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ECONOMIC DEVELOPMENT THROUGH FOREIGN DIRECT INVESTMENT IN CENTRAL AND EASTERN EUROPE

Background Paper for Special Session III on FDI and the Restructuring of Transition and Emerging Economies

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1. Introduction

Foreign direct investment (FDI) can be an important catalyst for the financing of development in Central and Eastern Europe. Yet, its importance lies not only in providing finance for the acquisition of new plant and equipment, but also in the transfer and diffusion of new technology and organizational forms from relatively more technologically advanced economies. Most research and development (R&D) takes place in transnational corporations (TNCs) located in the most advanced economies making it essential for relatively backward countries to develop channels for technology to transfer. These channels not only include FDI, but also subcontracting, joint ventures and strategic alliances, technology licensing and international trade in capital goods. Although it is not known whether these channels are complements or substitutes, together they form a network of international technology links, through which the impact on host countries takes place.

This paper examines the extent to which transnational activity facilitates technology transfer and productivity spillovers in the Central and Eastern European economies (CEECs). The analysis will make use of annual financial and operating data collected in the Czech Republic, Estonia, Hungary, Poland and Slovenia from 1993 to 1998. Primarily derived from the income statements of individual enterprises, these data include information about the enterprise including total sales, export sales, value added, employment, wages, profits, and assets. The data also allow for a comparison between enterprises with at least 10 per cent foreign ownership interest (foreign investment enterprises) and those with less than 10 per cent ownership interest (domestic or local enterprises). In contrast with balance of payments and direct investment data, the information collected on the overall operations of foreign investment enterprises (FIEs) can be used to analyze the extent of international technology transfer and technology spillovers.

2. The role of TNCs in facilitating technological and organizational change

Firms, and in particular TNCs, play an important role in transferring technology across national borders. These organizations transfer technology in two ways: (1) internalized to FIEs under their ownership and control; and (2) externalized to other firms in the host economy. They also can have both a *direct* and *indirect* positive impact on the diffusion of technology, irrespective of their ownership and control.[1] A TNC can encourage technical change and technological learning *directly* through the transfer of new technology and organizational skills to one of its affiliates (FIE). The absorptive capacity (knowledge, skills and experience) of the FIE will then determine the pace of technological accumulation within the enterprise. These direct effects can appear as a change in productivity, the industrial structure, R&D expenditure, and the composition of exports. At the same time the presence of TNCs in the host economy can increase technical change and technological learning *indirectly* through technology spillovers from their FIEs to domestically-owned or local enterprises (DEs). Spillovers can occur as a consequence of a TNC upgrading the technology of its affiliates (FIEs) to a level that is typically better than in the host economy. The innovation system and social capabilities of the host economy together with the absorptive capacity of other enterprises in the host economy will determine the pace of technological accumulation in the economy as a whole.

Technology spillovers can occur between firms that are vertically integrated with the TNC (inter-industry spillovers) or in direct competition with it (intra-industry spillovers). They can increase technical change and technological learning in at least four ways.[2] First,

[1] For a similar discussion, see UNCTAD, *World Investment Report 1992: Transnational Corporations as Engines of Growth*, (New York: United Nations, 1992) pp. 141-56.

[2] For a similar classification, see A. Kokko, Foreign Direct Investment, Host Country Characteristics, and Spillovers, (Stockholm: Stockholm School of Economics, 1992), and T. Perez, *Multinational Enterprises and Technological Spillovers*, (Amsterdam, Harwood Academic Publishers, 1998), pp. 24-27.

competition with the foreign affiliate can increase intra-industry spillovers by stimulating technical change and technological learning. Greater competitive pressure perceived by local firms induces them to introduce new products to defend their market share and adopt management methods to increase productivity. This kind of spillover is most important in industries with low actual and potential competition and high barriers to entry. Second, *co-operation* between FIEs and upstream suppliers and downstream customers increases technological spillovers. To improve the quality standards of its suppliers, TNCs often provide resources to improve the technological capabilities of both vertically and horizontally linked firms. Third, *human capital* can spillover from FIEs to other enterprises as skilled labour moves between employers. These spillovers are especially important for enterprises that lack the technological capabilities and managerial skills to compete in world markets. Finally, the proximity of local firms to FIEs can sometimes lead to *demonstration*- and *imitation*-spillovers. When new FIE's introduce new products, processes and organizational forms, they provide a kind of demonstration to other local enterprises. Local enterprises may also imitate new FIEs through reverse engineering, personal contact and industrial espionage. In addition, a concentration of related industrial activity might also encourage the formation of industrial clusters, which encourages further FDI and local spillovers.

Not all TNC activity leads to technology transfer and positive spillovers.[3] TNCs can have a negative impact on the direct transfer of technology to the FIE and reduce the spillovers from FDI in the host economy in several ways. They can provide their affiliates with too few, or the wrong kind of technological capabilities, or even limit access to the technology of the parent company. This type of behaviour reduces access to new technology and if it restricts the production of its affiliate to low-value activities it can also reduce the scope for technical change and technological learning within the affiliate. Even if the TNC transfers new technology to its affiliate, it can reduce the scope for technology spillovers by limiting downstream producers to low-value added activities or eliminate them altogether by relying on foreign suppliers (including itself) for higher value-added intermediate products. They may also limit exports to competitors and confine production to the needs of the TNC. This behaviour not only limits the scope for technology spillovers, but it may also lead to a decline in the overall growth rate by reducing competition and worsening the balance of payments.

Technology spillovers from TNCs tend to occur more frequently when the social capabilities of the host country and the absorptive capacity of the firms in the economy are high. While relatively backward countries have a certain advantage in catching-up, it becomes increasingly more difficult for the country to build the necessary social capabilities and absorptive capacities that allow firms to take advantage of the technology spillovers that are available in the economy. Countries (and firms) without the capability to assimilate new technology tend to attract mainly market-seeking or resource-seeking foreign investment, and countries with this capability tend to attract more efficiency-seeking and asset-seeking foreign investment.[4] Closing the technology gap will be difficult without the relevant technological capabilities. As a result, there appears to be a certain threshold that developing countries must cross before the potential for technological spillovers become realized.[5]

It is also useful to distinguish between the broad category of productivity spillovers from technological spillovers. Often both happen together since industrial restructuring and corporate restructuring are connected to the competitive environment. Technology spillovers occur when TNCs improve the technology of their affiliates and this in turn diffuses to other firms in the host economy. They tend to occur more frequently in countries with a relatively high level of 'social capabilities' (e.g. education levels, technological capabilities, good legal systems, etc.). In contrast, productivity spillovers can occur without any transfer of technology. For example, a TNC can create competitive pressures which force less efficient firms to exit, causing an increase in the average productivity of the industry in the host economy.

[3] See, for example, J. H. Dunning, "Re-evaluating the Benefits of Foreign Direct Investment", *Transnational Corporations*, (Vol. 3, No. 1, 1994), pp. 23-51. Dunning argues that TNCs can limit access of affiliates to certain markets, the range of products they produce, the kinds of technology they adopt, R&D activity they undertake, and their pattern of networking with DEs. They can also reduce competition and taxes paid in the host country through market domination and transfer pricing. Bardham also suggests that TNCs can restrict domestic production when they set up affiliates with the main purpose of protecting existing property rights and taking out patents in the host country. See P. Bardham, "The Contributions of Endogenous Growth Theory to the Analysis of Development Problems: An Assessment" in F. Coricelli, M. di Matteo, and F. Hahn, *New Theories in Growth and Development* (London, Macmillan 1998).

[4] Dunning, op. cit., 1994.

[5] A model of catching-up by Verspagen shows why countries with a high learning capacity and/or small productivity gap are likely to catch up, while other countries will tend to fall further behind. Crossing this threshold would require improving the human capital in the country as well as the "national innovation system". See B. Verspagen, "A New empirical Approach to Catching-up or Falling Behind", *Structural Change and Economic Dynamics*, Vol. 2, pp. 242-261. For a discussion of this threshold from the point of view of TNCs, see A. Kokko, op. cit., 1992.

3. The role of FDI in economic growth: theoretical and empirical considerations

Numerous empirical studies at the firm, industry and economy-wide levels confirm that technical change and technological learning are important determinants of economic growth.[6] TNCs are responsible for much of this technological accumulation, yet growth theory rarely acknowledges the important role that these organizations play. In neo-classical analysis, FDI does not influence the long-run growth rate, but only the level of income. An exogenous increase in FDI would increase the amount of capital (and output) per person, but this would only be temporary, as diminishing returns (on the marginal product of capital) would impose a limit to this growth. FDI can influence the long-run growth rate only through technological progress or growth of the labour force, which are both considered exogenous.

If FDI is not only finance, but also a bundle of fixed assets, knowledge (codified and tacit) and technology, then it can be expected to generate growth endogenously. The recent rise of endogenous growth theory enables FDI to influence growth by introducing certain parameters that capture the sources of economic growth, such as R&D and education (or human capital).[7] Even if diminishing returns should prevail inside the enterprise, various externalities (outside the enterprise) can provide the necessary positive feedback to sustain growth in the long run. TNCs create such positive externalities for the local economy when they transfer new technology and organizational forms directly to its affiliate. They can also create them indirectly through subcontracting, joint ventures and strategic alliances, technology licensing, imports of capital goods and migration. Through technology transfer and technology spillovers, these growth models suggest that FDI can speed up the development of new intermediate product varieties (the horizontally differentiated inputs model), higher product quality (the quality ladder model), facilitate international collaboration on R&D, and introduce new forms of human capital.[8] By providing firms in relatively backward countries with greater access to finance and a wider range of intermediate products, FDI can increase productivity directly in the FIE and indirectly in local enterprises through knowledge spillovers. The existence of technology transfer and local spillovers prevent the unbounded decline of the marginal productivity of capital suggested in conventional growth theory and makes endogenously driven long-term growth possible.

Although the scope for externalities of various types and the influence they have on long-run growth is a common theme in most endogenous growth models, very few of them consider the role of FDI in generating these externalities explicitly.[9] A widely held view is that international trade (especially new intermediate capital goods) leads to R&D spillovers and higher productivity growth.[10] But while recent evidence shows that the composition of imports does influence productivity growth (especially in the developing countries), it also reveals that domestic R&D has a greater influence on productivity growth and foreign R&D. The lack of sound evidence that international trade is an important channel of technology transfer has important policy implications for the creation of a new free trade agreement. It also suggests that other channels of technology transfer should be examined more closely.[11] Recent studies based on endogenous growth theory indicate that the transfer of technology and technology spillovers from FDI encourage long-run growth, but the extent to which this occurs depends crucially on the stock of human capital and the absorptive capacity of firms in the host

[6] See J. Temple, "The New Growth Evidence", *Journal of Economic Literature*, Vol. XXXVII, March 1999, pp. 112-156, and S. N. Durlauf and D. T. Quah, "The New Empirics of Economic Growth" in J. B. Taylor and M. Woodford, *Handbook of Macroeconomics* (Amsterdam: Elsevier Science), 1999, pp. 235-308.

[7] Simple AK models can generate endogenous growth without a technology parameter. See S.T. Robelo, "Long-run Policy Analysis and *Journal of Political Economy*, Vol. 99, 1991, pp. 500-521. Romer includes a technology parameter in the production function that exhibits increasing returns to knowledge and constant returns in knowledge accumulation. Technical knowledge is generally public (or non-rival) and at least partly excludable, and tacit knowledge is private or firm-specific (rival) and is excludable in that it requires certain rights to access it. See P. Romer, "Increasing returns and Long-run Growth" *Journal of Political Economy*, Vol. 94, 1986, pp. 1002-1037. Lucas introduced human capital as a parameter in the production function to generate increasing returns and endogenous growth. See R.E. Lucas Jr., "On the mechanics of Economic Development", *Journal of Monetary Economics*, Vol. 22, No. 3, 1988, pp. 3-42.

[8] Some growth models suggest that the intensity of R&D determines the pace of economic growth by increasing the variety (and quality) of capital goods and inducing the necessary human capital for subsequent innovations. This product differentiation reflects the increased specialization of labour across an increasing variety of activities in the global economy. See P.M. Romer, "Endogenous Technological Change", *Journal of Political Economy*, Vol. 98, 1990, pp. S71-102; G.M. Grossman and E. Helpman, Innovation and Growth in the Global Economy, (Cambridge: MIT Press, 1991); and P. Aghion and P. Howitt, "A Model of Growth Through Creative Destruction", *Econometrica*, Vol. 60, 1992, pp. 323-351. Grossman and Helpman represent the growth process as a quality ladder that firms climb depending on the stochastic nature of the R&D process. Aghion and Howitt describe how changing product variety leads to a process of creative destruction and explain how excessive R&D expenditures can have the opposite effect that Romer predicts.

[9] See L.R. de Mello, Jr., "Foreign Direct Investment in Developing Countries and Growth: A Selected Survey", *The Journal of Development Studies*, Vol. 34, No. 1, 1997, pp. 1-34. Grossman and Helpman, op. cit., incorporate FDI into their growth model, but only to the extent that it determined the international location of production.

[10] See D.T. Coe and E. Helpman, "International R&D Spillovers", *European Economic Review*, Vol. 39, 1995, pp. 859-887. They show that the total factor productivity of a country depends not only on its own R&D activity, but also the R&D activity of its trading partners.

[11] See W. Keller, "Do Trade Patterns and Technology Flows Affect Productivity Growth?", *The World Bank Economic Review*, Vol. 14, No. 1, 2000, pp. 17-47.

economy.[12] Scale effects found in industry data indicate that the direct transfer of technology to the FIE is more important than spillovers from the FIE to the domestic economy. But the dearth of statistically significant evidence suggests that no one channel of technology transfer is better than another and that these channels may be more complementary than substitutes for one another.

Most empirical evidence on technological spillovers in host economies relies on panel data or aggregations of the panel data to the two- and three- digit industry level. Panel data are derived directly from the income statements of individual enterprises and are usually obtained through industrial surveys carried out by the national statistical office. The data compiled at the firm level are often aggregated to the two- and three- digit industry level to avoid problems of confidentiality. One advantage of these data is that they pick up certain country-specific factors that do not appear in cross-country time series data.[13] This may be important if host country characteristics matter. One limitation of panel data analysis is that it is difficult to measure the inter-industry spillovers. The difficulty lies in identifying upstream suppliers (backward linkages) and downstream customers (forward linkages). Studies of R&D spillovers at the firm-level that do not make explicit reference to FDI provide some indirect evidence that there are technology spillovers from FIEs to DEs in other industries. There is also some direct evidence of positive inter-industry spillovers from a panel of individual firms in Venezuela and Indonesia.[14] In Venezuela, backward linkages appear less likely to facilitate spillovers than forward linkages because the FIEs have a high propensity to import, and in Indonesia, spillovers are more likely to happen if the local firm is in close proximity to an FIE.

Evidence of productivity spillovers through FDI is mixed. Studies of Australian manufacturing in 1966, Canadian industry in 1972, and Mexico in the mid-1970s find significant intra-industry spillovers when a foreign presence (in employment or value added) is included as an explanatory variable among other firm and industry characteristics in total factor productivity.[15] Similar results were found in a study of United States FDI in France, Germany, Japan and the United Kingdom from 1968 to 1988 and in two studies of UK manufacturing enterprises covering the periods 1984 to 1992 and 1991 to 1995.[16] Using a dynamic approach to take into account the different economies of scale across industries, a second study of Mexico confirms that a foreign presence can have a significant influence on local productivity growth.[17] These spillover effects were large enough to assist local firms in Mexico to converge to US productivity levels from 1965 to 1982.

Panel data from developing countries, however, provide little or no empirical support for positive net productivity spillovers from FDI. Panel data from Venezuela show significant technology transfer to the FIEs and some positive spillovers to domestic enterprises located near the FIE, but the data also indicate negative spillovers to the local economy as a whole.[18] Other studies at the firm level also find some positive spillovers, but they are limited to certain industries, such as those that had simpler technology (Morocco), or were export oriented (Indonesia).[19] There is also evidence that the presence of United States TNCs in Europe did not result in significant technology spillovers in many

[12] See E. Borensztein, J. De Gregorio, and J-W. Lee, "How Does Foreign Direct Investment Affect Economic Growth", *Journal of International Economics*, Vol. 45, 1998, pp. 115-135. Though not always statistically significant, the results show that FDI has a positive impact on economic growth, depending on the level of human capital in the host country. See also R.E. Baldwin, H. Braconier, and R. Forslid, "Multinationals, Endogenous Growth and technological Spillovers: Theory and Evidence", Centre for Economic Policy Research Discussion paper No. 2155, May 1999.

[13] L.R. de Mello, Jr., "Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data", *Oxford Economic Papers*, Vol. 51, 1999, pp. 133-151.

[14] For Venezuela see B.J. Aitken and A.E. Harrison, "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *American Economic Review*, Vol. 89, No. 3, 1999, pp. 605-618. For Indonesia see F. Sjöholm, "Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Establishment Data", *The Journal of Development Studies*, Vol. 36, No. 1, 1999, pp. 53-73.

[15] However, none of these studies can explain how these productivity spillovers take place. For the study on Australia, see R.E. Caves, "Multinational Firms, Competition and Productivity in Host-Country *Economica*, Vol. 41, 1974, pp. 176-193. For the study on Canada see S. Globerman, "Foreign Direct Investment and 'spillover' Efficiency Benefits in Canadian Manufacturing Industries", *Canadian Journal of Economics*, Vol. 12, 1979, pp. 42-56. For the study on Mexico, see M. Blomström and H. Persson, "Foreign Investment and Spillover Efficiency in an Underdeveloped Economy Evidence from the Mexican Manufacturing Industry", *World Development*, Vol. 11, 1983, pp. 493-501.

[16] M.I. Nadiri, "US Direct Investment an the Production Structure of the Manufacturing Sector in France, Germany, Japan, and the UK", NBER Working Paper, 1991. Using industry-level panel data, Hubert and Pain show significant intra-industry and inter-industry spillovers in UK manufacturing from 1984 to 1992. See F. Hubert and N. Pain, "Inward Investment and Technological Progress in the UK Manufacturing Sector", OECD Economic Department Working paper no. (2000)41. Using panel data for 48 UK manufacturing industries, Liu, et. al., show significant intra-industry productivity spillovers to the domestic economy, the extent to which depends on the absorptive capacity of the DEs. See X. Liu, P. Siler, C. Wang and Y. Wei, "Productivity Spillovers From Foreign Direct Investment: Evidence From UK Industry Level Panel Data", *Journal of International Business*, Vol. 31, No. 3, 2000, pp. 407-425.

[17] M. Blomström and E. Wolff, "Multinational Corporations and Productivity Convergence in Mexico", in W. Baumol, R. Nelson, and E. Wolff, eds., *Convergence of Productivity: Cross-National Studies and Historical Evidence*, (Oxford: Oxford University Press, 1994)

[18] B.J. Aitken and A.E. Harrison, op. cit., 1999. This study, first published in 1994 as a World Bank Research Paper (No. 1248), is one of the first empirical studies to use firm-level panel data to test for spillovers.

[19] For Morocco, see M. Haddad and A. Harrison, "Are there Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco", *Journal of Development Economics*, Vol. 42, 1993, pp. 51-74. For Indonesia, see M. Blomström and F. Sjöholm, "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?", *European Economic Review*, Vol. 43, 1999, p. 915-923.

industries, mainly because competitive pressure forced many local firms with small markets out of business.[20]

There is also little evidence of productivity spillovers in the CEECs. Panel data for industrial enterprises in the Czech Republic from 1992 to 1996 indicate that the presence of foreign firms not only did not result in any significant technology transfer, but that was also evidence of negative spillovers.[21] Imports of capital goods appear to be a more important channel for technology transfer in the Czech Republic. A more recent study based on panel data covering 1995 to 1998 indicate that there are some spillovers in the Czech Republic, but they are limited to enterprises engaging in R&D or producing electrical equipment.[22] This study indicates that the absorptive capacity of enterprises is an important factor in determining the extent of technology spillovers. Studies of other CEECs at the firm- and industry-level find similar results to those in the Czech Republic over the same period.[23] Nevertheless, there is significant evidence that FDI is having a direct positive impact on the restructuring of former state enterprises acquired by TNCs in Hungary.

4. Growth and structural change in Central and East European industry

Previous studies on technology spillovers through FDI focused on countries with relatively less structural change. During the first years of economic transition, virtually all of the CEECs experienced a rapid decline in industrial output, with the technology intensive industries having the greatest decline. When industrial growth returned to the region in the mid-1990s, the technology-intensive and scale-intensive industries had higher than average growth rates in almost every country.[24] Table 1 describes this structural change as the change in the composition of total manufacturing sales produced by firms within five of the more advanced CEECs. These figures were derived from the income statements of individual firms and represent gross revenue minus changes in inventories. The table shows that there is considerable variation across countries, but that the food and beverage industry continues to be the largest one in terms of sales. More importantly, the table shows considerable structural shifts from 1993 to 1998. Every country experienced higher than average growth in the electrical and optical equipment industries,[25] and Hungary saw its office machinery and equipment industry increase from 0.6 per cent of total manufacturing sales in 1993 to 6.3 per cent in 1998. Motor vehicle production also increased significantly in every country except for Estonia, and Hungary saw the share of this sector increase from 4.4 per cent in 1993 to 13.4 per cent in1998. In both industries, the share of sales in FIEs was also significantly above average.

There was also a significant shift in the ownership structure of manufacturing across industries from 1993 to 1998. Table 2 describes the structural change as the percentage shares of manufacturing sales attributed to FIEs in the five CEECs. All of the countries experienced a considerable shift in the percentage of sales attributed to FIEs. Most of this shift can be attributed to the sale of former state-owned enterprises to TNCs, except in the electric and electronic industries which attracted considerable 'greenfield' investment. As of 1998, 70 per cent of manufacturing sales in Hungary were attributed to FIEs whereas only slightly more than 24 per cent were attributed to FIEs in Slovenia. This difference is mainly due to different host country characteristics and especially the privatization strategy followed in each country. For example, the privatization authority in Hungary openly solicited TNCs as potential bidders whereas the strategy in Slovenia was to rely on corporate restructuring by existing management. The Czech Republic and Poland stepped up their solicitation of TNCs in the second half of the 1990s, which the relatively large shift in ownership indicates.

On average FIEs had significantly higher labour productivity than local enterprises in the region.[26] Labour

[20] J. Cantwell, Technological Innovation and Multinational Corporations (Oxford: Basil Blackwell, 1989)

[21] See S. Djankov and B. Hoekman, "Foreign Investment and Productivity Growth in Czech Enterprises", *The World Bank Economic Review*, Vol. 14, No. 1, 2000, pp. 49-64. Evidence from Slovenia also indicate no significant spillovers to the domestic economy as a whole, and that imports of capital goods are the most important channel of technology transfer. See J.P. Damijan and B. Majcen, "Transfer of Technology Through FDI, Spillover Effects and Recovery of Slovenian Manufacturing Firms", Manuscript, University of Ljubljana, 2000.

[22] Y. Kinoshita, "R&D and Technology Spillovers via FDI: Innovation and Absorptive Capacity", CERGE working paper, 2000. The study by Damijan and Majcen, op. cit., also indicates that spillovers in Slovenia are limited to enterprises engaged in R&D activity.

[23] A study of the Czech Republic, Hungary, Slovakia and Slovenia found no widespread inter-industry spillovers from 1993 to 1996. See M. Knell, "FIEs and Productivity Convergence in Central Europe" in G. Hunya, ed., Integration Through Foreign Direct Investment, (Cheltenham, Edward Elgar, 2000). A firm-level study not only finds no productivity spillovers in Bulgaria and Romania, but negative spillovers in Poland. Like in the study by Kinoshita, this study find positive spillovers in the R&D intensive firms. See J. Konings, "The Effect of Direct Foreign Investment on Domestic Firms: Evidence from Firm Level Panel Data in Emerging Economies", LICOS Discussion Paper 86/1999.

[24] See M. Knell and D. Hanzl, "Technology and Industrial Restructuring in Central Europe" in D.A. Dyker and S. Radosevic, *Innovation and Structural Change in Post-Socialist Countries: A Quantitative Approach*, (Amsterdam: Kluwer Academic Publishers, 1999).

[25] NACE DL or ISIC 30-33.

[26] Empirical studies reviewed by UNCTAD suggest that foreign affiliates are often more efficient in production than their domestic counterparts. Labour productivity in FIEs tended to be higher than that in DEs in the same industry. This difference is partly due to economies of scale, but it also reflects changes in the organization of the firm and to a lesser degree the introduction of new products and processes. Yet individual country-, industry-, and firm-specific factors can create

productivity in local enterprises ranged from one-third to two-thirds of the productivity of FIEs on average, measured as net sales per employee. In a few industries the domestic enterprises had higher labour productivity that the FIEs, including basic metals and wearing apparel in the Czech Republic and Estonia, office machinery in Estonia and Poland, and motor vehicles in Estonia. Acquisitions of former state-owned enterprises by foreign firms explain much of the variation in the table. The acquisition of a highly efficient domestic firm can have an important impact on the relative labour productivity levels between domestic and foreign firms and likewise on any regression analysis.

Table 3 shows no clear trend in the convergence in labour productivity between local enterprises and FIEs across industries when measured as net sales per employee. The aggregate productivity gap has appeared to close slightly in the Czech Republic, Estonia and Slovenia, but there are numerous examples where it has increased. In Hungary and Poland the gap appears to have widened significantly. Investment related to privatization and uncertainty about the future of institutional change explain some of the uneven pattern of relative productivity growth. Spillovers also tend to occur over time as competition increases, backward and forward linkages develop, and outsourcing becomes more prevalent.

Table 4 shows that the productivity gap between FIEs and local enterprises appears smaller when measured as value-added per employee. On this basis, in 1993 labour productivity of the local enterprises appeared about two-thirds of FIE in Slovenia and the Czech Republic and more than 80 per cent of the FIEs in Poland. Moreover, the productivity gap appears to have widened significantly in the Czech Republic as a whole, a very different conclusion from what the gross output measure suggests. This may be due to different relative prices of intermediate goods or factor of production between the FIEs and local enterprises. There is evidence across central Europe, and especially in the Czech Republic, that FIEs sometimes pay significantly higher wages and that depreciation in the local firms is much lower since the age of capital is much higher. The parent firm may also engage in transfer pricing.

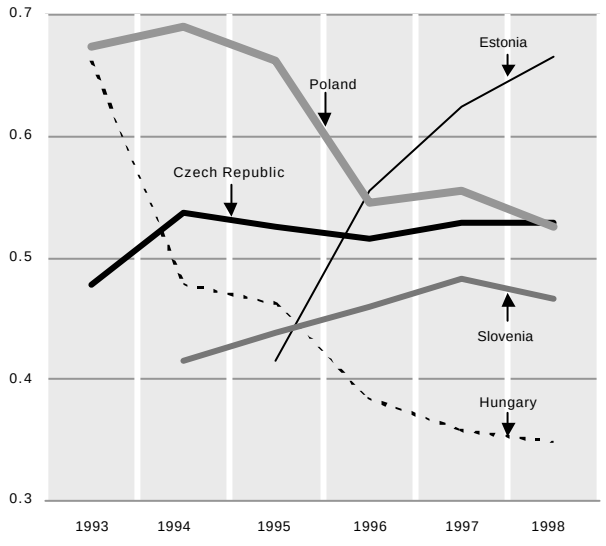
Table 5 shows that the gap between local enterprises and FIEs appears even wider in Hungary when measured by capital intensity. The capital intensity was about 2 to 3 times higher in foreign firms than in domestic-owned firms except in Poland where the difference was much smaller in 1993. Although the FIEs generally have a higher capital intensity than domestic firms, there are numerous examples where it is the other way around. There is no pattern that is consistent across central Europe, but there are notable examples especially in the electrical machinery and wood products industries in Slovenia and the apparel and leather industries in the Czech Republic. By contrast, the difference in capital intensity fell in the Czech Republic and Slovenia indicating that the local enterprises have been increasing their investment in fixed capital faster than the FIEs between 1993 and 1998.

Together, tables 3 through 5 show an uneven pattern of transnational activity that is reflected in some rather large productivity differences across central Europe. Chart 1 shows the ratio of labour productivity levels between domestic and foreign enterprises in aggregate manufacturing from 1993 to 1998. This figure suggests that there has not been enough inter-industry productivity spillovers within central Europe for the local enterprises to catch-up with the FIEs. The rapidly widening productivity gap in Hungary and the Slovak Republic illustrates this point. However, the elimination of the coke and petroleum sector from Hungary softens the decline significantly and shows how a sector with large changes in ownership can affect relative productivity data and any regression analysis.

CHART 1

Productivity convergence in between DEs and FIEs, 1993-1998

(Per cent)



Source: UN/ECE secretariat.

considerable difficulty in any empirical analysis. See: UNCTAD, World Investment Report 1997: Transnational Corporations, Market Structure and Competition Policy, Geneva: United Nations, 1997.

5. Testing for productivity spillovers in the CEECs

The data contained in tables 1 through 5 provide sufficient information to analyze the extent to which inter-industry productivity spillovers have taken place in all of the countries, except Estonia. This can be done by relating the rate of convergence in labour productivity levels between the local enterprises and FIEs to the percentage share of sales in FIEs by industry and the gap in labour productivity between the DEs and the FIEs in 1993, as well as one other explanatory variable.[27] The rate of convergence is defined as the ratio of the 1998 ratio of productivity levels between local enterprises and FIEs to the 1993 (or closest year) ratio of productivity levels between local enterprises and FIEs.

$$CONVERGE = \alpha + \beta_1 FIE + \beta_2 GAP + \varepsilon,$$

where FIE is the share of sales in foreign-owned enterprises in total sales and GAP is the ratio of gross output or sales per employee in domestically-owned firms to the ratio of gross output or sales per employee in foreign-owned firms in 1993. Evidence that multinational activity is generating enough spillovers for productivity convergence is present when $\beta_1 > 0$, and evidence that the relatively size of the productivity gap in 1993 leads to productivity convergence is present when $\beta_2 < 0$.

Table 6 summarizes the estimation results for the four countries. The negative sign for the coefficient on FIE indicates that there are not enough productivity spillovers from FDI to close the productivity gap in central Europe. It also indicates that when there is productivity convergence between FIEs and local enterprises it is more likely to appear in those industries with a declining share of sales accounted for by FIEs. Yet, the coefficient is not significant for either the Czech Republic or Poland. The negative sign for the Czech Republic also does not conform with the evidence that catching-up is occurring in the manufacturing sector as a whole. Evidence from panel data, however, confirms this finding.[28] The negative sign for the coefficient on GAP suggests that the initial size of the productivity gap does influence the probability of productivity convergence in the CEECs. This coefficient is significant in all countries, except Poland.

It is possible to include an additional variable (K/L) into the regression equation that represents the relative change in the capital-intensity between FIEs and local enterprises from 1993 to 1998:

$$CONVERGE = \alpha + \beta_1 FIE + \beta_2 GAP + \beta_3 K/L + \varepsilon,$$

In this equation, $\beta_3 > 0$ represents a decrease in the difference of the capital-labour ratios between the two years and $\beta_3 < 0$ represents an increase in this difference. The coefficient is positive and significant for both Hungary and Slovenia and is negative and insignificant for both the Czech Republic and Poland. This suggests that FIEs in Hungary and Slovenia are becoming increasingly more capital intensive, making it more difficult for local enterprises to incorporate the new technology transferred from abroad. This trend may also explain some of the divergence between FIEs and local enterprises in these two countries. There is also an implication that FIE sales of existing firms will increase relative to the local enterprises, creating further divergence.

6. Does FDI facilitate catching-up with the European Union?

FDI can be a catalyst for catching-up with the European Union (EU) through both the transfer and diffusion of technology to the CEECs. The regressions show only that there are not enough inter-industry productivity spillovers for local enterprises to catch-up with the FIEs. Yet, catching-up will occur if labour productivity in the two sets of enterprises increases faster than in the average enterprise in the EU. Table 8 shows that this is true for all countries, except for the local enterprises in Hungary which have fallen behind at an average of about 2 per cent per year. The average annual productivity growth of FIEs in the region exceeded the EU average from just over 5 per cent in Estonia to well over 10 per cent in Poland. Productivity growth exceeded the EU average by more than 15 per cent in particular industries such as transport equipment (Czech Republic, Hungary and Poland), machinery and equipment (Czech Republic), electrical and optical equipment (Hungary), pulp and paper, etc. (Poland), textiles and textile products (Slovenia) and wood and wood products (Slovenia). In all of the countries except Estonia productivity growth in local enterprises producing machinery and equipment was higher than the EU average and higher than the FIEs in the respective country. This indicates that productivity spillovers might be occurring, but as in the cases of Venezuela, Morocco and Indonesia, they are limited to certain industries.

The average labour productivity of the FIEs and local enterprises in total manufacturing remains well below the average EU productivity level in 1998. When measured in terms of 1996 PPPs, labour productivity of FIEs in the Czech Republic, Hungary and Slovenia was about three-fourths of the average productivity level in the EU in 1998, and even exceeded the EU average in some industries. In contrast, the average productivity level of FIEs in Poland and Estonia was about one-half and one-fourth of the EU average respectively. Of the industries that exceeded the EU average the most notable is the transport and equipment sector in the Czech Republic and Hungary. Some enterprises within the electrical and optical equipment industry also exceeded the EU average. In both cases domestic outsourcing has become an important potential source of productivity spillovers.[29] For example, Volkswagen owns a majority share of Skoda Automotive, but often outsources production to Skoda General Manufacturing, a domestically-owned firm. The most obvious example of domestic outsourcing appears in office machinery and computer equipment in Hungary. A concentration of FDI

[27] This section adopts the method for testing for intra-industry productivity spillovers developed by Blomström and Wolff, op. cit., 1994. In their study, Blomström and Wolff estimate productivity spillovers in two ways: (1) the rate of labour productivity growth of DEs within an industry; and (2) the rate of convergence in labour productivity levels between local and foreign firms within an industry. This paper tests for productivity spillovers using the second approach because it avoids constructing price indices for each industry.

[28] See S. Djankov and B. Hoekman, op. cit., 2000; and Y. Kinoshita, op. cit., 2000.

[29] U. Hotopp and S. Radosovic, "The Product Structure of Central and Eastern European Trade: The Emerging Patterns of Change and Learning", *MOCT-MOST*, Vol. 9, 1999, pp. 171-199.

in computing equipment by several well-known European and American firms has resulted in considerable outsourcing their production to domestic-owned firms, especially Videoton.[30] These examples suggest that there may be considerable scope for the transfer of technology and technology spillovers in central Europe.

7. Does FDI increase innovative activity in Central Europe?

R&D plays a dual role of stimulating innovation and identifying, assimilating and utilizing existing knowledge from abroad.[31] Since most R&D takes place in TNCs located in the most advanced countries, and that the CEECs must rely on the transfer of technology and technology spillovers, it becomes essential for R&D to take on the second role. Panel data from the Czech Republic at the firm level shows that local enterprises that have the absorptive capacity are much more likely to catch-up with the FIEs.[32] Since growth depends on innovation and innovation depends on R&D, it is possible to examine the influence that FDI might have on innovation. Data from innovation surveys conducted in Poland and Slovenia are used to measure the percentage of enterprises engaged in R&D activity and have introduced either a product or a process innovation between 1994 and 1996. The expectation is that R&D activity and the FDI will have a positive impact on the extent to which enterprises innovate in the economy. The equation representing the percentage of innovative firms (innovate) can be written as:

$$INNOVATE = \alpha + \beta_1 R\&D + \beta_2 FIECAP + \varepsilon,$$

where R&D is the share of enterprises engaged in R&D and FIECAP is the share of enterprises with at least 10 per cent foreign capital.

Table 8 shows the results of this regression for 1996. The data used in this regression were aggregated to the 2-digit ISIC industry level. They confirm that there is a very close and significant relationship between firms that engage in R&D activity and those that introduce new products and processes. This suggests that R&D activity is complementary to the innovation process and that the domestic R&D effort is important for growth and innovation in central Europe. The table also shows, however, that the share of foreign capital at the industry level is highly insignificant, indicating that there is no relationship between firms with FDI and the introduction of new and more modern products and process technologies.[33] Although this result suggests that FDI might not be an important channel for technology transfer in the CEECs, the data from the innovation survey does not contain information about the transfer of managerial skills or organizational restructuring. This is one of the first activities that TNCs undertake after a new acquisition.

8. Concluding comments

The data presented in this paper show that there is a large productivity gap between the FIEs and the local enterprises, but with the exception of Hungary, both are catching up with the average productivity of EU industry when measured in PPPs. There is, however, no direct evidence of widespread productivity spillovers that are large enough to close the productivity gap between local enterprises and the FIEs. This is found in the negative relationship between the share of sales of FIEs and the rate of convergence between local enterprises and FIEs. These results support the idea that there are certain advantages of backwardness and they suggest that the local firms have the opportunity for productivity convergence. But future prospects will depend on whether these firms have the technological capability to absorb the new technology.

There are certain problems with such an analysis.[34] One particular problem with the analysis used in this study is that there is a high correlation between FDI and the size of the firm. The data clearly show that FIEs are generally larger than the local enterprises. Larger firms tend to have certain economies of scale that bias labour productivity upwards. One way to avoid some of the estimation bias is to use a panel data set of individual firms, if it is possible to obtain such data. Many countries do not release such data because it contains confidential financial and operating data from individual firms.

An important question that this paper raises is whether FDI is an important channel for technology transfer and technology spillovers in the CEECs. There is little evidence that FDI generates technological spillovers in the region, suggesting that FDI may not be the panacea that Central and Eastern Europe is looking for. It will undoubtedly take time for technology to transfer and spillover in the region, but the evidence from other countries that FDI generates significant spillovers in the host economy is relatively weak. If the objective is to catch-up with the European Union (or North America), then policies should be focused not only on the promotion of FDI, but also on improving the national innovation system (or social capabilities) and the absorptive capacities of local enterprises. Since FDI is complementary to other channels of technology transfer, such a policy would be more likely to attract the kinds of FDI that would result in technological spillovers.

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[30] A. Szalavetz, "Sailing Before the Wind of Globalization: Corporate Restructuring in Hungary", Institute for World Economics Working Paper No. 78, Hungarian Academy of Sciences, 1997.

[31] W.M. Cohen and D.A. Levinthal, "Innovation and Learning: The Two Faces of R&D", *Economic Journal*, Vol. 99, 1989, pp. 176-193.

[32] Y. Kinoshita, op. cit., 2000.

[33] The variable is highly insignificant even without R&D activity included.

[34] Jenkins discusses some of the difficulties of doing an empirical analysis of FDI at the industry level and argues that conventional cross-section analysis of the behaviour of firms at the industry level does not provide adequate evidence of the relationship between FDI and growth. Instead, he suggests that longitudinal industry studies provide a better methodology. See R. Jenkins, "Comparing Foreign Subsidiaries and Local Firms in LDCs: Theoretical Issues and Empirical Evidence", *The Journal of Development Studies*, Vol. 26, 1990, pp. 205-228.

TABLE 1

Percentage share of total manufacturing sales by industry, 1993 and 1998

		Czech Republic		Estonia		Hungary		Poland		Slovenia	
ISIC	Industry	1993	1998	1995	1998	1993	1998	1993	1998	1995	1998
D	**Total Manufacturing**	100	100	100	100	100	100	100	100	100	100
15+16	Food, beverages and tobacco	19.2	16.8	37.2	30.2	26.9	19.7	26.2	24.8	12.2	11.6
17	Textiles	4.7	3.7	8.2	6.6	2.7	2.1	3.6	2.3	4.5	4.6
18	Wearing apparel and fur	1.0	0.8	3.6	3.8	1.9	1.7	1.9	1.5	2.7	2.3
19	Leather products	2.2	0.7	1.4	1.2	1.3	0.8	1.0	0.6	*	1.6
20	Wood products	1.8	1.4	6.9	10.1	1.7	1.4	2.0	2.5	4.0	3.4
21	Pulp and paper products	2.5	2.8	0.5	1.7	1.8	1.8	1.9	2.3	4.4	3.9
22	Printing and publishing	1.4	1.7	2.4	4.8	4.6	3.4	2.3	2.7	4.6	4.4
23	Petroleum and Coke	5.7	3.1	16.4	7.7	11.6	7.2	8.3	7.5	*	0.5
24	Chemicals and chemical products	6.3	7.3	In 23	In 23	10.2	7.5	8.6	8.0	9.7	9.9
25	Rubber and plastics	2.5	3.6	0.9	2.4	2.8	3.4	2.9	3.2	4.5	5.1
26	Non-metallic mineral products	5.4	5.9	4.6	5.2	3.4	3.1	4.3	4.4	3.9	4.0
27	Basic metals	12.2	12.8	2.5	6.9	4.7	4.4	9.4	7.7	5.8	4.5
28	Fabricated metals	4.7	5.5	In 27	In 27	5.4	4.3	3.1	4.0	6.6	7.6
29	Machinery and equipment	10.9	8.8	2.3	2.8	6.3	5.4	7.4	6.5	8.8	10.0
30	Office machinery and computers	0.1	0.0	3.0	6.0	0.8	6.3	0.1	0.3	0.9	*
31	Electrical machinery	3.9	5.0	In 30	In 30	3.0	4.5	3.1	3.4	4.7	4.4
32	Radio, telephone and communication equipment	0.6	1.3	In 30	In 30	2.2	5.9	1.6	2.6	2.1	2.5
33	Precision instruments	0.7	0.7	In 30	In 30	1.6	1.3	0.9	1.1	2.2	2.2
34	Motor vehicles	8.7	13.7	4.5	3.2	4.4	13.4	5.3	8.4	9.6	11.3
35	Other transport equipment	2.3	1.6	In 34	In 34	0.4	0.6	3.6	3.1	*	0.6
36	Furniture and miscellaneous manufacturing	2.6	2.5	5.6	7.3	1.9	1.3	2.4	2.8	3.5	3.5
37	Recycling	0.6	0.4	In 36	In 36	0.0	0.4	0.3	0.3	*	*

Source: WIIW Database on Foreign Investment Enterprises.

Note: Data for Estonia and Slovenia is for 1995 instead of 1993. * indicates sectors with less than 3 multinational firms but are included in total manufacturing. The share of total manufacturing sales was 5.5 per cent in 1995 and 2.1 per cent in 1998

TABLE 2

Percentage share of sales in FIEs by industry, 1993 and 1998

		Czech Republic		Estonia		Hungary		Poland		Slovenia	
ISIC	Industry	1993	1998	1995	1998	1993	1998	1993	1998	1995	1998
D	**Total Manufacturing**	11.5	27.2	20.1	28.2	41.3	70.0	13.7	40.0	17.6	24.4
15+16	Food, beverages and tobacco	13.9	24.9	19.8	19.3	48.1	55.7	12.5	37.6	7.2	10.2
17	Textiles	0.5	14.3	40.5	70.5	38.9	55.9	7.4	14.6	7.1	10.7
18	Wearing apparel and fur	1.6	6.9	4.1	9.8	39.6	47.2	23.3	40.1	2.0	1.1
19	Leather products	2.3	6.5	–	45.5	34.0	57.3	5.4	16.5	*	*
20	Wood products	4.7	20.8	28.6	16.3	31.8	45.5	12.9	43.6	2.5	2.6
21	Pulp and paper products	8.9	29.1	–	77.5	66.8	77.6	37.4	72.1	41.0	48.1
22	Printing and publishing	1.8	30.8	–	19.7	42.6	40.5	27.3	54.1	4.9	6.2
23	Petroleum and Coke	–	–	27.4	44.4	2.1	100.0	–	0.4	*	*
24	Chemicals and chemical products	8.5	14.3	In 23	In 23	47.4	83.6	8.4	32.7	14.4	20.4
25	Rubber and plastics	21.8	45.8	–	26.3	58.1	51.7	17.4	56.7	13.6	20.1
26	Non-metallic mineral products	23.4	39.4	56.8	61.0	53.5	70.2	15.5	44.7	8.5	20.7
27	Basic metals	1.3	3.9	–	10.6	14.6	47.7	5.7	10.7	2.4	18.4
28	Fabricated metals	3.9	25.6	In 27	In 27	43.5	39.1	11.6	30.3	2.0	6.4
29	Machinery and equipment	2.0	12.3	11.8	20.3	32.9	52.6	8.1	18.5	20.4	26.1
30	Office machinery and computers	–	11.1	–	42.7	51.5	95.8	26.7	18.4	18.3	*
31	Electrical machinery	6.8	40.3	In 30	In 30	71.8	79.9	16.2	51.4	15.2	21.3
32	Radio, telephone and communication equipment	2.5	41.8	In 30	In 30	53.5	82.8	31.7	81.8	39.6	42.5
33	Precision instruments	9.4	25.2	In 30	In 30	47.7	40.6	9.0	38.0	11.9	22.6
34	Motor vehicles	58.5	76.5	–	13.7	64.0	96.8	53.2	89.9	72.3	83.1
35	Other transport equipment	2.2	2.3	In 34	In 34	60.1	48.6	3.5	7.6	*	*
36	Furniture and miscellaneous manufacturing	1.5	30.5	–	18.9	26.2	33.0	31.2	60.4	2.9	1.6
37	Recycling	–	40.3	In 36	In 36	27.9	31.6	22.4	20.6	–	–

Source: WIIW Database on Foreign Investment Enterprises.

Note: Data for Estonia and Slovenia is for 1995 instead of 1993. * indicates sectors with less than 3 multinational firms but are included in total manufacturing.

TABLE 3

Productivity convergence gross output per employee between DEs and FIEs, 1993 and 1998
(Ratio of productivity levels between DEs and FIEs)

		Czech Republic		Estonia		Hungary		Poland		Slovenia	
ISIC	Industry	1993	1998	1995	1998	1993	1998	1993	1998	1995	1998
D	**Total Manufacturing**	0.48	0.65	0.42	0.67	0.66	0.37	0.62	0.47	0.44	0.47
15+16	Food, beverages and tobacco	0.95	0.75	0.50	0.48	0.58	0.52	0.82	0.45	0.78	0.78
17	Textiles	0.89	1.00	0.53	0.53	0.63	0.49	0.48	0.73	0.78	0.84
18	Wearing apparel and fur	1.09	2.21	2.20	1.53	0.64	0.55	0.64	0.58	0.58	0.82
19	Leather products	1.11	1.02	..	0.43	0.62	0.68	0.66	0.87	..	..
20	Wood products	0.62	0.89	0.15	0.68	0.46	0.36	0.75	0.42	0.67	0.93
21	Pulp and paper products	0.61	0.97	..	0.54	0.55	0.37	2.91	1.60	0.32	0.46
22	Printing and publishing	2.08	0.86	..	0.59	0.42	0.39	0.42	0.50	1.32	1.17
24	Chemicals and chemical products	0.68	1.00	0.48	0.46	0.86	0.51	0.58	0.70	0.67	0.65
25	Rubber and plastics	0.52	0.48	–	0.47	0.35	0.65	0.48	0.55	0.99	1.01
26	Non-metallic mineral products	0.44	0.53	0.36	0.39	0.59	0.43	0.46	0.49	0.52	0.45
27	Basic metals	0.70	1.17	0.0	1.41	0.75	0.64	0.83	0.63	1.78	0.82
28	Fabricated metals	1.24	0.50	In 27	In 27	0.42	0.70	0.55	0.43	0.70	0.95
29	Machinery and equipment	1.05	0.63	0.35	0.35	0.66	0.66	0.45	0.56	0.61	0.72
30	Office machinery and computers	..	..	..	1.35	1.13	0.15	0.33	1.64	0.43	..
31	Electrical machinery	0.67	1.02	..	In 30	0.76	0.51	0.75	0.69	0.74	0.76
32	Radio, telephone and communication equipment	0.31	0.86	..	In 30	0.34	0.18	0.57	0.19	0.44	0.58
33	Precision instruments	1.02	0.53	..	In 30	0.51	0.79	0.43	0.29	1.28	0.86
34	Motor vehicles	0.27	0.39	..	1.60	0.32	0.12	0.23	0.19	0.22	0.19
35	Other transport equipment	0.90	0.40	..	In 34	0.62	0.59	0.56	1.05	..	..
36	Furniture and miscellaneous manufacturing	0.63	0.43	..	0.56	0.75	0.70	0.61	0.54	0.72	0.70

Source: WIIW Database on Foreign Investment Enterprises.

Note: Data for Estonia and Slovenia is for 1995 instead of 1993. * indicates sectors with less than 3 multinational firms but are included in total manufacturing.

TABLE 4

Productivity convergence of value added per employee between DEs and FIEs, 1993 and 1998
(Ratio of productivity levels between DEs and FIEs)

		Czech Republic		Estonia		Hungary		Poland		Slovenia	
ISIC	Industry	1993	1998	1995	1998	1997	1998	1993	1998	1995	1998
D	**Total Manufacturing**	0.66	0.53	0.56	0.70	0.35	0.39	0.84	0.47	0.66	0.70
15+16	Food, beverages and tobacco	0.70	0.52	0.47	0.44	0.42	0.49	0.85	0.45	0.64	0.71
17	Textiles	1.33	0.78	0.49	1.05	0.41	0.41	0.65	0.73	0.86	0.71
18	Wearing apparel and fur	1.05	1.00	1.73	1.16	0.59	0.56	0.81	0.58	1.49	0.72
19	Leather products	1.05	0.73	..	0.98	0.56	0.67	0.60	0.87	..	..
20	Wood products	0.47	0.40	-0.40	0.75	0.33	0.35	0.96	0.42	1.08	0.53
21	Pulp and paper products	0.50	0.87	..	0.59	0.26	0.32	4.02	1.60	0.48	0.59
22	Printing and publishing	1.87	0.71	..	1.05	0.35	0.47	0.65	0.50	1.53	1.31
24	Chemicals and chemical products	0.49	0.57	0.26	0.28	0.33	0.33	0.62	0.70	0.89	1.05
25	Rubber and plastics	0.59	0.45	..	0.31	0.46	0.56	0.48	0.55	0.96	1.10
26	Non-metallic mineral products	0.62	0.42	0.73	0.40	0.36	0.41	0.44	0.49	0.47	0.49
27	Basic metals	0.75	0.72	..	1.07	0.48	0.70	0.99	0.63	0.99	0.70
28	Fabricated metals	0.86	0.70	In 27	In 27	0.53	0.64	0.56	0.43	0.76	0.93
29	Machinery and equipment	1.40	0.68	0.51	0.36	0.59	0.77	0.41	0.56	0.57	0.72
30	Office machinery and computers	..	..	..	1.03	0.08	0.12	0.12	1.64	0.52	..
31	Electrical machinery	1.15	0.72	..	In 30	0.41	0.48	0.81	0.69	0.67	0.77
32	Radio, telephone and communication equipment	0.10	0.54	..	In 30	0.48	0.44	0.59	0.19	0.40	0.58
33	Precision instruments	0.85	0.84	..	In 30	0.61	0.68	0.50	0.29	2.32	1.02
34	Motor vehicles	0.81	0.38	..	1.45	0.22	0.20	2.84	0.19	0.57	0.47
35	Other transport equipment	2.93	1.21	..	In 34	0.50	0.92	0.66	1.05	..	..
36	Furniture and miscellaneous manufacturing	1.18	0.68	..	0.59	0.43	0.63	0.76	0.54	0.97	1.63

Source: WIIW Database on Foreign Investment Enterprises.

Note: Data for Estonia and Slovenia is for 1995 instead of 1993. * indicates sectors with less than 3 multinational firms but are included in total manufacturing.

TABLE 5

Comparison of capital-intensity (capital assets per employee) between DEs and FIEs, 1993 and 1998

(Ratio of capital intensity between DEs and FIEs)

		Czech Republic		Estonia		Hungary		Poland		Slovenia	
ISIC	Industry	1993	1998	1995	1998	1993	1998	1993	1998	1995	1998
D	**Total Manufacturing**	0.54	0.70	0.14	0.52	0.56	0.32	0.92	0.54	0.66	0.60
15+16	Food, beverages and tobacco	1.08	0.60	0.21	0.25	0.42	0.28	1.06	0.45	0.94	0.71
17	Textiles	0.19	0.68	0.71	0.54	0.72	0.49	0.47	0.95	0.92	0.97
18	Wearing apparel and fur	2.38	1.13	0.96	1.82	0.63	0.39	0.81	0.79	0.45	0.46
19	Leather products	6.23	2.06	..	0.28	0.51	0.83	2.85	1.11	*	*
20	Wood products	0.67	0.81	0.19	0.45	0.64	0.24	1.02	0.32	0.89	0.61
21	Pulp and paper products	0.62	0.97	..	0.26	0.91	0.52	0.62	0.22	0.23	0.30
22	Printing and publishing	0.14	0.95	..	2.33	0.55	0.44	1.16	0.60	0.98	0.85
24	Chemicals and chemical products	0.65	0.74	0.11	0.17	0.95	0.48	1.03	0.82	1.01	0.87
25	Rubber and plastics	0.42	0.52	..	0.27	0.31	0.48	1.91	0.59	1.66	0.87
26	Non-metallic mineral products	0.39	0.34	0.10	0.17	0.41	0.27	0.80	0.32	0.51	0.29
27	Basic metals	0.51	1.03	..	0.89	0.36	0.29	1.21	1.06	3.05	0.97
28	Fabricated metals	0.63	1.09	..	In 27	0.34	0.23	0.61	0.44	0.77	1.06
29	Machinery and equipment	0.67	0.98	0.24	0.70	0.56	0.47	1.37	0.59	0.83	0.86
30	Office machinery and computers	..	..	..	0.89	0.63	0.84	1.71	1.06	*	*
31	Electrical machinery	0.26	0.89	..	In 30	0.36	0.31	1.09	0.73	0.76	0.71
32	Radio, telephone and communication equipment	0.52	0.55	..	In 30	1.21	0.47	0.64	0.36	0.28	0.41
33	Precision instruments	0.92	0.82	..	In 30	1.27	0.82	0.44	0.37	1.19	1.07
34	Motor vehicles	0.52	0.61	..	0.99	0.54	0.15	0.32	0.29	1.17	1.09
35	Other transport equipment	0.82	3.41	..	In 34	0.71	0.43	1.34	0.80	*	*
36	Furniture and miscellaneous manufacturing	0.28	0.75	..	0.49	0.62	0.48	1.61	0.68	0.65	0.55

Source: WIIW Database on Foreign Investment Enterprises.

Note: Data for Estonia and Slovenia is for 1995 instead of 1993. * indicates sectors with less than 3 multinational firms but are included in total manufacturing. Data for Hungary is nominal capital; data for the remaining countries is fixed assets.

TABLE 6

Regression analysis I of productivity convergence between FIEs and DEs

	Dependent variable: Convergence			
Independent variables	Czech Republic	Hungary	Poland	Slovenia
Constant	1.913	2.143	1.810	1.663
	(4.32)	(6.29)	(3.86)	(11.60)
FIE	-0.118	-1.368	-1.363	-0.640
	(-0.12)	(-2.81)	(-1.06)	(-2.39)
GAP	-0.885	-0.874	-0.360	-0.636
	(-2.43)	(-2.31)	(-0.88)	(-4.69)
R^2	0.32	0.45	0.13	0.61
F-statistic	3.74	7.05	1.22	10.99
Sample size	19	20	20	17

Source: UN/ECE secretariat.

Note: Absolute value of the t-statistic shown in parentheses. Data does not include the coke and petroleum. Dependant variable convergence is defined as the ratio of the 1998 ratio of productivity levels between DEs to productivity in FIEs to the 1993 ratio of productivity in Des to productivity in FIEs. Data for the dependent variables is found in table3.

TABLE 7

Regression analysis II of productivity convergence between FIEs and DEs

Independent variables	Dependent variable: Convergence			
	Czech Republic	*Hungary*	*Poland*	*Slovenia*
Constant	1.896	1.845	1.851	1.165
	(4.32)	(5.96)	(2.58)	(5.19)
FIE	-0.059	-1.221	-1.382	-0.653
	(-0.06)	(-2.92)	(-1.03)	(-2.91)
GAP	-0.816	-1.155	-0.364	-0.463
	(-1.79)	(-3.41)	(-0.85)	(-3.53)
K/L	-0.027	0.509	-0.047	0.404
	(-0.27)	(2.74)	(-0.08)	(2.62)
R^2	0.32	0.63	0.13	0.75
F-statistic	2.37	9.00	0.77	12.71
Sample size	19	20	20	17

Source: UN/ECE secretariat.

Note: Absolute value of the t-statistic shown in parentheses. Data does not include the coke and petroleum. Dependant variable convergence is defined as the ratio of the 1998 ratio of productivity levels between DEs to productivity in FIEs to the 1993 ratio of productivity in Des to productivity in FIEs. Data for the dependent variables is found in table 3.

TABLE 8

International comparison of labour productivity, 1998
(Value added per person employed)

			EU-15 average	*Percentage of EU-15 average*									
				Czech Republic		*Estonia*		*Hungary*		*Poland*		*Slovenia*	
NACE	*ISIC*		*(ecu)*	*FIE*	*DE*	*FIE*	*DE*	*FIE*	*DE*	*FIE*	*DE*	*FIE*	*DE*
D		**Total Manufacturing**	50 048	0.82	0.45	0.28	0.20	0.76	0.27	0.49	0.31	0.72	0.51
DA	15-16	Food products and beverages	45 223	0.84	0.57	0.52	0.23	0.62	0.31	0.63	0.33	1.01	0.72
DB	17-18	Textiles and textile products	28 636	0.61	0.50	0.26	..	0.49	0.23	0.44	0.35	0.87	0.57
DC	19	Leather and leather products	25 115	0.55	0.41	0.34	0.34	0.41	0.27	0.44	0.36	0.95	0.54
DD	20	Wood and wood products	34 739	1.12	0.45	0.33	0.25	0.74	0.26	0.53	0.38	1.11	0.59
DE	21-22	Pulp, paper , publishing and printing	55 572	0.73	0.57	0.30	0.23	0.88	0.34	0.47	0.51	0.74	0.64
DG	24	Chemicals and man-made fibres	80 154	0.90	0.51	0.20	0.06	0.71	0.23	0.47	0.27	0.59	0.62
DH	25	Rubber and plastic products	46 557	1.00	0.45	0.73	0.23	0.71	0.40	0.62	0.38	0.62	0.68
DI	26	Other non-metallic mineral products	46 966	1.24	0.52	0.65	0.26	0.76	0.31	0.50	0.34	1.09	0.54
DJ	27-28	Basic and fabricated metals	44 758	0.69	0.53	0.27	0.28	0.57	0.37	0.60	0.39	0.66	0.53
DK	29	Machinery and equipment n.e.c.	49 556	0.57	0.39	0.43	0.16	0.43	0.33	0.42	0.28	0.67	0.48
DL	30-33	Electrical and optical equipment	55 820	0.52	0.35	0.19	0.20	0.82	0.27	0.54	0.32	0.68	0.50
DM	34-35	Transport equipment	55 164	1.01	0.36	0.26	0.38	1.24	0.30	0.41	0.30	0.73	0.31
DN	36-37	Furniture; manufacturing n.e.c.	33 961	0.78	0.53	0.39	0.23	0.48	0.31	0.45	0.34	0.35	0.57
		Average annual growth rate relative to EU-15 growth rate, 1993-1998											
D		**Total Manufacturing**	..	6.77	2.60	4.80[a]	4.77[a]	7.73[b]	-1.83[b]	10.50	4.70	5.05[c]	7.38[c]

Source: Eurostat Cronos Database and WIIW Database on Foreign Investment Enterprises.

Note: Eurostat estimates of EU average. Calculations based on 1996 producer prices and 1996 PPPs.

a 1996-1998.

b Hungarian growth rate relative to EU-15 growth rate of industrial production.

c 1995-1998.

TABLE 9

Regression analysis of industrial innovation and FDI

	Dependent variable: percentage of innovative firms			
	Poland		*Slovenia*	
Constant	0.228	0.324	0.101	0.101
	(6.23)	(4.34)	(5.57)	(4.60)
Share of firms engaged in R&D	1.245	1.266	0.958	0.958
	(7.07)	(7.37)	(16.76)	(15.47)
Share of firms with foreign capital	..	-0.350	..	0.002
		(-1.46)		(0.007)
R^2	0.71	0.74	0.94	0.94
SEE	0.105	0.102	0.049	0.059
Sample size	21	21	19	19

Source: UN/ECE secretariat.

Note: t-statistic shown in parentheses.