are classified as firms with any positive degree of foreign capital. The share of foreign firms in the whole sample of manufacturing firms varies around 8% during the observed period.

It is also evident that the sample size has tripled from the initial 1999-2000 years with 923 observations in total, to 2,758 observations in 2002-2003 years. In the first two-year period 1999-2000 there are more firms from the East than from the West of Ukraine presented in the dataset. In the next periods the share of firms from the West increased in our sample.

This increased number of observations in general from year 1999 to 2003 and in particular in the West relative to the East is due to the specific features of the random process of the data collection process and imperfect reporting rather than the exit of the firms. Consequently, the fluctuation in the coverage does not purport to reflect a systematic pattern of changes in the size of a given industry itself. Noteworthy, due to the special status of two cities Kyiv-city (capital) and Sevastopol-city (special military zone) the firms from these cities have been excluded both from the sample of the West and the East.

The regional difference of the Ukrainian economy, which was illustrated above by political and economic developments, different attitude to foreign investment and different nature of FDI, provides an argument to hypothesize that foreign presence has different impact on domestic firms in two parts of Ukraine. The impact of foreign presence on the efficiency change and technical change of domestic firms in the East and West of Ukraine is evaluated.

Among different productivity measures, the Malmquist Index (1953) was used in this study. This index is distinguished by the possibilities it offers for decomposition and aggregation. The Malmquist Productivity Index (MPI) uses Shephard's distance function to estimate a geometrical mean of two Malmquist quantity indices, with different technology base period²³:

$$M_o(x_s, x_t, y_s, y_t) \equiv (M_o^s(x_s, x_t, y_s, y_t) \times M_o^t(x_s, x_t, y_s, y_t))^{0.5} = \left(\frac{D_o^s(x_t, y_t)}{D_o^s(x_s, y_s)} \times \frac{D_o^t(x_t, y_t)}{D_o^t(x_s, y_s)} \right)^{0.5} \quad (4.1)$$

Here s-base period and t-current period of time, x – input, y - output. $D_o^s(x_t, y_t)$ is output-oriented Shephard's distance function of observation with set of inputs and outputs (x,y) in period t measured with respect to technology set in period s.

To estimated these four distance functions: $D_o^s(x_t, y_t)$, $D_o^s(x_s, y_s)$, $D_o^t(x_t, y_t)$, $D_o^t(x_s, y_s)$ Data Envelopment Analysis (DEA) is used (Fare, 1989). The general specification of

²³ The relevance of Malmquist Productivity Index to other estimation of economic index numbers (Fisher and Tornquist Indices) has been discussed by Caves, Christensen and Diewert (1982).

DEA estimation of output oriented Malmquist Productivity Index (formula (1)) with constant returns to scale (CRS) is modeled as a following linear program (LP):

$$\left[\bar{D}_o^v(x_u^j, y_u^j) \right]^{-1} \equiv \max \theta \quad (4.2)$$

$$\text{s.t. } \sum_{k=1}^n z^k y_{m,r}^k \geq \theta y_{m,u}^j, m=1 \dots M \quad (4.3)$$

$$\sum_{k=1}^n z^k x_{i,r}^k \leq x_{i,u}^j, i=1 \dots N \quad (4.4)$$

$$\theta \geq 0, z^k \geq 0, k=1 \dots n \quad (4.5)$$

Where v is a set of technology in period s or t ($v=s, t$) and u is indication of period in which firm j is observed ($u=s, t$). N is a number of inputs, M is a number of outputs, k is a number of firms defining a technology set n .

To estimate Malmquist Productivity Index all firms were grouped in the consecutive two-year balanced panels (first option in Figure 4), where the chain method was used to identify a current period t and a base period s .

Figure 4. Current and base period's options to estimate Malmquist Productivity Index for 1999-2003

In order to minimize the loss of observations in our sample the option of consecutive years' comparison was chosen. Figure 4 presents some alternative options to estimate MPI for five-year panel dataset (1999-2003). The possibility to estimate of MPI with longer time lag is presented in options 2, 3 and 4 in Figure 4. The time lag with which MPI is estimated can influence the second step evaluation results on the spillover ef-

fect from foreign presence (for example see Smarzhinska, 2004a). Introduction of time lag causes a drop of many observations in our dataset and therefore was not exploited in the current research. Longer time span and more balanced structure of the dataset is desired to employ a time lag analysis.

The most popular decomposition of Malmquist Index $M_o(x_s, x_t, y_s, y_t)$ was proposed by Fare et al. (1994) and comprises two sources of productivity change: technical change and efficiency change. This is modeled in the following fashion:

$$M_o(x_s, x_t, y_s, y_t) = \frac{D_o^t(x_t, y_t)}{D_o^s(x_s, y_s)} \times \left(\frac{D_o^s(x_s, y_s)}{D_o^t(x_s, y_s)} \times \frac{D_o^s(x_t, y_t)}{D_o^t(x_t, y_t)} \right)^{0.5} \quad (4.6)$$

$$= EC \times (TC_s \times TC_t)^{0.5} = EC \times TC$$

For output oriented distance functions a Malmquist Productivity Index greater than unity implies an increase/growth in total factor productivity (TFP) in the current period t compared to the base period s (and, conversely, a negative change/reduction in TFP if MPI is less than unity). The results of decomposition of the sources of TFP change should be interpreted in a similar manner. Technical change (TC) shows the movement of the technological frontier. Here, the technological frontier is defined as a surface enveloping the hyperspace of $N \times M$ dimension of the most efficient firms (where N and M is a number of inputs and outputs). This frontier serves as a benchmark for the rest of the firms. If TC is greater than unity then technology improvement can be observed. Meaning that the frontier moves in the direction to envelope more efficient observations and technical change is equal to $(TC-1)$ percent. A technical change score less than unity indicates technology deterioration by $(1-TC)$ percent or the opposite movement of the technological frontier. Efficiency change (EC) shows the relative movement of a firm towards the technological frontier and can be interpreted as a catching up effect when this component is greater than one and a lagging behind effect if it is less than one.

In the second stage the regional differences in Ukraine have been introduced into the empirical model to analyze the impact of foreign presence on the various indicators of the performance of domestic firms in the regions. This approach is different from the one introduced in the previous studies, where the spillovers were analyzed only at the industry level. The general empirical model is established as follows:

$$EC_{it}/TC_{it} = f(FDI_Spill_{rt}, Ind_Dev_{rt}, Size_{it}, Age_{it}) + u_{it} \quad (4.7)$$

where i - domestic firm, r - region, t - time period, EC (efficiency change) and TC (technical change) are the components of MPI for each domestic firm estimated within each sector (see formula 4.6).

Turning to proxies for spillovers, FDI_Spill_{rt} captures the extent of foreign presence in region r at time t and is defined as foreign equity in the region normalized by the size

of the region. A number of economically active population from 17 until 70 has been used as a proxy for the size of the region and FDI_Spill_t increases with the increase of FDI capital.

The Ind_Dev_t variable is defined as value added per employee in each region r at time t . The higher the variable the more industrially developed the region is. The term ‘industrial development’ is used here as a proxy for the total level of economic activity in the region and does not refer to the scale of the manufacturing sector in the region. This parameter is introduced in the model (4.7) to take into account difference in the regional economic development that might potentially cause bias in the estimate of spillover effect.

Firm-specific age and size effects are to be captured by $Size_{it}$ and Age_{it} variables of each firm i at time t . Here, age is expressed as the number of years since the establishment of the firm and size is proxied by the number of employees in the firm in each year.

In order to estimate Model (4.7) the firm-level Amadeus dataset has been merged with the regional dataset of FDI and value added per employee. As it was pointed out by Moulton (1990) that using ordinary least squares in measuring effect of aggregate industry or region variables on such micro units like firms entails potential pitfalls. Misspecification of the model can lead to downward bias of standard errors and hence upward bias in t-statistics leading to the spurious significance. To take into account the Moulton’s critique in Model (4.7) industry and time fixed effects have been included. It enabled the standard errors to be corrected for a correlation between observations belonging to the same industry in a given year.

Further, the impact of FDI on the domestic firms’ performance was estimated separately for efficiency and productivity change as a dependent variable. To pick up possible institutional difference in the Eastern and Western parts of Ukraine, model (4.7) is estimated separately for the two parts of the country.

5.5. Results discussion

A model estimated with all firms as dependent variable produces findings consistent with different impact of foreign presence in different parts of Ukraine. The first two columns of Table 3 represent the name and units of measurement of the explanatory variables. In the columns (3), (4), (5) and (6) spillover effect (FDI_Spill) on efficiency change and technical change respectively was analyzed in the sub-sample of the domestic firms in the East and West of Ukraine. In the other four following columns (columns 7-10) the sample has been reduced to only domestic firms mainly for the purpose of the robustness check interpreted later.

Table 3.

Second stage: Regression analysis results. Dependent variable is efficiency and technical change of *all* firms and *domestic* firms

Variable	Definition of the variable	All firms				Domestic firms			
		East		West		East		West	
		Efficiency change	Technical change	Efficiency change	Technical change	Efficiency change	Technical change	Efficiency change	Technical change
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FDI_Spill	Log (FDI capital in the region/Economically active employment in the region), USD/ employee	-1.03 (4.33)	-2.89 (3.02)	-8.33** (3.78)	3.59# (2.58)	-0.10 (4.51)	-3.27 (3.17)	-9.31** (3.88)	3.59# (2.72)
Ind_Dev	Log (Value added per employee in the region, USD/ employee)	1.53 (13.62)	4.31 (9.51)	36.89** (15.58)	-4.66 (10.61)	1.94 (14.09)	4.10 (9.92)	43.40*** (16.05)	-4.60 (11.24)
Age	Log(years since the establishment)	3.90* (2.03)	-0.25 (1.42)	0.15 (2.21)	-3.15** (1.51)	3.94* (2.11)	-0.46 (1.48)	-0.19 (2.24)	-3.04** (1.57)
Size	Log(Number of employees)	32.20*** (10.79)	1.03 (7.53)	41.80** (17.65)	13.81 (12.01)	30.98*** (11.59)	1.42 (8.16)	44.64*** (18.02)	12.43 (12.62)
Square_Size	(Log(Number of employees)) ²	-2.70*** (0.95)	0.19 (0.66)	-2.92* (1.66)	-1.37 (1.13)	-2.54*** (1.04)	0.12 (0.74)	-3.19* (1.70)	-1.19 (1.19)
Intercept		-163.43* (96.66)	-58.80 (67.50)	-430.00*** (109.96)	12.17 (74.87)	-164.15* (99.98)	-55.88 (70.39)	-478.16*** (113.18)	14.81 (79.27)
R ²		0.05	0.20	0.05	0.24	0.06	0.20	0.05	0.25
Number of observations		3523	3523	4715	4715	3253	3253	4435	4435

Notes: Robust standard errors are presented below each coefficient. Each regression includes industry and year fixed effects.

Significant at the 20-percent level.

* Significant at the 10-percent level.

** Significant at the 5-percent level.

*** Significant at the 1-percent level.

The results suggest that the spillover effect of FDI in two parts of Ukraine is different, but not quite opposite. As Columns (3) and (4) and Columns (7) and (8) of Table 3 suggest there is no clear pattern of the impact of foreign presence observed in the eastern regions of Ukraine both in terms of the efficiency and technical change of firms. Note also that the sign of all coefficients *FDI_spill* in the East is constantly negative. In the West there is a significant negative effect of foreign presence on the efficiency change (Columns (5) and (9) and positive, but not very significant (significant only at 20% level), spillover effect on technical change (Column (6) of Table 3).

The different impact of FDI on the technical change of firms in two parts of Ukraine underlines possible regional differences in the country. Arguably, the difference is grounded in the diverse nature of FDI in two parts of Ukraine, which was sketched in the earlier section of this chapter. Nevertheless, the presence of new entrants on the regional market disturbs the existing equilibrium and increases competition, which might lead to the negative efficiency change in the firms operating in the region. The fact that such negative effect is more significant in the West than in the East may support the hypothesis about different nature of FDI in two parts of the country.

Results also suggest that firms operating in the West benefit from foreign presence as higher amount of FDI in the region leads to the higher technical change of the firms. While in the East the effect of FDI on technical change is still insignificant and negative suggesting that FDI in the East has a low technological intensity and therefore reduces the potential benefits from foreign presence in the region.

At the same time, the institutional difference may not fully explain the different results in two parts of Ukraine as one should take into account different economic specialization of the regions. Most of the big and old manufacturing plants in heavy industries are located in the East. Presumably it is harder for such giants in general to adjust to the changing market environment. Nevertheless the eastern regions get much more of FDI (see Table 1 in Section 3), which could stimulate the technical and efficiency change in the region.

In order to control for different industrial structure of the regions the variable *Ind_Dev* was introduced. The results suggest that industrial development of the region has a very significant and positive effect on the efficiency change in the West. In the previous analysis of the aggregate indicator of regional economic development (see Table 1), also proxied by the value added per employee in the region, the eastern part of Ukraine contributed to the total value added of the economy much more than the western part. Nevertheless, the results of the disaggregate analysis suggest that the level of regional economic development has no significant impact on the efficiency and technology change in the East of Ukraine. It implies that firms in more industrially developed regions have higher efficiency change in the West than in the East.

The age turns out to be significant for the efficiency change both for the whole sample and for the sample of domestic firms. For a long period of early transition old firms in

Ukraine went through the severe recession right after the demise of Soviet Union in 1991. The obsolete management left after planned economy era has characterized these old firms in Ukraine. The positive efficiency changes of older firms in 1999-2003, revealed in this research, might reflect the fact of gradual adjustment to the required organizational changes and may be a sign of recovery of the main manufacturers in the East. The results also suggest that the older firms in the West experience negative technical change.

The size of firm has statistically significant and similar effect only on the efficiency change of firms both in the West and the East (see Columns (3), (5), (7) and (9)). The results of regression suggest that size has a parabolic shape with diminishing effect on the efficiency change. Smaller firms experience lower efficiency change until a turning point where the percentage change of size has zero effect on the efficiency change and after which a positive relation starts dominating.

The robustness check of the results performed with a sub-sample of domestic firms is presented in Columns (7)-(10). The signs of all coefficients remain consistent with the results presented in Columns (3)-(6), where all firms were taken into account. The results are also consistent with the estimates of the model with firm fixed effects, where the significance of the aggregate spillover variable is a little bit higher.

5.6. Conclusions

The amount of foreign direct investment in Ukraine is low in comparison to the neighboring countries. At the same time most FDI stays in Kyiv-city or goes to the more industrially endowed Eastern regions.

Though foreign presence has been shown to be a catalyst for economic development in many countries, its effects call for deeper understanding. Assessing the impact of foreign presence only on the total factor productivity of domestic firms can be misleading. This study provides empirical evidence that foreign presence can have different effect on the efficiency and technical change of domestic firms.

Particularly, we find that FDI at the regional level negatively influences the efficiency change of domestic firms in the western regions of Ukraine, but has a positive effect on the technical change of the firms located there. At the same time there is no clear pattern of spillover effect on the firms operating in the eastern regions of Ukraine both in terms of technical and efficiency change observed. The different impact of foreign presence on the performance of firms in two parts of Ukraine might reflect deep institutional divergence of the West and the East.

The results suggest that industrial development of the region has a very significant and positive effect on the efficiency change in the West and has no significant impact on the efficiency and technology change in the East of Ukraine. It might imply that firms

in more industrially developed regions have higher efficiency change in the West than in the East.

The bigger the domestic firms the higher efficiency change they experience. The results of regression suggest that size has a parabolic shape with diminishing effect on the efficiency change. Smaller firms experience lower efficiency change until a turning point where the percentage change of size has zero effect on the efficiency change and after which a positive relation starts dominating. We also find that the older the firm in our sample the less technical change it experiences and the less technically efficient it is.

References

- Abramovitz, M. (1995). The elements of social capability. Social Capability and long-term growth. D. H. Perkins and B. H. Koo. Basingstoke, Macmillan Press.
- Adamchik, V. A. and A. S. Bedi (2000). "Wage differentials between the public and the private sectors: evidence from an economy in transition." Labour Economics 7(2): 203-224.
- Aitken, B. J. and A. E. Harrison (Jun., 1999). "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela." The American Economic Review 89(3): 605-618.
- Altomonte, C. and I. Colantone (2005). "Firm Heterogeneity and Endogenous Regional Disparities." LICOS Discussion Paper No. 161/2005.
- Archibugi, D. and J. Michie (1995). "The globalisation of technology: a new taxonomy." Camb. J. Econ. 19(1): 121-140.
- Åslund, A. (2002). Building Capitalism: The Transformation of the Former Soviet Bloc. Cambridge, Cambridge University Press.
- Audretsch, D. and M. Feldman (1996). "Knowledge Spillovers and the Geography of Innovation and Production." American Economic Review 86: 630-640.
- Banker, R., A. Charnes and W. Cooper (1984). "Some Models for Estimating Technical and Scale Efficiencies In Data Envelopment Analysis." Management Science 30(9): 1078-1092.
- Belderbos, R. (2001). "Overseas innovations by Japanese firms: an analysis of patent and subsidiary data." Research Policy 30(2): 313-332.
- Bhagwati, J. (1988). "Export Promoting Trade Strategy: Issues and evidence." World Bank Research Observer 3(1): 27-58.
- Birkinshaw, J. and N. Hood (1998). Multinational Corporate Evolution and Subsidiary Development. Macmillan Press, Houndmills, Basingstoke.
- Blanchard, O. and M. Kremer (1997). "Disorganization." The Quarterly Journal of Economics 112(4): 1091-1126.
- Blomström, M. and A. Kokko (1998). "Multinational Corporations and Spillovers." Journal of Economic Surveys 12(3): 247.
- Blomström, M. and A. Kokko (2003). "The Economics of Foreign Direct Investment Incentives." In H. Herrmann and R.E. Lipsey, eds., Foreign Direct Investment in the Real and Financial Sector of Industrial Countries. Springer Verlag, Hamburg: 37-56.
- Blomström, M. and F. Sjöholm (1999). "Technology Transfer and Spillovers: Does local participation with multinational matter?" European Economic Review 43: 915-923.

- Blomström, M., A. Kokko and M. Zejan (1995). "Host Country Competition, Labor Skills, and Technology Transfer by Multinationals." Working Papers of Stockholm School of Economics, Department of Economics No. 138.
- Blomström, M., A. Kokko and S. Globerman (2001). The determinants of host country spillovers from foreign direct investment: a review and synthesis of the literature. Inward Investment, Technological Change and Growth: The impact of Multinational Corporations on the UK Economy. N. Pain. Basingstone, Houndmills, Palgrave.
- Borensztein, E., J. De Gregorio and J.-W. Lee (1998). "How does foreign direct investment affect economic growth?" Journal of International Economics 45(1): 115-135.
- Braconier, H., K. Ekholm and K. Midelfart-Knarvik (2001). "In Search for FDI - Transmitted R&D Spillovers: A Study Based on Swedish Data." Weltwirtschaftliches Archiv 137(4): 644-665.
- Cantwell, J. (1989). Technical Innovations in Multinational Corporations. London, Basil Blackwell.
- Cantwell, J. and G. D. Santangelo (1999). "The frontier of international technology networks: sourcing abroad the most highly tacit capabilities." Information Economics and Policy 11(1): 101-123.
- Carlin, W., M. Schaffer, and P. Seabright (2004). "A Minimum of Rivalry: Evidence from Transition Economies on the Importance of Competition for Innovation and Growth." William Davidson Institute Working Paper No. 670, University of Michigan, Ann Arbor, MI.
- Caves, D. W., L. R. Christensen and W. E. Diewert (1982). "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity." Econometrica: Journal of the Econometric Society 50(6): 1393-1414.
- Caves, R. E. (1974). "Multinational Firms, Competition and Productivity in Host-Country Markets." Economica 41: 176-193.
- Coe, D. T. and E. Helpman (1997). "North-south R&D spillovers." Economic Journal 107(440): 134, 16p.
- Cohen, W. and D. Levinthal (1989). "Innovation and learning: The two faces of R&D." Economic Journal 99: 569-596.
- Crespo, N. and M. P. Fontoura (2005). "Determinant Factors of FDI Spillovers – What Do We Really Know?" Technical University of Lisbon Working Paper No 2005/06, Technical University of Lisbon, Lisbon.
- Damijan, J. e. P. and M. Rojec (October 2004). "Foreign Direct Investment and the Catching-up Process in New EU Member States: Is There a Flying Geese Pattern?" WIIW Research Reports Series(310).

- Damijan, J. P., M. Knell, B. Majcen and M. Rojec (2003). "The role of FDI, R&D accumulation and trade in transferring technology to transition countries: evidence from firm panel data for eight transition countries." Economic Systems 27(2): 189-204.
- Das, S. (1987). "Externalities, and Technology Transfer through Multinational Corporations: A Theoretical Analysis." Journal of International Economics Letters 22: 171-182.
- Dimelis, S. and H. Louri (2002). "Foreign Direct Investment and Efficiency Benefits: a Quantile Regression Analysis." Oxford Economic Papers 54: 449-469.
- Dimelis, S. and H. Louri (2004). "Foreign Direct Investment and Technology Spillovers: Which Firms Really Benefit?" Review of World Economics 140(2): 230-253.
- Djankov, S. and B. M. Hoekman (2000). "Foreign Investment and Productivity Growth in Czech Enterprises." World Bank Economic Review, Oxford University Press 14(1): 49-64.
- Dörrenbächer, C. and J. Gammelgaard (2004). "Subsidiary Upgrading: Strategic Inertia in the Development of German-Owned Subsidiaries in Hungary." CKG Working Paper No. 8/2004, Copenhagen Business School, Copenhagen.
- Dosi, G. and D. J. Teece (1998). Organizational Competencies and the Boundaries of the Firm. Markets and organization: 281-302.
- Driffield, N. (2001). "The impact on Domestic productivity of Inward Investment in UK." The Manchester School 69(1): 103-119.
- Driffield, N. and J. H. Love (2003). "Foreign Direct Investment, Technology Sourcing, and Reverse Spillovers." The Manchester School 71(6): 659-672.
- Dunning, J. H. (1994). "Multinational enterprises and the globalization of innovatory capacity." Research Policy 23(1): 67-88.
- EBRD (2002), (2004), (2005). Transition Report. London, European Bank for Reconstruction and Development.
- Edvardsen, D. F. and F. R. Forsund (2003). "International benchmarking of electricity distribution utilities." Resource and Energy Economics 25(4): 353-371
- Egelhoff, W. G., L. Gorman, and S. McCormick (1998). "Using Technology as a Path to Subsidiary Development." In J. Birkinshaw and N. Hood, eds., Multinational Corporate Evolution and Subsidiary Development. Macmillan Press, Houndmills, Basingstoke: 213-238.
- Fagerberg, J. (1994). "Technology and International Differences in Growth Rates." Journal of Economic Literature XXXII: 1145-75.
- Färe, R. and D. Primont (1995). Multi-output production and duality: Theory and applications. Boston and Dordrecht, Kluwer Academic.
- Färe, R. and V. Zelenyuk (2003). "On aggregate Farrell efficiencies." European Journal of Operational Research 146(3): 615-620.

- Färe, R., S. Grosskopf, M. Norris and Z. Zhang (1994). "Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries." The American Economic Review **84**(1): 66-83.
- Farrell, M. J. (1957). "The Measurement of Technical Efficiency." Journal of the Royal Statistical Society Series A(General, 120, Part 3): 253-81.
- Findlay, R. (1978). "Relative Backwardness, Direct Foreign Investment, and the Transfer of Technology: A Simple Dynamic Model." Quarterly Journal of Economics **96**: 1-16.
- Fischer, S., R. Sahay and C. Vegh (1996). "Economies in Transition: The Beginnings of Growth." The American Economic Review **86**(2): 229-233.
- Fischer, S., R. Sahay and C. Vegh (1998). From Transition to Market: Evidence and Growth Prospects. Lessons from the Economic Transition: Central and Eastern Europe in the 1990s. S. Zecchini, OECD/Kluwer Academic Publishers: 79-101.
- Flores, G. R., M. P. Fontoura and R. G. Santos (2000). "Foreign Direct Investment Spillovers: What can we learn from Portuguese data?" Mimeo, ISEG, Universidade Tecnica de Lisboa, Lisbon.
- Florida, R. (1997). "The globalization of R&D: Results of a survey of foreign-affiliated R&D laboratories in the USA." Research Policy **26**(1): 85-103.
- Fosfuri, A., M. Motta and T. Ronde (2001). "Foreign direct investment and spillovers through workers mobility." Journal of International Economics **53**(1): 205-222.
- Freeman, C. (1987). Technology Policy and Economic Performance: Lessons From Japan. London, Frances Pinter.
- Freeman, C. (1995). "The 'National System of Innovation' in historical perspective." Cambridge Journal of Economics **19**(1): 5-24.
- Gerschenkron, A. (1962). Economic Backwardness in Historical Perspective. Cambridge, MA, The Belknap Press of Harvard University Press.
- Girma, S. (2003). "The Domestic Performance of UK Multinationals." National Institute Economic Review **185**: 78-92.
- Girma, S. and K. Walkelin (2001). "Regional Underdevelopment: Is FDI the Solution? A semi-parametric analysis." Leverhulme Centre for research on Globalization and Economic Policy, Research Paper(11).
- Glass, A. and K. Saggi (2002). "Multinational Firms And Technology Transfer." Scandinavian Journal of Economics **104**(4): 495-513.
- Glass, A. J. and K. Saggi (1998). "International technology transfer and the technology gap." Journal of Development Economics **55**(2): 369-398.
- Gorg, H. and D. Greenaway (2004). "Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" World Bank Research Observer **19**(2): 171-197.

- Gorg, H. and E. Strobl (2001). "Multinational Companies and Productivity Spillovers: A Meta-Analysis with a Test for Publication Bias." Economic Journal 111(475): 723-739.
- Grunfeld, L. A. (2003). "Meet me halfway but don't rush: absorptive capacity and strategic R&D investment revisited." International Journal of Industrial Organization 21(8): 1091-1109.
- Haacker, M. (1999). "Spillovers from Foreign Direct Investment Through Labour Turnover: the Supply of Management Skills." CEP Discussion Paper, London School of Economics.
- Haddad, M. and A. E. Harrison (1993). "Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco." Journal of Development Economics 42(1): 51-74.
- Hamar, J. and J. Stephan (2006). "Results of a Fieldwork Project." In J. Stephan, ed., Technology Transfer via Foreign Direct Investment in Central and Eastern Europe. Palgrave MacMillan, Houndmills, Basingstoke: 126-159.
- Haskel, J. E., S. C. Pereira and M. J. Slaughter (2002). "Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms?" NBER Working Paper No. 8724 2002.
- Hatzichronoglou, T. (1997). "Revision of the High-technology Sector and Product Classification." STI Working Papers 1997/2, OECD, Paris.
- Havrylyshyn, O. and R. van Rooden (2003). "Institutions Matter in Transition, But So Do Policies." Comparative Economic Studies 45(1): 2-24
- Henderson, D. J. and R. R. Russell (2005). "Human Capital and Convergence: A Production-Frontier Approach." International Economic Review 46(4): 1167-1205.
- Hirschberg, J. G. and P. J. Lloyd (2002). Does the Technology of Foreign-Invested Enterprises Spill Over to Other Enterprises in China? An application of Post-DEA Bootstrap Regression Analysis. Modelling the Chinese Economy. P. J. Lloyd and X. G. Zang. London, Edward Elgar Press.
- Holm, U., A. Malmberg, and Ö. Sölveöll. (2003). "Subsidiary Impact on Host-Country Economies – The Case of Foreign-owned Subsidiaries Attracting Investment into Sweden." Journal of Economic Geography 3(4): 389-408.
- Jackman, R. and M. Rutkowski (1994). Labour markets: wages and employment. Labour Markets and Social Policy in Central and Eastern Europe. N. Barr. New York, NY, Oxford Univ. Press: 121-159.
- Jaffe, A. B., M. Trajtenberg and R. Henderson (Aug., 1993). "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations." The Quarterly Journal of Economics (3): 577-598.
- Jamasb, T. and M. Pollitt (2001). "Benchmarking and regulation: international electricity experience." Utilities Policy 9(3): 107-130.

- Javorcik, B. and M. Spatareanu (2003). "To Share or Not to Share: Does local Participation Matter for Spillovers from Foreign Direct Investment?" World Bank Policy Research Group Paper No. 3118, World Bank, Washington, DC.
- Jensen, C. (August 2002). "Spillovers in the Polish food industry - exploring the role of local externalities and global networks." Center for East European Studies Working Papers Series No. 44 Copenhagen Business School.
- Keller, W. (1996). "Absorptive capacity: On the creation and acquisition of technology in development." *Journal of Development Economics* 49(1): 199-227.
- Keller, W. and S. R. Yeaple (2003). "Jump to the Navigation Bar Multinational Enterprises, International Trade, and Productivity Growth: Firm-Level Evidence from the United States." NBER Working Paper No. 9504.
- Kinoshita, Y. (2001). "R&D and Technology Spillovers through Foreign Direct Investment: Innovation and Absorptive Capacity." CEPR Discussion Paper no. 2775.
- Kogut, B. and U. Zander (4th Qtr., 1993). "Knowledge of the Firm and the Evolutionary Theory of the Multinational Corporation." Journal of International Business Studies 24(4): 625-645.
- Koizumi, T. and K. J. Kopecky (1977). "Economic Growth, Capital Movements and the International Transfer of Technical Knowledge." *Journal of International Economics* 7: 45-65.
- Kokko, A. (1992). "Foreign Direct Investment, Host Country Characteristics, and Spillovers." A Dissertation for the Doctor's Degree in Philosophy, Stockholm School of Economics.
- Kokko, A. (1994). "Technology, Market Characteristics, and Spillovers." Journal of Development Economics 43(279-293).
- Kokko, A. (1996). "Productivity Spillovers from Competition between Local Firms and Foreign Affiliates." Journal of International Development 8: 517-530.
- Kokko, A. And V. Kravtsova (2006). "Innovative Capability in MNC Subsidiaries: Evidence from Four European Transition Economies." Stockholm School of Economics Working Paper 224.
- Kokko, A., M. Zejan and R. Tansini (2001). "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay." *Weltwirtschaftliches Archiv* 137(1): 124-149.
- Kokko, A., M. Zejan and R. Tansini (2001). "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay." Weltwirtschaftliches Archiv 137(1): 124-149.
- Könings, J. (2001). "The Effects of Direct Foreign Investment on Domestic Firms: Evidence from Firm Level Panel Data in Emerging Economies." Economics of Transition 9(3): 619-633.
- Kravtsova, V. (2007). "Foreign Presence and Efficiency in Transition Economies: Semi-Parametric Model." Forthcoming in the Journal of Productivity Analysis.

- Kuemmerle, W. (1999). "Foreign direct investment in industrial research in the pharmaceutical and electronics industries--results from a survey of multinational firms." *Research Policy* 28(2-3): 179-193.
- Kumar, S. and R. R. Russell (2002). "Technological Change, Technological Catch-up, and Capital Deepening: Relative Contributions to Growth and Convergence." *American Economic Review* 92(3): 527-548.
- Kvinge, T. (2004). "Knowledge Diffusion through FDI -Established Wisdom or Wishful Thinking?" University of Oslo, Centre for Technology, Innovation and Culture, Working Paper 37.
- Lall, S. (1992). "Technological Capabilities and Industrialization." *World Development* 20(2): 165-186.
- Li, Q. (1996). "Nonparametric Testing of Closeness between Two Unknown Distribution Functions." *Econometric Reviews* 15: 261-274.
- Lipsey, R. E. and F. Sjöholm (2004). "Foreign Direct Investment, Education and Wages in Indonesian Manufacturing." *Journal of Development Economics* 73: 415-422.
- Liu, Z. (2002). "Foreign Direct Investment and Technology Spillover: Evidence from China." *Journal of Comparative Economics* 30(3): 579-602.
- Mannik, K., H. Hannula, and U. Varblane (2004). "Country, Industry and Firm Size Effects on Foreign Subsidiary Strategy. An example of Five CEE Countries." *Faculty of Economics and Business Administration Working Paper Series* No. 27, University of Tartu, Tartu.
- Markusen, J. R. (2001). "Contracts, intellectual property rights, and multinational investment in developing countries." *Journal of International Economics* 53(1): 189-204.
- Markusen, J. R. and A. J. Venables (1999). "Foreign direct investment as a catalyst for industrial development." *European Economic Review* 43(2): 335-356.
- Meyer, K. (2003). "FDI Spillovers in Emerging Markets: A Literature Review and New Perspectives." *DRC Working Papers* No. 15, London Business School, London.
- Moulton, B. R. (1990). "An illustration of a pitfall in estimating the effects of aggregate variables on micro units." *Review of Economics and Statistics* 72(2): 334-338.
- Nelson, R. and S. Winter (1982). *An evolutionary Theory of Economic Change*. Cambridge, Harvard University Press.
- North, D. (1990). *Institutions, Institutional Change and Economic Performance*, Cambridge University Press.
- Olley, G. S. and A. Pakes (1996). "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica* 64(6): 1263-1297.

- Papanastassiou, M. and R. D. Pearce (1994). "Host-country determinants of the market strategies of US companies' overseas subsidiaries." Journal of the Economics of Business 1(2): 199-217.
- Patel, P. and K. Pavitt (1997). "The technological competencies of the world's largest firms: Complex and path-dependent, but not much variety." Research Policy 26(2): 141-156.
- Pearce, R. (1999). "The evolution of technology in multinational enterprises: the role of creative subsidiaries." International Business Review 8(2): 125-148.
- Perez, T. (1997). "Multinational enterprises and technological spillovers: An evolutionary model." Journal of Evolutionary Economics 7(2): 169.
- Porter, M. (1990). The Competitive Advantage of Nations. Free Press, New York, NY.
- Pye, R. (1998). "Foreign direct investment in Central Europe: Experiences of major Western investors." European Management Journal 16(4): 378-389.
- Ramachandran, V. (1993). "Technology Transfer, Firm Ownership, and Investment in Human Capital." Review of Economics and Statistics 75(4): 664-670.
- Ray, S. C. (2004). Data Envelopment Analysis: Theory and Techniques for Economics and Operations Research, Cambridge University Press.
- Rodríguez-Clare, A. (1996). "Multinationals, Linkages, and Economic Development." American Economic Review 86(4): 852 – 873.
- Roland, G. and T. Verdier (2003). "Law enforcement and transition." European Economic Review 47(4): 669-685.
- Rugman, A. M. and A. Verbeke (2001). "Subsidiary Specific Advantages in Multinational Enterprises." Strategic Management Review 22(3): 237-250.
- Sachs, J. (1997). "Private sector development in transition economies : A comment." Carnegie-Rochester Conference Series on Public Policy 46: 281-287.
- Schoors, K. and B. v. d. Tol (2002). "Foreign direct investment spillovers within and between sectors: Evidence from Hungarian data." University of Gent, WORKING PAPER 157.
- Shephard, R. W. (1970). Theory of Cost and Production Functions. Princeton, Princeton University Press.
- Simar, L. (2003). "Detecting Outliers in Frontier Models: A Simple Approach." Journal of Productivity Analysis 20: 391–424.
- Simar, L. and P. W. Wilson (2007). "Estimation and Inference in Two-Stage, Semi-Parametric Models of Production Processes." Journal of Econometrics 136(31--64).
- Simar, L. and V. Zelenyuk (2006a): "Statistical Inference for Aggregates of Farrell-Type Efficiencies," Discussion paper 0424, Institut de Statistique, UCL, forthcoming in Journal of Applied Econometrics.

- Simar, L. and V. Zelenyuk (2006b): "On Testing Equality of Distributions of Technical Efficiency Scores." Econometric Reviews 25(4): 497-522.
- Simar, L. E. and P. W. Wilson (1999). "Of Course We Can Bootstrap DEA Scores! But Does It Mean Anything? Logic Trumps Wishful Thinking." Journal of Productivity Analysis, 11: 93-97.
- Sinani, E. and K. E. Meyer (2004). "Spillovers of technology transfer from FDI: the case of Estonia." Journal of Comparative Economics 32(3): 445-466.
- Sjöholm, F. (1999). "Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Indonesia." Journal of Development Studies 36(1): 53-73.
- Smarzynska Javorcik, B. (2004a) "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages." The American Economic Review 94(3): 605-627(23).
- Smarzynska Javorcik, B. (2004b) "The composition of foreign direct investment and protection of intellectual property rights: Evidence from transition economies." European Economic Review 48(1): 39-62.
- Stiglitz, J. (1999). "Whither Reform? Ten Years of the Transition." Paper presented at the World Bank Annual Conference on Development Economics, Washington DC.
- Stiglitz, J. (2002). *Globalization and Its Discontents*. New York, W.W. Norton
- Svejnar, J. (2002). "Transition Economies' Performance and Challenges." Journal of Economic Perspectives 16(2)
- Teece, D. J. (1977). "Technology transfer by multinational firms: the resource cost of transferring technological know-how." Economic Journal 87(3): 242-261.
- Teece, D. J. (1981). "Internal Organization and Economic performance: An Empirical Analysis of the Profitability of Principal Firms." The Journal of Industrial Economics 30(2): 173-199.
- Teece, D. J. (1989). "Inter-Organizational Requirements of the Innovation Process." Managerial and Decision Economics 10: 35-42.
- Torlak, E. (June 2004). "Foreign Direct Investment, Technology Transfer, and Productivity Growth in Transition Countries Empirical Evidence from Panel Data." GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN(CeGE -Discussion Paper 26)
- Toth, I. and A. Semjen (1999): "Market Links and Growth Capacity of Enterprises in a Transforming Economy: The Case of Hungary," in *Market Links, Tax Environment and Financial Discipline of Hungarian Enterprises*, ed. by I. Toth, and A. Semjen. Budapest: Institute of Economics, Hungarian Academy of Science.
- Tunzelmann, v. N. (2004). *Network Alignment in the Catching Up Economies of Europe. The Emerging Industrial Structure of the Wider Europe*. McGowan. London, Routledge: 23-37.

- Van den Bosch, F. A. J., H. W. Volberda and M. de Boer (1999). "Coevolution of firm absorptive capacity and knowledge environment: Organizational Forms and Combinative Capabilities." *Organization Science* 10(5): 551-568.
- Vernon, R. (1966). "International Investment and International Trade in the Product Cycle." *Quarterly Journal of Economics* 80: 190-207
- Walsh, S., J. Linton, R. Boylan, and C. Sylla (2002). "The Evolution of Technology Management Practice in Developing Economies: Findings from Northern China." *International Journal of Technology Management* 24(2/3): 311-329.
- Wang, J.-Y. and M. Blomström (1992). "Foreign Investment and Technology Transfer: A Simple Model." *European Economic Review* 36(1): 137-155.
- White, R. E. and T. A. Poynter (1984). "Strategies for Foreign-Owned Subsidiaries in Canada." *Business Quarterly* 49(2): 59-69.
- World Bank (2002). "World Development Report: Building Institutions for Markets."
- Yudaeva, K., K. Kozlov, N. Melentieva, and N. Ponomareva (2003). "Does foreign ownership matter?" *Economics of Transition* 11(3): 383-400.
- Zander, I. (1997). "Technological diversification in the multinational corporation--historical evolution and future prospects." *Research Policy* 26(2): 209-227.
- Zelenyuk, V. (2006). "On Aggregation of Malmquist Productivity Indexes." *European Journal of Operational Research* 174: 1076-1086.
- Zelenyuk, V. and V. Zheka (2006). "Corporate Governance and Firm's Efficiency: The Case of a Transitional Country, Ukraine." *Journal of Productivity Analysis* 25: 143-168.

Conclusions

In this thesis the determinants of innovative capability in a sample of MNC subsidiaries were explored in four transition economies: Estonia, Hungary, Poland, and Slovenia. Four different indicators of innovative capability reflecting the autonomy and capacity of the subsidiary in product and process technology, marketing and management have been used. These variables were regressed on a set of firm specific variables and industry characteristics reflecting, among other things, the role of the subsidiary in the parent MNC's international production network, the technological standard of the host industry, and the competition from local firms in the host country.

The main finding from the regression analysis is that capability in product and process technology seems to be determined by a different set of variables than capability related to marketing and management knowledge. A rough generalization would be that the most independent affiliates – those that are diversified, oriented towards the local market, established through acquisitions rather than greenfield investments, and where the foreign MNCs' only hold minority ownership – are also those that have the strongest innovative capability in product and process technology. This conclusion needs to be tempered with a comment about technology levels. During the period under study, the skill requirements in the most advanced industries appeared to be somewhat too high for the level of skills available in the four transition economies. Hence, subsidiaries in high technology industries recorded lower levels of independent capability. For marketing and management capability, the pattern is almost the opposite. The highest levels of capability are recorded in subsidiaries that are closely tied to the parent company, with high foreign ownership shares and substantial exports back to the parent company.

These differences are probably related to the existing skills and capabilities available in the host countries, as well as to character of various types of knowledge. Arguably, product and process technology is more tangible and codifiable than knowledge in marketing and management. This means that much of product and process development can be centralized to the parent company or specialized R&D affiliates, from where it is transferred to those subsidiaries that are closely integrated in the MNC's international production network. Subsidiaries that are not so closely tied to this network – e.g. because they are minority owned or acquired – may not have equal access to the resources of the parent, and are forced to create their own capability. Marketing and management skills, by contrast, are more difficult to transfer in a codified form, and those subsidiaries that are closely connected to the parent MNC may receive substantial assistance to develop these capabilities. Those affiliates that are more loosely connected to the parent MNC seem to have weaker capabilities in these areas.

The industry variables also have different effects on the two kinds of capabilities. For product and process technology, it seems that local competition is one of the determinants of the decision to invest in innovative capability. The variables reflecting local

labor productivity and the productivity gap between the subsidiary and competing local firms both have significant negative coefficients. This suggests that the need to maintain innovative capability is related to local competition: when local firms are able to challenge the subsidiaries (either because the industry is relatively simple, with low labor productivity, or because the gap between subsidiaries and local firms is small) subsidiaries are forced to invest in developing their own technological capacity. The gap does not appear to have any impact on marketing and management capabilities, and the impact of local productivity on these skills is actually positive. A likely interpretation is that more sophisticated industries (with differentiated goods) require stronger capabilities in these areas, irrespective of how the competition from local firms looks.

The finding that there are different types of innovative capabilities that vary across firms and industries in a reasonably systematic manner is highly interesting from a policy perspective. The results suggest, for instance, that the host country faces somewhat of a trade-off between different capabilities depending on the trade orientation of MNC subsidiaries. While wholly foreign-owned, export oriented affiliates tend to create substantial capabilities in marketing and management, they seem to rely to a relatively large extent on the parent company for product and process innovations. Local market oriented joint ventures tend to develop stronger capabilities in product and process technologies (excluding high technology sectors), but may be less successful in establishing modern marketing and management skills. These differences can be expected to have some impact on what kinds of spillovers different kinds of FDI projects may generate. In the European transition economies, where the domestic skills and capabilities in “hard” technology are relatively strong whereas “soft” technology (read marketing and management) are weaker, it can be argued that outward-oriented MNCs might provide some of the skills that are in shortest supply.

Chapter three tests several hypotheses about the performance of foreign firms in transition economies and the effect of foreign direct investment on domestically-owned firms competing with foreign subsidiaries. Foreign investment enterprises (FIEs) may serve as effective generators of knowledge externalities and can work as a competitive force, reducing the excess profits earned by domestic competitors and improving efficiency. To find empirical evidence of such influence, and to overcome the shortcomings associated with traditional parametric methodologies, a two-stage semi-parametric model was employed.

In the first stage, the technical and scale efficiency of foreign and domestic firms were estimated using Data Envelopment Analysis (DEA) separately for ten manufacturing sectors. We conclude that the average efficiency of foreign firms shows a weak tendency to be higher than the technical efficiency of their domestic counterparts, but more scale-efficient, on average, than domestic firms in most of the industries considered. However, in more advanced countries like Poland and Hungary in our sample the

difference of the average efficiency is in favor of foreign firms. These results provide a ground to conclude that while foreign firms have the strongest advantages compared to domestic firms in relatively less developed countries, the host country conditions are crucial in determining the behavior of foreign firms.

In the second stage, a truncated regression was used to analyze the main determinants of foreign direct investment spillover effects. The analysis shows that older domestic firms are less efficient than younger firms. Wage rates and Intangible assets turn out to not be reliable proxies for the quality of personnel and absorptive capacity respectively in transition economies and do not prove to be significant in most of the models. The foreign direct investment spillover effect hypothesis was tested with several alternative proxies for foreign presence and turns out to be significantly positive in all models.

The results lead us to conclude that a large foreign presence is associated with improved performance for domestic firms. However, strong conclusions about spillover effects cannot be made with the data available in this study. Because of data limitations we are unable to demonstrate the dynamic mechanism that is necessary in order to more reasonably connect the foreign firms' presence with the efficiency of their domestic counterparts.

In the fourth Chapter the dynamic effects in the performance of the firms was evaluated by nonparametric frontier. The movement of the frontier was associated with technical change and the movement towards the frontier represents the efficiency change. The impact of FDI on both efficiency and technical change of the domestic firms was evaluated.

It was found that domestic firms experience higher technical change in medium and high-tech industries than in low-tech sectors, where the foreign presence has been highest in Ukraine.

Results suggest that FDI differently influences efficiency and technical change of domestic firms in Ukraine. Foreign presence positively influences efficiency change, but makes negative and significant effect on technical change. The outcome results imply that foreign presence through competition disturbs the existing equilibrium in the industry and stimulates domestic firms to become more efficient. At the same time, a negative influence of FDI on the technical change of domestic firms may suggest that FDI causes a segmentation of the market, where foreign companies are working in enclaves. It happens when domestic firms are outcompeted by foreign firms and marginally crowded out of the market. Alternatively, domestic firms are forced to move down the quality ladder in the production, obtaining less profit. Consequently, it leads to the reduction in the investment in research and development, causing negative tendency in following the technical change in the industry.

The amount of foreign direct investment in Ukraine is low in comparison to the neighboring countries. At the same time most FDI stays in Kyiv-city or goes to the more industrially endowed Eastern regions.

Though foreign presence has been shown to be a catalyst for economic development in many countries, its effects call for deeper understanding. Assessing the impact of foreign presence only on the total factor productivity of domestic firms can be misleading. This study provides empirical evidence that foreign presence can have different effect on the efficiency and technical change of domestic firms.

Particularly, we find that FDI at the regional level negatively influences the efficiency change of domestic firms in the western regions of Ukraine, but has a positive effect on the technical change of the firms located there. At the same time there is no clear pattern of spillover effect on the firms operating in the eastern regions of Ukraine both in terms of technical and efficiency change observed. The different impact of foreign presence on the performance of firms in two parts of Ukraine might reflect deep institutional divergence of the West and the East.

The results suggest that industrial development of the region has a very significant and positive effect on the efficiency change in the West and has no significant impact on the efficiency and technology change in the East of Ukraine. It might imply that firms in more industrially developed regions have higher efficiency change in the West than in the East.

The bigger the domestic firms the higher efficiency change they experience. The results of regression suggest that size has a parabolic shape with diminishing effect on the efficiency change. Smaller firms experience lower efficiency change until a turning point where the percentage change of size has zero effect on the efficiency change and after which a positive relation starts dominating. We also find that the older the firm in our sample the less technical change it experiences and the less technically efficient it is.

Curriculum Vitae

Viktoriya Kravtsova
ul. Zupadnaya, 80/198
86114 Makeyevka
Ukraine

e-mail: victoria.kravtsova@merit.unimaas.nl

Date of birth: 11/24/1975 **Nationality:** Ukrainian

EDUCATION

- September 2001 - May 2002** PhD courses at Maastricht Economic Research Institute of Innovation and Technology (MERIT), Netherlands.
- December 1998 – 2001** Postgraduate (Ph.D.) courses Donetsk State University, *Donetsk, Ukraine*. Field of study: International Economics
- September 1993 – July 1998** Donetsk State University, *Donetsk, Ukraine* Field of study: Economics *Diploma of Specialist (with specialisation in Marketing) with distinction, July 1999*
- September 1990 - July 1993** Donetsk Economic Technical School, *Donetsk, Ukraine* Major field of study: Economics *Diploma of Young Specialist (equivalent of Bachelor's degree) in Economics with distinction, July 1993*
- September 1982 – June 1990** Secondary School № 27, *Makeyevka, Ukraine* Graduation *with distinction, June 1990*

WORK EXPERIENCE

International Economist, April 2007 – Present

Vienna Institute for International Economic Studies (WIIW)

- Research on FDI and trade in services

Lecturer, September 2003-August 2005

University of Maastricht, Maastricht, The Netherlands

- 1st year students- Microeconomics, International Economics, International Trade and International Economic Relations
- 2nd year students – European Studies, International Economics.

Lecturer, January 2000 – June 2000

Business Centre, Donetsk, Ukraine

- Course 'Information Systems for Management' for ex-miners, industrial workers.
- Creating a handbook and booklets for the course.

Deputy Assistant, February –August 2000

Verkhovna Rada (Parliament) of Ukraine, Kiev, Ukraine

- Preparing and analysing data for law project development,
- Creating database of incoming/outgoing information on the economic laws
- Participation in scientific conferences and exhibitions that is in scope of interest of the deputy.

Economist, July 1997 – December 1998

BIS-Holding, Donetsk, Ukraine

- Created and tested suitable software for business planning for Ukrainian firms on International Standards Basis. Designed pattern and performed investment project analyses. Responsible for testing marketing and financial part of investment project.

HONORS AND ACTIVITIES

Nov 2005-Jan 2006	Visiting Researcher at Kyiv Economic Institute (KEI) and EERC-Kyiv, <i>Ukraine</i>
May-August, 2006	Visiting Researcher at the Stockholm School of Economics, <i>Stockholm, Sweden</i>
May, 2006	Participant of DIME Workshop on Technological Knowledge and Opportunities in Competition, Entrepreneurship & Innovation, <i>Göteborg, Sweden</i>
May, 2006	Participant of Ph.D.-School on National Systems of Innovation and Economic Development - Globelics Academy, <i>Lisbon, Portugal</i>
June, 2005	Participant of IX Workshop on Efficiency and Productivity Analysis, <i>Brussels, Belgium</i>
March – Dec, 2003	Holder of the Swedish Institute scholarship
May 2002 – Mar 2003	Holder of Job Cohen Fund scholarship
May, 2002	Participant of New Institutional Economics Summer School, <i>Corsica, France</i>
August, 2001	Participant of Summer School 'Europe and New Economy', <i>Oslo, Norway</i>
June-July, 2001	Participant of Transatlantic Summer Academy (TASA) in European Integration, <i>Bonn, Germany</i>
October, 2000	Participant of Economics of Technological and Institutional Changes Doctoral Session (Part 2) for PhD students, <i>Maastricht, The Netherlands</i>
Dec 1999 – Aug 2000	Intern of Verkhovna Rada (Parliament) of Ukraine, <i>Kiev, Ukraine</i>
April, 2000	Participant of Economics of Technological and Institutional Changes Doctoral Session (Part 1) for PhD students, <i>Strasbourg, France</i>
April, 2000	Intensive course 'Management of Foreign Trade Operations', Japanese educational Centre in Ukraine, <i>Kiev, Ukraine</i>
Feb – May, 2000	Intensive Courses in Ukrainian Legislation as a part of Assistant of the Head of Verkhovna Rada (Parliament) of Ukraine Committee Program, Kiev-Mohila Academy, Centre of Legislation Information Systems, <i>Kiev, Ukraine</i>
Nov-Dec, 1999	Training visit under the project 'Teaching Methods of Information Systems for Management', <i>Sunderland, England, UK</i>
July-Aug 1999	Participant of the Summer School on the Problems of Global Warming, <i>Dundee, Scotland, UK</i>
1995 – 1998	Holder of Special Government Scholarship for Students, who Achieved Success in Social Field
1994 – 1998	Participant in a number of native scientific conferences, seminars and workshops for economics students

This research presents an analysis of Foreign Direct Investments (FDI) flows into transition economies, together with an up-to-date review of the literature on the impact of FDI. It identifies the main determinants of the innovative capabilities of foreign firms in transition economies. The empirical evidence presented clarifies the influence of the presence of foreign manufacturing firms on their domestic counterparts, in terms of both efficiency and technological change.