Economic Transformation and Industrial Restructuring: The Hungarian Experience

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Preface

This book, *Economic Transformation and Industrial Restructuring : The Hungarian Experience*, is published in the Economic Research Series of the Institute of Economic Research of Hitotsubashi University. It represents the major results obtained from a Hungary-Japan joint research project entitled 'Multinationals and Local Resources' that explores the important aspects of industrial restructuring in Hungary in the transition period towards a market economy. This international project was launched and conducted by the staff members at the Institute of Economic Research of Hitotsubashi University, the Institute of Sociology, and the Institute for World Economics of the Hungarian Academy of Sciences, and the Faculty of Economics and Business Administration of the University of Debrecen.

As our home institutions, these organizations provided considerable support with our research within the framework of the project. We owe thanks to our colleagues and other staff members for their kind cooperation.

Many others deserve recognition for their contribution to this work. We especially thank Cristiano Antonelli, Svetlana Avdasheva, Iván Bélyácz, Judit Berényi, László Csonka, Bruno Dallago, Károly Fazekas, Valeria Gattai, Judit Hamar, Shuichi Ikemoto, Annamária Inzelt, Michael Keren, Yukinobu Kitamura, Péter Mihályi, Satoshi Mizobata, Éva Ozsvald, Magdolna Sass, Kazuko Sato, Fumikazu Sugiura, Taku Suzuki, Jan Svejnar, Andrea Szalavetz, Tomoka Takeda, Hiroshi Tanaka, Álmos Telegdy, Tsuyoshi Yanagihara, Kengo Yasui, Jacques Werner, and anonymous journal referees for their valuable comments and suggestions on the earlier versions of our articles contained in this book and Lubica Bajzikova, Wojcak Emil, Sajgalikova Helena, and Polakova Michaela for their kind support with our company survey conducted in Slovakia. We are also grateful to Akira Ishida and Jim Treadway for their editorial assistance with the preparation of the manuscripts.

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Last but not least, we would like to extend our thanks to Shuichiro Kobayashi and other editorial staff members of the Maruzen Publishing Co. for their generous efforts toward the production of this book.

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Introduction

During the two decades beginning from the collapse of the communist bloc in Central and Eastern Europe, Hungary was recognized as a reforming country of former socialist transition economies in the international community. In fact, this country had always been a leader in terms of the progress in transition to a market economy and in nation-building based on democracy and the rule of law.

To maintain a favorable course in the sweeping transformation of the socio-economic system in Hungary, a large influx of foreign capital and advancement of western multinational enterprises (MNEs) played a crucial role. The active investment activities by foreign companies lowered hurdles for Hungary to overcome a capital shortage that is a serious impediment to structural reforms in a transition economy, boosted the domestic corporate sector, and greatly improved the position of Hungary in the world economy through the substantial expansion of exports. In other words, the reform-promoting effects of foreign direct investment (FDI) and MNEs were remarkable in Hungary.

In recent years, however, heavy dependence on FDI and MNEs has been found to have several side-effects. They include (a) the emergence of 'technological economic dualism' (Farkas, 2000; 2004) between domestic and foreign corporate sectors; (b) the tendency to increase in profit repatriation by MNEs and consequent current account deficit; (c) regional disparity in income and unemployment; and (d) the vulnerability of the national economy to changes in the global strategy of major international corporations. To tackle these new challenges for the Hungarian government and citizens, reconsideration of the national development strategy is required in order to promote the stable settlement of MNEs and deepen ties between these foreign companies and local industrial resources, given the substantial presence of foreign capital in the country.

A Hungarian-Japanese joint research project, 'Multinationals and Local Resources,' was conducted to provide scientific evidence for drawing policy implications for the above purpose. This book is based on the major findings obtained from this international project.

As the project title suggests, we originally aimed to empirically investigate the relationship between MNEs and local industrial

resources (i.e., domestic firms, universities and other research institutions, and regional economies) in transition Hungary. In the course of the project, however, our research interest was extended to include organizational innovation, which is now regarded as one of the most important issues regarding the industrial restructuring in the Hungarian economy.

From the end of the last century, the service sector in general, and the knowledge-intensive business service sector in particular, became the key driver of new job creation in Europe and outpaced manufacturing. In addition to the fact that the service sector's share in the GDP ranges from 70-80% in the developed countries and 58-63% in the post-socialist countries in the Central and Eastern European region, we still have a poor understanding of the factors shaping innovation and sustainable competitiveness in this sector.

The explanatory factors of this knowledge deficiency are the following. First, in spite of the fact that information and communication technologies are extremely important, in both the service and manufacturing industries, non-technological innovation is dominant in the service sector and receives less attention than technological innovation. Secondly, there is a consensus among policymakers and academics that innovation and learning are the key sources for success of the national economies within the context of intensive global competitive pressure. However, this consensus on the importance of innovation and learning generally ignores the fact that innovation is embedded into social and organizational relations in the workplace. For example, the U. S. has been more successful in technological innovation and, also, in non-technical fields than Europe (Makó et al., 2006). In this respect, we agree with the following observation of Arundel et al. (2006):

> "The bottleneck in improving the innovation capabilities of European firms might not lie in the low level of R&D expenditure, which is strongly determined by industry structures and therefore difficult to change, but the widespread existence of working environments that are unable to provide a fertile environment for innovation" (pp. 28-29).

Thirdly, the European economy is characterized by a great variety in the forms of work organization, reflecting various degrees of

learning and innovation capacity of the firms. The European comparison indicates that the learning and innovation oriented forms of work organization, which are characterized by a high level of autonomy in work, learning and problem-solving capabilities, and task complexity, are more widely diffused in the North European countries than elsewhere in Europe. The position of Hungary and Slovakia, which are at the heart of our empirical research within the EU-27 countries, is rather unbalanced. This means that, in Hungary and Estonia, the share of learning or innovative organization is the highest among the post-socialist countries of the region. However, on the other hand, the work organization of mass production (the Taylorist model), characterized with a minimum learning and innovation capability, exceeds the EU average. A similar pattern is observable in Slovakia, where the share of 'lean organization' having limited learning and innovative capability is higher than the EU average, but, at the same time, the rate of a Taylorist work organization also exceeds the EU average[1].

With the above motivation, we designed the book as an investigation of the major aspects of the industrial restructuring closely linked with FDI and MNEs as well as the organizational innovation within the service industry gleaned from the results of company surveys conducted in Hungary and Slovakia, which were aimed at developing a more comprehensive picture of the economic transformation in Hungary.

The book has eight chapters. The first two in Part I deal with economic reform and the role of FDI in Hungary. Chapter 1 is a comprehensive survey of the studies of the impacts of FDI on the Hungarian economy from 1989 through 2004 with emphasis on corporate restructuring. In this chapter, we maintain that large-scale FDI and intensive business activities by MNEs have played a crucial role in Hungary's transition to a market economy. Indeed, the massive inflow of foreign capital has supported the national economy by spurring effective demand, contributing substantially to its long-lasting and stable economic growth and to the drastic changes in the corporate sector through the conversion of ownership structure, improvements in the production system, strengthening of market competitiveness,

[1] For more details, see Valeyre et al. (2009).

modernization of management systems, and revitalization of R&D and innovation activities. In spite of all this, Hungary still has many problems with corporate restructuring even though several years have passed since EU accession. We maintain that the Hungarian government and the business sector should reconsider their passive strategy of economic transformation and devote more effort to promoting the stable settlement of MNEs and stronger ties between these foreign companies and local industrial resources.

Chapter 2 examines the effects of ownership transformation from the state to the private sector on firm performance in the post-privatization period. In this chapter, we empirically assess the advantage of foreign acquisition in comparison with company buy-outs by domestic investors. Among researchers of transition economies, there is a consensus that, in Central and East European countries, the effects of enterprise privatization have been mostly positive on the ex-post performance of former state-owned enterprises. Earlier research works, however, do not report whether these effects are due to the privatization process itself or to other factors. In fact, the empirical results regarding the relationship between ownership changes and firm performance in Hungary are mixed. Using annual census data of Hungarian enterprises for the early 2000s, we reexamine this issue. In this chapter, we propose a new empirical methodology on the basis of meta-analysis techniques[2] to overcome the data limitations arising from an insufficient observation period. As a result, we effectively capture restructuring efforts by new owners and company managers and provide strong empirical evidence of the close relationship between ownership transformation and firm performance. More specifically, we document that there are clear differences in the performance improvement effects among privatization implemented with no lower limit on the scale of ownership transformation, privatization with strategic control rights, and full privatization. We also report that ownership transformation to foreign investors has greater positive impacts on firm performance than that to domestic investors.

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[2] Meta-analysis is a precise scientific method to combine the results from individual studies for the purpose of integrating the research findings. There are various approaches from the vote-counting method to meta-regression analysis. See Section 2.5 in Chapter 2 for more details.

As the two chapters discussed above focus on the direct impacts of FDI on the economic reform and corporate restructuring in Hungary, the next two in Part II present an examination of the indirect effects or externalities of foreign capital inflow from the viewpoint of efficiency improvement in domestic firms. That is to say, technology and knowledge transfer from MNEs to indigenous companies. The issues concerning the relationship between MNEs and local firms in the host countries raised in the 1960s witnessing the advent of the age of internationalization are still of great interest to researchers today, and, consequently, a number of microeconomic research works that empirically examine so-called 'FDI spillover effects' have been published in recent years with the remarkable enhancement of firm-level datasets worldwide. We contribute to the literature from the standpoint of the Hungarian transition economy.

To ensure this end, Chapter 3 scrutinizes the impact of FDI on productivity of domestic firms. In this chapter, we present a new empirical model with respect to the productivity spillover effects of horizontal FDI by focusing on the multi-layered structure of industrial classifications (i.e., NACE). In this model, the market presence of horizontal FDI in a host country is expressed using multiple spillover variables with a nested structure corresponding to the aggregated level of industrial classification. Empirical models that comprise these nested spillover variables of horizontal FDI in the right-hand side of the estimation equation are called 'nested variable models' to distinguish them from the models having a single horizontal variable as an independent variable. Using large-scale firm-level data from Hungary, we estimate the nested variable model and verify horizontal FDI spillover effects that cannot be captured with the conventional model having a single horizontal variable.

Chapter 4 examines the impact of FDI on the export decision of domestic firms. It is argued that domestic firms in a host country might be able to more easily overcome various trade barriers associated with new entry into export markets by observing and imitating the advanced export operations of foreign companies. This positive externality of FDI is considered to have originated mainly in the reduction of information costs that domestic firms would have had to bear without the MNEs, and, hence, it is called the 'information spillover effect' (Aitken et al., 1997) that is the main subject of this chap-

ter. Based on the results of empirical analysis, we report that, in comparison with the conventional model that expresses the export propensity of MNEs with a single variable, the nested variable model more precisely specifies the source, extent, and direction of information spillovers from MNEs to indigenous firms. We also verify the close relationship between the information spillover effect and the heterogeneity of FDI and domestic firms.

The two chapters in Part Ⅲ represent our research regarding the organizational innovation in Hungary in comparison with that in Slovakia. In these chapters, we bring the knowledge-intensive business service (KIBS) into focus. In Chapter 5, we report that, at the end of the 20th Century, the service sector became the dominant engine of employment creation worldwide over manufacturing. Even in the post-socialist countries in Central and Eastern Europe, service employment accounts for more than half of the total employment. In a comparison of the employment share and growth potential of the service sector of Hungary and Slovakia, Hungary is in a better position from both static and dynamic perspectives. According to the results from our company surveys conducted in Hungary and Slovakia during the period of 2008-09[3], the overwhelming majority of firms surveyed in both countries belong to the *de novo* category; they were established in the post-socialist period (after 1990). With regard to the size of the firms investigated, the Slovakian KIBS firms are more balanced than the Hungarian ones. A great majority of the Hungarian firms are small (i.e., employing fewer than 50 people). In contrast, although small firms are predominant in Slovakia, there are a significant number of medium-size and large ones. With regard to the organizational structure or architecture of the firms in both countries, a lean work organization with one or fewer hierarchical levels is dominant. There are noticeable differences between the two countries, particularly with regard to the ownership structure. Domestically owned firms are predominant in both. However, the share of foreign-owned companies is three times higher in Slovakia. The research reported in Chapter 5 shows that innovation in individual firms is less than that in company groups and networks, where a premium is placed on innovation and

[3] See Section 5.4 in Chapter 5 and Makó et al. (2011) for details of the company surveys.

learning. It is noteworthy in this regard that less than one fifth of the firms in Hungary belong to a company network, in contrast to more than two fifths in Slovakia, where the majority comprises members of international networks. The degree of complexity of services was measured by the customer-tailored and the high value-added content of services. Furthermore, basic similar patterns were evident in that the majority of firms surveyed provided customer-tailored and high value-added services to their clients. With regard to competitiveness, both countries place a high value on reliability, quality, flexibility/speed, and experience. However, the role of the variety of services is significantly greater in the Hungarian than that in the Slovakian firms.

Chapter 6 conducts a comparative analysis of the Hungarian and Slovakian KIBS sectors in terms of organizational innovation in detail. Compared to the U. S. and Southeast Asia, Europe lags behind in competitiveness and innovation. The primary reason for Europe's third-place position is the lack of organizational innovation to support the transformation of research results into market advantage rather than a lack of emphasis on R&D. Organizational innovations are critically important in the service sector, where technological innovation has a less significant role than manufacturing. Therefore, in Chapter 6, we present a brief overview of the various types of organizational innovation prevalent in Hungarian and Slovakian KIBS sectors and their drivers and obstacles at the firm level. According to our survey results, the so-called 'structural organizational innovations,' which require the modification of the organizational structure, e.g., the power and interest relations of firms, such as project-based work, lean organization, or inter-professional working groups, are more diffused among the Slovakian than the Hungarian KIBS firms. Insight is also presented in this chapter into the use of information and communication technology (ICT) and competence development practices of the Hungarian and Slovakian KIBS firms, as these are prerequisites for sustaining and strengthening their positions in the face of global competitive pressure. We report that ICT is used more extensively in Hungarian than in Slovakian company practices. Hungarian firms perform better, especially regarding the ICT-based development activities. In relation to company knowledge development practices in both countries, various forms of experience-based knowledge development (e.g., on-the-job training) are more important than participation in

formal education and training schemes. In the case of Slovakia, however, KIBS firms rely more intensively on external sources of knowledge, such as higher education or training institutions, than do their Hungarian counterparts.

The last two chapters in Part Ⅳ focus on a relatively new research subject for the study of transition economies, namely, the concept of industry cluster[4]. In the epoch of globalization, small or medium-sized national companies have great difficulties in finding an appropriate place for themselves in global labor division systems. They most frequently apply strategies that help them become part of global value chains as regular suppliers, or they try to locate where they might cooperate with other small companies in industrial clusters to compete with larger MNEs. In both cases, communication, knowledge transfer, and cooperative actions among companies are essential for improving competitive capacities. Since this type of cooperation relies heavily on close, regular contact and face-to-face interaction, the spatial concentration of actors can improve the chances for success. Literature on the topic of supplier networks and spillover effects, as well as that on industrial clusters, emphasizes the importance of a 'critical mass' of companies and other organizations and institutions. From this standpoint, we look at the emergence and subsequent development of industry clusters in transition Hungary and analyze their impact on regional economies. Namely, in Chapter 7, we define and describe the types of synergies that stem from the collocation of cooperating market actors. In addition, the potential linkages among the two types of networks, supplier chains and clusters, are explained. After a brief overview of the related literature, we introduce a new, refined measurement method of spatial concentration of industry and then present a new cluster mapping for Hungary[5].

In Chapter 8, relying on the same methodology developed in the previous chapter, we test major hypotheses of spatial economic theo-

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[4] According to Michael Porter (1990), "[Industry] clusters are geographic concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (p. 199).

[5] See **Table 7.4** and **Figure 7.1** in Chapter 7.

ries focusing on the impact of industrial and market concentrations on regional economic growth. More precisely, the aim of this chapter is to show how the geographic concentration of industry and market affects employment and production growth in regions of Hungary. The empirical results in this chapter confirm that both industrial and market concentrations have a significant positive impact on production growth. This finding strongly supports the Marshall-Arrow-Romer model of local knowledge externalities, suggesting that investment-driven regional development prevails in Hungary. Our empirical evidence also indicates the possible synergy of monopolistic market structure and the presence of big companies for regional production growth. Overall, the two chapters in Part Ⅳ demonstrate that an industry cluster is a key element for a more thorough understanding of the industrial restructuring in Hungary's transition economy.

Finally, the concluding chapter summarizes the major results of this study and discusses a possible agenda for future research.

Part I

Economic Reform and Foreign Direct Investment

Chapter 1

Corporate Restructuring and Foreign Direct Investment

1.1 Introduction

In May 2004, Hungary joined the European Union with seven other former socialist countries in Central and Eastern Europe (CEE) and the Baltic region, materializing the countries long-cherished dream of re-integrating with Europe. The fifteen-year reform efforts to tackle systemic transformation by the Hungarian government and its citizens finally paid off after their decision to break away from the socialist regime. The road to the EU accession has not been easy since the 'European Agreements', which proclaimed that the European club would allow membership from CEE countries, were signed in December 1991. However, Hungary had always been a 'front runner' in the process of the EU enlargement towards the east[1].

One of the main reasons why Hungary has been able to promote its systemic transformation is that this small country attracted relatively large amounts of foreign direct investment (FDI). The Hungarian government has been making great efforts to increase foreign investment from the very early stages of its economic transformation including the end of socialist era. In fact, Hungary had been a leader in

[1] See Iwasaki and Suganuma (2009) for more details of the accession negotiation between Central and Eastern European countries and the EU.

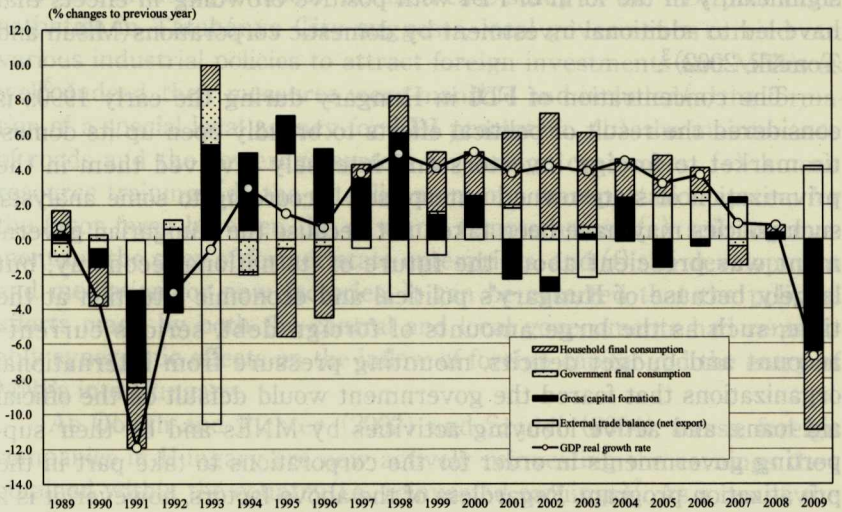
the region in terms of the total accumulated FDI inflows through to 1997. Although Poland and the Czech Republic have ranked higher than Hungary since 1998 in that category, the country received 40.7 billion USD as FDI during the twelve years from 1992 to 2004, accounting for 25.3% of the total in Central Europe and 19.8% of the total in CEE region (UNCTAD, 2005). This vast influx of foreign capital strengthened the Hungarian economy by spurring effective demand, contributing significantly to the restructuring of domestic firms through the conversion of corporate ownership structure, improvements in production system, strengthening market competitiveness, modernization of management systems, revitalization of R&D and innovation activities. In other words, FDI has been a powerful 'driving force' for Hungary to create an effective market economy, which was one of prerequisites for joining the EU. As Kárpáti (2003) states, the success of the Hungarian economy during this period was largely dependent upon foreign investment.

As reported above, in the period from the collapse of the socialist regime to EU accession, the role of FDI and multinational enterprises (MNEs) was noteworthy in transition to a market economy in Hungary. Hence, this chapter examines economic development and corporate restructuring in this country from 1989 through 2004, with special attention to FDI. Section 1.2 presents an overview of the roles of FDI in the growth and stability of the macro-economy. Section 1.3 describes the effects of foreign investment and business activities of MNEs on reforms of corporate ownership and governance and on the improvement of efficiency in the management and production systems in the Hungarian firms. Section 1.4 examines the contributions of foreign companies to R&D and innovation activity. Section 1.5 concludes.

1.2 Roles of Foreign Direct Investment in the Stabilization and Growth of the National Economy

Hungary has enjoyed positive economic growth for fifteen straight years through 2008 after coming out of a debilitating economic slump which had continued until 1994 due to the confusion arising from the abandonment of its planned economy. According to official statistical data issued by Hungary's Central Statistical Office (KSH), the 15-year average of the real GDP growth rate from 1994 through 2008 stands

Figure 1.1 Changes in GDP real growth rate and contribution of demand components, 1989–2009



Source : Authors' illustration based on KSH, *Magyrország Nemzeti Számlái* (various years) and the Hungarian Central Statistical Office Website (http://portal.ksh.hu/).

at 3.2%. This long-lasting economic boom has steadily pushed up Hungary's national income, leading to a remarkable increase in its per capita GDP on a purchasing power parity basis from 6,800 EUR in 1990 to 13,700 EUR in 2004 and, further, to 15,700 EUR in 2008 (WIIW, 2009).

Investment activities have been a key factor in Hungary's long-term and stable economic growth. In contrast to its flagging private consumption, domestic investment has continued to expand at a rapid pace after reaching its lowest point in 1992, and, in 2004, it had grown 55% larger than in 1989, the last year of the socialist period[2]. As a result, according to **Figure 1.1**, fixed capital formation contributed to economic recovery from 1993 through 2000 by pushing the GDP real growth rate by an annual average rate of 3.6%. It is no doubt that Hungary's booming economy in this period has been driven by these intensive investment activities with their multiplying effects. More-

[2] Authors' calculation based on KSH, *Magyar Statistiai Évkönyv 2004* (2005, p. 12).

over, even it was possible that foreign enterprises have contributed significantly in the form of FDI with positive crowding-in effects that have led to additional investment by domestic corporations (Mišun and Tomšík, 2002)[3].

The concentration of FDI in Hungary during the early 1990s is considered the result of political efforts to broadly open up its domestic market to foreign investors and intensely involved them in the privatization of state-owned enterprises. According to some analysts, such policies may have been taken not because the Hungarian government was prescient about the future of its national economy, but largely because of Hungary's political and economic situation at the time, such as the large amounts of foreign debt, serious current-account and budget deficits, mounting pressure from international organizations that feared the government would default on the official aid loans, and active lobbying activities by MNEs and by their supporting governments in order for the corporations to take part in the privatization program. Regardless of the above factors, however, it is a fact that the Hungarian government succeeded in attracting large amounts of foreign capital especially in the privatization of the state-owned enterprises by continuously offering investment incentives such as large scale corporate tax holidays and the establishment of custom-free zones in line with the basic principle of opening up the market and letting foreign investors participate in privatizing state-owned businesses[4]. In fact, 66% of the total amount of FDI for Hungary between 1990 and 1999 was invested in privatizing state-owned enterprises (Antalóczy and Sass, 2002). The Hungarian government's decision to sell off its largest public corporations to strategic foreign investors led to the expansion of greenfield investment as well as to

[3] Mišun and Tomšík (2002) verified FDI's spill-over effects on domestic investment in Hungary, the Czech Republic and Poland by using panel data and investment models based on the mix of the stock adjustment theory and the adaptive expectation theory regarding investment for economic growth, which revealed that Hungary from 1990 to 2000 and the Czech Republic from 1993 to 2000 both enjoyed FDI's crowding-in effects while Poland from 1990 to 2000 had crowding-out effects.

[4] Regarding the policy measures taken by the Hungarian government to enhance investment incentives, see Antalóczy and Sass (2003a) and Iwasaki and Sato (2004).

export-driven economic growth, as noted by Mihályi (2001)[5]. Moreover, as Antalóczy's (2004) detailed case study of the FDI promotion activities in Tatabánya City suggests, local goverments carried out various industrial policies to attract foreign investments and MNEs as well[6]. Indeed, their measures were manifold and included (a) the formation of a special local agency for FDI promotion, (b) the maintenance of roads and the sewerage system for foreign customers, (c) human resource training, (d) the establishment of a transportation system for the labor force between the city and remote areas, (e) soil improvement for the sites of former state enterprises, and (f) site development and mediation for new factories. It can be asserted that the political efforts made by both the central and local governments had remarkably synergistic effects on the inflow of foreign capital and the entry of MNEs into Hungary.

As Oblath and Richter (2002) and Szanyi (2004) stress, foreign companies in Hungary are now actively reinvesting the earnings they obtained within the country (i.e., reinvested earnings)[7]. As a result, the gap between the amount of capital inflow from the outside and that of investment by foreign companies, including those in Hungary, has been widening. In fact, as shown in **Table 1.1**, such reinvested earnings from 1995 to 2004 accounted for as much as 37.5% of the total amount of annual FDI inflow during the same period. The share of reinvested earnings maintained almost the same level (33.8%) from 2005 to 2009. This means that investment by foreign companies in

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[5] The ratio of FDI to the total amount of privatization earnings obtained by the Hungarian government had rapidly declined as follows : 1996 : 32.3%, 1997 : 15.1%, 1998 : 0.8%, 1999 : 0% (Antalóczy and Sass, 2002).

[6] Tatabánya is the largest city in the Komárom-Esztergom region, and its total population as of 1 January 2005 is 71,000 (KSH, 2005). At the begining of the transition, Tatabánya fell into economic difficulties due to the closure of a coal factory, the key indusrty of the city in the socialist era, and other problems. By grace of successful policy efforts, however, the Tatabánya government attracted 22 foreign manufacturing firms by the beginning of 2004 and created new jobs for about 6,000 workers, or 15 percent of the total labor force in the city.

[7] 'Reinvested earnings' are : (a) earnings of Hungarian affiliates/subsidiaries of foreign corporations that are not allocated to investors as dividends; and (b) earnings of Hungarian branch offices of foreign corporations and those of foreign non-corporate entities that are not directly remitted to investors.

Table 1.1 Selected indices of the foreign direct investment in Hungary, 1990–2009

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual FDI inflow (million EUR)[a b]	244	1,186	1,142	2,039	966	3,696	2,625	3,681	2,988	3,106	2,998	4,391	3,185	1,887	3,439	6,172	5,454	2,852	4,896	1,495
Reinvested earnings (million EUR)	—	—	—	—	—	▲ 164	397	1,155	1,009	1,054	1,135	1,479	1,911	1,788	2,227	1,918	1,359	2,274	1,337	163
Accumulated FDI stock (million EUR)[a b]	244	1,430	2,572	4,610	5,576	9,272	11,897	15,578	18,566	21,672	24,671	29,062	32,247	34,134	37,573	43,745	49,199	52,051	56,947	58,442
Annual FDI inflow per capita (EUR)[a c]	24	114	110	197	93	358	254	357	291	303	293	430	313	186	340	611	541	283	487	149
Accumulated FDI stock per capita (EUR)[a c]	24	138	248	445	539	897	1,153	1,512	1,806	2,114	2,414	2,849	3,169	3,366	3,714	4,332	4,882	5,171	5,669	5,826
Direct investment income (million EUR)[a]	▲ 19	▲ 26	▲ 34	▲ 48	▲ 98	▲ 119	▲ 698	▲ 1,619	▲ 1,888	▲ 2,057	▲ 2,117	▲ 2,570	▲ 3,275	▲ 3,044	▲ 3,856	▲ 4,224	▲ 4,534	▲ 5,797	▲ 5,145	▲ 3,200
Number of foreign affiliated enterprises	5,693	9,117	17,182	20,999	23,557	24,612	25,670	26,083	26,265	26,435	26,634	26,809	26,796	26,793	26,475	26,019	25,796	27,177	28,988	29,266
Total equity capital (billion HUF)[d]	274.2	475.6	713.1	1,113.2	1,398.2	1,994.0	2,467.9	4,260.3	4,994.2	6,603.6	7,109.7	7,913.1	8,692.4	10,068.2	13,053.0	15,711.8	17,598.2	20,652.5	18,002.6	18,572.0
Total foreign capital participation (billion HUF)[d]	93.2	215.0	401.8	662.9	833.5	1,432.1	1,882.7	3,202.3	3,913.8	5,031.5	5,576.6	6,292.1	7,019.9	8,716.2	9,941.9	11,794.9	13,635.3	14,810.0	15,091.3	15,976.6
Foreign capital participation rate (%)[d e]	34.0	45.2	56.3	59.5	59.6	71.8	76.3	75.2	78.4	76.2	78.4	79.5	80.8	86.6	76.2	75.1	77.5	71.7	83.8	86.0

Notes : [a]Net figures based on a balance-of-payments basis.

[b]Figures from 1990 to 1994 exclude reinvestment earnings.

[c]Calculated by the author based on total number of population of each year.

[d]Figures from 1990 to 1994 are on a subscribed capital basis.

[e]Share of foreign capital in total equity capital.

Source : Compiled by the authors based on KSH, *Magyar Statisztikai Évkönyv* (various years), KSH (2005, p. 166), official statistics available at the Magyar Nemzeti Bank website (http://www.mnb.hu/) and the Hungarian Central Statistical Office website (http://portal.ksh.hu/).

Hungary is still active enough to stimulate economic growth by shoring up effective demand on the same large scale as that of the mid-1990s, although sources of capital investment are becoming more sophisticated as foreign companies expand (Bélyácz and Kuti, 2011) .

1.3 Foreign Direct Investment and Corporate Restructuring

Large-scale and continous foreign capital inflows have completely changed the supply side of the Hungarian economy, that is, the corporate sector. As **Table 1.1** shows, in the period from 1990 to 2004 (2009), the number of Hungarian companies with foreign participation increased 4.7 (5.1) times, and the amount of investment by foreign investors and their capital participation rate in these firms reached 9,942 (15,977) billion HUF and 76.2 (86.0) %, respectively, during the same period. In this regard, we can confirm in **Table 1.2** that the role of foreign enterprises has rapidly expanded in the production, employment, investment, and trade activities while the accession negotiation proceeded actively between Hungary and the EU from 1995 through 2003. In addition, as shown in **Table 1.3** indicating the sectoral brakedown of FDI in 2004, foreign capital has made inroads into every area of the Hungarian economy, especially in manufacturing, wholesale and retail trade, and real estate and renting businesses.

The same can be said about the financial sector. The share of the FDI of the total subscribed capital in the financial service sector expanded from 44% in 1996 to 89% in 2001 (Hamar, 2004). According to Várhegyi (2001; 2004), by the end of 2000, foreign capital increased to 66.6% of the total subscribed capital in the banking sector, and the number of banks with a foreign participation rate of more than 50% surged to 68.1% of all Hungarian commercial banks. This active foreign participation remarkably mitigated the high market concentration in the banking sector from 1991 to 2002 and encouraged the competition between banks, especially in corporate deposits and financing services[8].

[8] Várhegyi (2004) confirmed that, during this period, the market share of the largest three (five) commercial banks decreased from 58 (76) to 45 (59) percent and the Herfindahl index notably fell from 1565 to 986.

Table 1.2 Position of foreign companies in the corporate sector, 1995-2003

(%)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Net sales revenue	38	41	43	45	47	47	49	47	45
Added value	33	36	41	43	44	44	44	43	43
Employment	25	24	27	27	27	27	26	25	25
Investment	51	53	53	52	51	53	50	43	41
Exports	51	62	69	75	77	73	81	83	80
Imports	56	62	68	70	72	71	79	79	75

Note : Figures indicate share of foreign-affiliated enterprises with 10 percent or more of foreign ownership in the overall corporate sector.
Source : KSH, *A Külföldi Működő Tőke Magyarországon* (various years).

In Hungary, 'foreign companies' (*külföldi érdekeltségü vállalkozás*) are defined as those with a foreign participation rate of more than 10%[9]. Almost all foreign companies in the country, however, far exceed such standard, as seen in the fact that the share of 100% foreign-owned enterprises in the total number of Hungarian foreign companies increased from 1.8% in 1989 to 61.8% in 2000 while the share of joint venture companies with a domestic participation rate of over 50% sharply fell from 86.7% to 17.2% during the same period (Inzelt, 2003). By the end of the 1990s, 76 of the top 100 of the world's largest corporations had entered the Hungarian market in some form (Antalóczy and Sass, 2003b). Currently, establishing a 100%-owned subsidiary is the most common way of doing business in Hungary for major MNEs. This trend can be seen also for Japanese companies operating in Hungary. In fact, as of March 2003, 61 or 70.1% of 87 Japanese-capital-affiliated enterprises in Hungary were wholly owned subsidiaries of Japanese parent companies or those of Japanese companies' affiliates in Europe (**Table 1.4**). This trend has been gaining momentum against the background of an increasing number of Japanese companies coming to the country as suppliers for European affiliates of Japanese electronic and auto manufacturers. Hungarian affiliates of these

[9] More exactly, a direct investment enterprise is defined as an incorporated or unincorporated enterprise in which a foreign investor owns 10 per cent or more of the ordinary shares or voting power of an incorporated enterprise or the equivalent of an unincorporated enterprise.

Table 1.3 Foreign direct investment by industrial sector, 2004

Industry, branch	Enterprises		Total equity capital		FDI share in total equity capital (%)
	Number	Share (%)	Billion HUF	Share (%)	
Agriculture	774	3.0	48.1	0.4	81.5
Mining and quarrying	69	0.3	14.0	0.1	98.6
Manufacturing	3,364	13.2	6,316.9	49.5	68.2
Food, beverages and tobacco products	401	1.6	575.2	4.5	89.3
Textiles	346	1.4	87.4	0.7	91.4
Leathers	76	0.3	13.6	0.1	97.1
Wood and wood products	147	0.6	48.9	0.4	95.1
Pulp, paper, paper products and printing	354	1.4	154.6	1.2	90.9
Fuel and chemical products[a]	125	0.5	2,208.7	17.3	31.2
Rubber and plastic products	251	1.0	166.3	1.3	95.8
Other non-metallic mineral products	137	0.5	171.4	1.3	95.2
Basic metals and fabricated metal products	461	1.8	342.4	2.7	84.1
Machinery and equipments	309	1.2	272.1	2.1	96.5
Electrical and optical equipments	436	1.7	1,162.8	9.1	74.4
Transport equipments	116	0.5	1,088.0	8.5	97.6
Others	205	0.8	25.5	0.2	94.5
Electricity, gas and water supply	75	0.3	530.6	4.2	74.5
Construction	950	3.7	97.8	0.8	76.7
Wholesale, retail trade and repair	10,308	40.4	1,005.3	7.9	95.1
Hotels and restaurants	1,175	4.6	82.8	0.6	93.4
Transport, storage, post and telecommunications	753	3.0	1,492.9	11.7	66.0
Financial intermediation	209	0.8	1,122.3	8.8	92.8
Real estate and renting and business activities	7,019	27.5	1,817.2	14.2	90.4
Others	810	3.2	235.9	1.8	96.7
Total	25,506	100.0	12,763.8	100.0	76.5

Note : [a]Includes coke, refined petroleum products, nuclear fuel and man-made fibers.
Source : KSH, *Magyar Statisztikai Évkönyv 2004* (2005, pp. 298-299).

Japanese corporations such as Panasonic, SONY, SANYO and SUZUKI, as well as those of other MNEs such as Audi, Philips, Nokia, GE, Opel and Samsung, have become the leading companies in Hungary. For this reason, at that time, Hungary was recognized, along with Ireland and Malaysia, as a country whose industry was over-

Table 1.4 Types of Japanese enterprises in Hungary by industrial sector, as of March 2003

(No. of enterprises)

	Manufacturing	Trade	Finance	Others[a]	Total
Subsidiaries/Affiliations	33	33	1	7	74
Wholly owned Japanese corporations	19	11	0	3	33
Joint venture enterprises	5	5	0	3	13
Others[b]	9	17	1	1	28
Liaison offices	5	5	0	3	13
Total	38	38	1	10	87

Notes : [a]Includes construction, consulting services and software development.
[b]Includes corporations in European countries.
Source : Compiled by the authors based on JETRO Budapest Office (2003).

whelmingly dominated by foreign capital (Hunya, 2002).

As mentioned in the previous section, the priority of selling off state-owned enterprises to strategic investors, as well as greenfield investment activities by MNEs, has led to the emergence of strong corporate ownership of Hungary's core businesses. In fact, of the top 100 non-financial corporations in terms of net annual sales in 2000, 63 were owned by MNEs, and their majority was incorporated as non-listed joint-stock companies or limited liability companies and operated under a very rigid ownership structure (Mihalyi, 2004). Direct corporate control by these new types of owners has been effective in alleviating so-called 'agency problems' and has prevented Hungary from being troubled by serious corporate governance woes, especially, those arising from heavy insider-control ownership, which other post-communist countries have confronted. In this context, it is remarkable that Török (1998) presented the view that, in Hungarian companies, management and supervisory organs, including the Board of Directors, do not have a substantial influence on corporate strategies except for daily management issues. Moreover, according to Perotti and Vesnaver (2004), who closely examined the relationship between investment activities and financial constraints of 56 listed Hungarian firms in the period of 1992-98, foreign participation relaxed the dependence of these firms on internal reserves as the source of investment and enabled them to increase their fixed capital much more than compa-

nies that were 100% domestically owned. In this sense, foreign capital played a positive role in restructuring Hungarian firms also from the viewpoint of corporate finance. Considering that, in the first half of the 1990s, Hungary was mired in a credit crisis triggered by a vast quantity of non-performing loans in the state banks, the effects of FDI should not be underestimated.

Foreign companies, thus, formed a 'mega economic sector' in Hungary (Nishimura, 2001) and brought about significant changes in the corporate ownership and governance structure of Hungarian firms. The increased number of foreign-owned companies has had a remarkable influence on Hungary's industrial and trading structures in the transition period, especially in its manufacturing sector, and greatly contributed to the improvement of its productivity.

The penetration of foreign capital has resulted in drastic changes to Hungary's industrial structure. From 1996 to 2004, the share of the manufacturing sector in the total industrial production increased by 8.8% to 89.8%. During the same period, the machine industries, in which about half of Hungary's total FDI has been concentrated, jumped phenomenally to 28.8% in terms of the share in the total industrial production, while the share of traditional industrial sectors in the socialist era including food, wood and papar, and light industries combined declined by as much as 12.9%[10]. The market environment also greatly changed during this time. For example, according to estimates by Éltető (2001, pp. 6-10), the market share of 100% domestically-owned enterprises was completely surpassed by that of foreign-affiliated companies during the seven years from 1993 to 1999. The share of foreign enterprises in the manufacturing sector and in the export market increased to 71.8% and to 88.6% respectively in 1999. Based on a review of financial data of Hungarian manufacturing companies from 1996 to 2000, Hamar (2003) points out that there was a significant positve relation between these companies' foreign participation rates and their degrees of export orientation, which is consistent with the findings of Éltető (2001)[11].

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[10] Calculated based on KSH (2005, p. 254) and official statistics available at the KSH website (http://portal.ksh.hu/) .

[11] The 'degree of export orientation' is defined as the share of exports in total net sales.

Under these circumstamces, the total trade volume of Hungary in US dollars surged 6.3 times from 1990 to 2004, while that with 15 old EU members rose at a more rapid pace, marking a 13.3 times increase over the same period[12]. It is obvious that such dominance of foreign enterprises over the export activities is closely related to the fact that the affiliates of MNEs in Hungary have continued to actively supply their products to EU markets in line with their global marketing strategies.

Many previoius studies indicate that foreign firms greatly contributed to the improvement of productivity of the Hungarian corporate sector. For example, Hunya (2002) estimates that labor productivity of foreign companies was as much as 3.1 times higher than that of domestic firms in 1999, the largest difference noticed among ten Central and Eastern European countries[13]. The statistical office also recognized that a significant labor productivity gap does exist between the two groups(KSH, 2003a). They estimate that the average added-value per employee of foreign firms was 1.8 times higher than domestic corporations, adding that much larger gaps were observed in several industrial categories (**Table 1.5**). Moreover, Hamar (2004) estimates that the difference between foreign corporations and domestic firms in productivity, added-value, wage level and capital equipment ratio per employee reached 2.9 times, 4.0 times, 1.6 times and 3.2 times respectively in 2000.

There also have been many quantitative empirical evidences on this topic. By estimating Cobb-Douglas production functions based on cross-section data of 1994-1997, Szekeres (2001) showed that total factor productivity (TFP) tended to improve in proportion to the growth of the foreign participation rate. Using a large-scale database covering about 90% of all Hungarian manufacturing and construction firms, Sgard (2001) confirmed that TFP showed a significant increase of 38.5% on average when the foreign ownership rate was expanded from 0% to 100%. By performing regression analysis of the productivity of foreign-owned corporations through estimation of three quantitative models, including a simultaneous equation model designed to treat the endogeneity of the investment decision-making process of

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[12] Calculated based on KSH, *Magyar Statisztikai Évkönyv*.

[13] Judging the context, the estimation was conducted only for manufacturing firms.

Table 1.5 Labor productivity by industrial sector and by forms of corporate ownership, 2000 (average added-value per employee of foreign-affiliated enterprises = 100)

	100% domestically-owned enterprises	Foreign companies (Foreign ownership rate)		
		100%	50-99%	Less than 50%
Overall corporate sector	56.7	90.0	119.9	92.1
Food, Beverage	42.5	126.3	98.8	70.9
Chemical	35.1	106.8	99.6	94.4
Electronics	63.1	99.0	96.8	124.3
Transport equipment	20.5	112.5	86.4	23.5
Power generation	84.3	101.1	99.9	101.2
Agriculture	47.8	115.1	81.5	75.8
Construction	49.8	900.6	50.0	86.9
Wholesale	44.2	104.2	90.3	91.6
Retail	83.3	111.6	60.5	101.8
Land transport	52.9	97.5	161.9	67.9
Post/Telecommunications	11.6	33.9	87.4	243.6
Real estate	18.9	142.6	37.4	144.2
Services	51.9	97.6	111.3	87.8

Source : KSH (2003a, p. 29).

foreign firms, Novák (2002) also found that Hungarian corporations with a foreign ownership rate of over 50% probably succeeded in improving their productivity at a faster pace than other enterprises. Furthermore, conducting panel-data analyses based on enterprise-level data of manufacturing firms in 1986-2002, Brown et al. (2006) verified that former state enterprises that were more than 50% foreign-owned improved much more in productivity after ownership transformation than privatized firms owned by domestic investors.

The above-mentioned research strongly suggests that there is a close relationhip between the facts found by Oblath and Richter (2002), according to which the productivity of the Hungarian manufacturing sector rose at an average annual rate of 15.4% from 1993 to 2000—a much faster pace than that of any other CEE countries—, and the large inflows of foreign capital into Hungary during this period. However, the dichotomy of categorizing Hungarian firms into only two groups, 'foreign-affiliated corporations' and 'other domestic corporations,' is insufficient. As Halpern and Kőrösi (2000) and Novák (2003) noted, it is impossible to strictly verify the relationship between the

growth of foreign investment and the improvement of productivity, considering the selection bias that foreign investors may choose domestic companies for investment, because such companies have a significantly greater potential to improve their own management efficiency and productivity than their competitors[14]. In fact, the empirical evidence provided by Brown et al. (2006) confirms that former state enterprises that were more than 50% foreign-owned significantly outperformed other privatized firms and remained state companies in terms of an average productivity of the pre-privatization period. Thus, it is quite likely that a selection bias of this kind did exist in Hungary. In addition, attention must be given to the possibility that the improvement of profitability and productivity of foreign corporations in their accounts might be largely due to preferential investment incentives given to foreign investors by the Hungarian government.

A way to mitigate these problems is to compare newly established FDI-based companies and major domestic corporations. Here, we discuss Hungarian affiliates of MNEs. As already mentioned above, those local subsidiaries—almost all of which were established in the framework of greenfield investment—can fully utilize management know-how and production technologies devised by their parent companies. Therefore, such wholly owned companies of multinationals could easily dominate privatized, formerly state-owned enterprises and other domestic corporations—both of which have been afflicted with a negative legacy from the socialist era—in terms of management efficiency and productivity.

The results of our empirical analysis support the above presumption. **Table 1.6** compares 153 of Hungary's major corporations listed in the *Figyelő* magazine in 2003 by using representative management and financial indices. This comparison reveals that there is a clear difference with statistical significance at the 1% level in the average per-

[14] While Halpern and Kőrösi (2000) state, based on their estimates of Dynamic Cobb-Douglas frontier production functions using dataset from 1990 to 1997, that selection bias effects can be observed only during the initial few years of the transition period, Novák (2003), who came up with estimated production functions in fixed effect models by using 1992-1998 panel data on industrial firms, suggests that selection bias effects are universal. In this way, there are different views on selection bias effects over time.

Table 1.6 Performance of 153 largest Hungarian enterprises, FY2003

	Annual sales per employee (million HUF)	Operating profit per employee (million HUF)	Gross pretax profit per employee (million HUF)	ROE[a] (%)	ROA[b] (%)
All 153 enterprises	156.09	5.30	4.26	21.08	5.71
Subsidiaries of multinational enterprises[c]	*245.83	*8.71	*6.71	18.46	*8.43
Other enterprises	101.29	3.22	2.77	22.67	4.05

Notes : [a]Return on equity = current profits/equity capital.
[b]Return on assets = current profits/total assets.
[c]* : Statistical significance of difference in mean values from domestic enterprises at the 1% level.
Source : Authors' estimation based on Figyelő (2004).

formance between multinational-affiliated corporations and other companies except for return on equity (ROE), demonstrating that affiliate companies of MNEs enjoy a remarkable advantage in terms of labor productivity and profitability over foreign-owned and domestic companies.

Next, we examined the effects of the organizational form as a multinational affiliate company on TFP by regression analysis. Following Szekeres (2001), we estimated log-linear Cob-Douglas production function with a constant dummy (*MNEs*), which controls the recognition of being a 100% multinational-affiliate, and checked its value and statistical significance. Here, an unbalanced panel of 277 corporations, which are listed on *Figyelő* magazine's leading corporation rankings through to 1999, were used for estimation. We conducted cross-section analyses for each of the 1999-2003 data and panel-data analyses using all observations. In the latter case, individual effects of samples were taken into consideration by estimating ramdom and fix effects models.

The main results shown in **Table 1.7** are almost satisfactory, because signs of explanatory variables are consistent with theoretical assumptions and the hypothesis of constant returns to scale is virtually met in all cases. The impact of *MNEs* on TFP is positive throughout the analysis period with statistical significance. In addition, the panel-data estimations of RE II and FE indicate that there is the 1% level of significant difference between the above two sampling groups regarding the mean of individual effects. That is to say, MNEs had

Table 1.7 Regression analysis on efficiency of local subsidiaries of multinational enterprises[a]

Estimation period	1999	2000	2001	2002	2003	1999–2003			
Estimation method	OLS	OLS	OLS	OLS	OLS	Pooled OLS[b]	RE I[b]	RE II[c]	FE[c]
Const.	7.691***	7.949***	8.320***	7.857***	8.276***	7.807***	7.459***	7.585***	7.014***
	(22.68)	(24.12)	(28.71)	(27.43)	(24.97)	(52.81)	(43.46)	(45.32)	(29.38)
ln (*K*)	0.286***	0.214***	0.200***	0.228***	0.224***	0.228***	0.168***	0.168***	0.164***
	(5.41)	(4.25)	(4.71)	(5.37)	(4.94)	(11.08)	(10.18)	(10.17)	(9.00)
ln (*L*)	0.705	0.899*	0.735*	0.724**	0.615	0.715***	0.865***	0.811***	0.813***
	(1.17)	(1.62)	(1.64)	(2.29)	(1.31)	(3.23)	(7.68)	(7.43)	(8.22)
MNEs	0.398***	0.336**	0.316***	0.303***	0.205*	0.305***	0.282***	—	—
	(2.80)	(2.50)	(2.83)	(2.93)	(1.82)	(5.77)	(3.02)		
00D	—	—	—	—	—	0.148*	0.203***	0.203***	0.200***
						(1.79)	(9.48)	(9.49)	(9.32)
01D	—	—	—	—	—	0.282***	0.356***	0.356***	0.351***
						(3.54)	(16.78)	(16.79)	(16.41)
02D	—	—	—	—	—	0.254***	0.395***	0.396***	0.395***
						(3.22)	(17.84)	(17.87)	(17.58)
03D	—	—	—	—	—	0.334***	0.470***	0.471***	0.466***
						(4.06)	(19.78)	(19.82)	(19.23)
Mean of individual effects									
Multinationals[d]	—	—	—	—	—	—	0.000	0.180†	0.166†
Other firms	—	—	—	—	—	—	0.000	−0.092	−0.153
N	144	161	189	202	169	865	865	865	865
R^2	0.329	0.297	0.279	0.345	0.272	0.321	0.809	0.805	0.969
Adjusted R^2	0.315	0.283	0.267	0.335	0.258	0.315	0.808	0.804	0.955
F-test[e]	22.920***	22.089***	23.846***	34.806***	20.511***	57.836***	520.004***	590.422***	72.712***

Notes: [a]The estimation equation is formulated as follows: $\ln(Y) = \mu + a_1 \cdot \ln(K) + a_2 \cdot \ln(L) + a_3 \cdot MNEs\ [+ a_4 \cdot 00D + a_5 \cdot 01D + a_6 \cdot 02D + a_7 \cdot 03D] + \varepsilon$: *Y* is total annual sales (million HUF). *K* is total equity capital (million HUF). *L* is annual average number of employees adjusted differences in average work hours per employee based on Fazekas and Koltay (2003, pp. 216–217). *MNEs* is a dummy of multinational enterprises. *00D*, *01D*, *02D* and *03D* are year dummies. μ and a_i are constant terms. ε is an error term.

[b]Breusch and Pagan Lagrangian multiplier test for the specification of the pooled estimation and random effects model I (RE I): $\chi^2 = 1290.11$, $p = 0.000$.

[c]Hausman test for the specification of the random effects model II (RE II) and fixed effects model (FE): $\chi^2 = 15.88$, $p = 0.014$.

[d]† : Statistical significance of the mean differences from domestic enterprises at the 1% level.

[e]Null-hypothesis: All coefficients are zero.

The *t*-statistics are given in parentheses. *** : significance at the 1% level, ** : significance at the 5% level, * : significance at the 10% level.

Source: Authors' estimation based on Figyelő (various issues).

much larger individual effects than other companies[15]. These findings verify the superiority of local subsidiaries of MNEs as production organizations over other Hungarian enterprises. Therefore, our empirical results—which strongly suggest that the expansion of MNEs contributed to the improvement of efficiency in the overall corporate sector in Hungary—supports assertions by preceding studies by Hunya (2002) and others.

From the above consideration, it is evident that the large-scale FDI inflow and massive embarkation of MNEs changed the corporate ownership and governance structure in Hungarian firms as well as played a crucial role in improving export competitiveness and streamlining its management and production activities from the collapse of the socialist regime to EU accession. The next section will further demonstrate FDI effects by focusing on R&D and innovation activities, both of which are also important aspects of corporate restructuring.

1.4 Foreign Direct Investment and R&D/Innovation Activities

In the late 1980s, Hungary spent 2.5% of its GDP on R&D, which is a large percentage by international standards of the time (Balázs, 1994). However, the ensuing full-fledged transition to a market economy brought about a drastic reduction in Hungary's R&D activities. According to **Table 1.8**, by 1996, the R&D expenditure as a percentage of GDP dropped to 0.6%, and the total number of researchers fell by 22,437 or 37.6% from 1990 to 1996. In particular, the number of corporate researchers diminished sharply by 10,948 persons or 63.9% in the same period. Even during the high economic growth after 1997, R&D activities stagnated at low levels. In 2004, the year of EU accession, the R&D expenditure as a percentage of GDP was almost 0.9%, which is much lower than that recorded during the socialist era, and this modest level was maintained until 2009. As illustrated in **Figure 1.2**, this scale is much smaller than the average of developed countries

[15] The results of cross-section analyses show that the explanatory power of *MNEs* declines yearly. This finding is regarded as a good sign of progress in the restructuring of Hungarian firms because it indicates that the TFP gap between the MNEs and others is steadily diminishing.

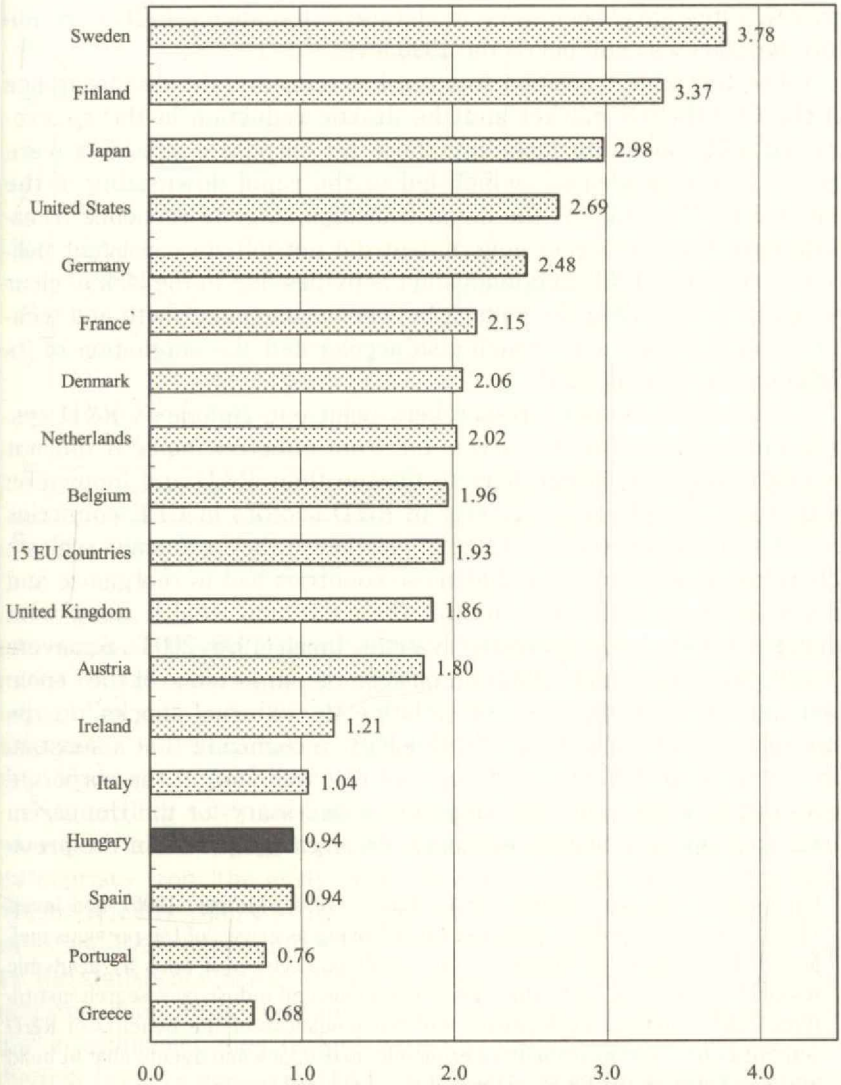
Table 1.8 Selected indices of R&D activities in Hungary and its corporate sector, 1990-2009

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total staff number	59,723	51,218	43,879	40,999	39,810	38,088	37,286	39,626	41,317	42,088	45,325	45,676	48,727	48,681	49,615	49,723	50,411	49,485	50,279	52,522
in R&D institutions	19,802	16,598	13,749	11,886	9,966	9,312	11,015	10,781	10,174	9,995	11,255	10,461	11,767	11,474	11,483	11,627	11,498	10,429	9,996	10,100
in R&D units of higher education	22,787	22,607	22,296	22,029	21,765	20,699	20,085	22,434	24,750	24,411	25,972	26,543	27,532	27,769	29,262	28,702	27,165	25,923	26,240	25,934
in R&D units of enterprises	17,134	12,013	7,834	7,084	8,079	8,077	6,186	6,411	6,393	7,682	8,098	8,672	9,428	9,438	8,870	9,394	11,748	13,133	14,043	16,488
Share of enterprise R&D staffs (%)	28.7	23.5	17.9	17.3	20.3	21.2	16.6	16.2	15.5	18.3	17.9	19.0	19.3	19.4	17.9	18.9	23.3	26.5	27.9	31.4
Total number of R&D units	1,256	1,257	1,287	1,380	1,401	1,442	1,461	1,679	1,725	1,887	2,020	2,337	2,426	2,470	2,541	2,516	2,787	2,840	2,821	2,898
R&D institutions	142	133	118	124	112	107	121	131	132	130	121	133	143	168	175	201	208	219	195	197
R&D units of higher education	940	1,000	1,071	1,078	1,106	1,109	1,120	1,302	1,335	1,363	1,421	1,574	1,613	1,628	1,697	1,566	1,552	1,496	1,471	1,394
R&D units of enterprises	174	124	98	178	183	226	220	246	258	394	478	630	670	674	669	749	1,027	1,125	1,155	1,307
Share of R&D units of enterprises (%)	13.9	9.9	7.6	12.9	13.1	15.7	15.1	14.7	15.0	20.9	23.7	27.0	27.6	27.3	26.3	29.8	36.8	39.6	40.9	45.1
Total R&D expenditure (HUF/million)	33,725	27,100	31,600	35,300	40,289	42,310	46,027	63,591	71,186	78,188	105,388	140,605	171,470	175,773	181,525	207,764	237,953	245,693	266,388	299,159
From state budget	28,240	9,100	11,000	12,000	14,700	23,277	23,558	34,854	38,930	41,624	52,207	75,386	100,392	102,008	94,049	102,666	106,538	109,117	111,401	125,595
From other domestic sources	538	···	···	···	···	1,744	3,172	2,929	2,022	2,131	2,189	3,317	2,369	991	1,334	974	1,497	1,574	1,600	2,052
By international organizations	346	···	···	···	···	1,997	2,076	2,655	3,375	4,363	11,202	12,918	17,773	18,847	18,791	22,171	26,877	27,233	24,704	32,620
By enterprises	13,075	13,085	10,921	9,891	10,096	11,563	17,221	23,153	26,859	30,070	39,790	48,984	50,936	53,926	67,351	81,954	103,040	107,769	128,683	138,892
Share of R&D expenditure by enterprises (%)	38.8	48.3	34.6	28.0	25.1	27.3	37.4	36.4	37.7	38.5	37.8	34.8	29.7	30.7	37.1	39.4	43.3	43.9	48.3	46.4
Total R&D expenditure to GDP (%)	1.6	1.1	1.1	1.0	0.9	0.7	0.6	0.7	0.7	0.7	0.8	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.2
Total number of national patent applications	2,591	2,305	2,112	1,409	1,144	1,910	1,030	1,189	1,257	1,881	1,605	1,445	1,278	1,421	977	1,126	1,089	637	551	415
By Hungarian residents	1,205	1,068	896	687	536	534	352	346	263	300	176	182	209	310	158	130	140	112	109	86
By non-Hungarian residents	1,386	1,237	1,216	722	608	1,376	678	843	994	1,581	1,429	1,263	1,069	1,111	819	996	949	525	442	329

Source: Compiled by the authors based on KSH, *Magyar Statisztikai Évkönyv* (various years), official statistics available at the Hungarian Central Statistical Office website (http://portal.ksh.hu/) and information available at the WIPO website (http://www.wipo.int/ipstats/).

Figure 1.2 R&D expenditure by country

(Total expenditure to GDP: %)



Notes : Figure for Hungary is in 2001. Figures for Greece, Ireland, Italy, Belgium, Netherlands, Denmark and Spain are in 1999. Figures for the average of 15 EU nations and other countries are in 2000.

Source : Authors' illustration based on *Népszabadság*. 2003. Április 12., p. 5.

as well as that of 15 EU nations. As indicated in **Figure 1.3**, although R&D activities in Hungary have been on the rise since 1996, the growth rates have been very moderate. The national R&D expenditure for 2009 was still below the 1990 level.

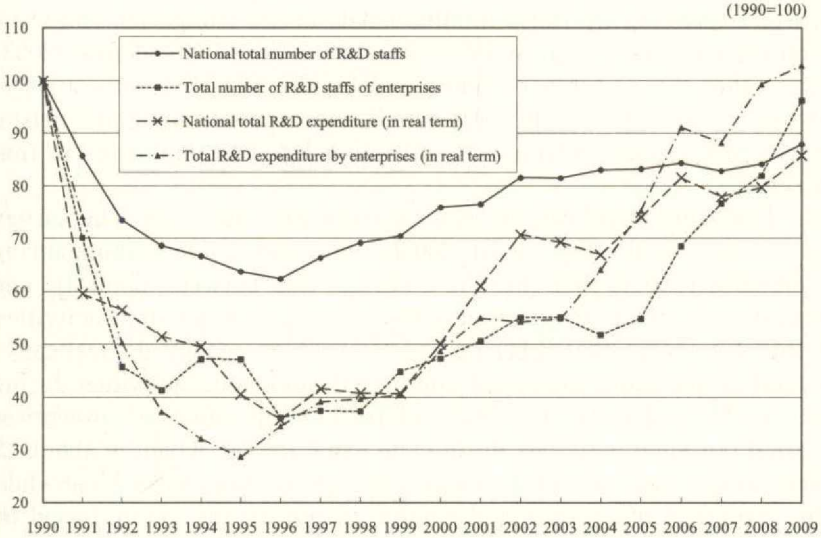
The full-scale transition to a market economy, the disappearance of the COMECON market and the drastic reduction in the government's R&D spending including those for corporate subsidies were grave 'external shocks' which led to the rapid downsizing of the national R&D sector. At the initial transition stage of economic transformation, the Hungarian government did not initiate consistent policies to stimulate R&D and innovation activities due to the lack of clear recognition regarding the linkage between economic growth and technological development—which also accelerated the stagnation of its R&D sector (Havas, 2002).

Meanwhile, as many researchers point out, Hungary's R&D system during its socialist era was far from effective, since it did not strongly motivate researchers to pursue their R&D and innovation activities[16]. In addition, the size of R&D sectors in CEE countries including Hungary was too large in relation to their economic scales[17]. Therefore, it is no surprise that those countries had to reorganize and downsize their R&D units to suit their national wealth along with changes in their socio-economic systems. Inzelt (1998; 2003), Szalavetz (1999), and Nikodémis (2003) emphasize the importance of the 'spontanenous adjustment processs' relative to 'external shocks' in the modanization of the industrial technology, recognizing that a substantial reduction of R&D expenditure and research staff at the corporate level had produced restructuring effects necessary for the Hungarian firms to adapt to a market economy. As already clarified in the previ-

[16] For more details, see Tanaka (1993), Balázs (1994), Matsui (1996), and Inzelt (1998). These researchers point out the following as causes of the previous ineffective R&D sector in Hungary : (a) Localized division of roles by academic research institutions, high educational insitutions and industrial research institutions ; (b) Domestic enterprises' low consciousness of the benefits of R&D activities ; (c) Non-availability of economic institutions and agents able to build a bridge between the R&D sector and the industrial sector.

[17] According to Knell (2000), as of 1990, scales of R&D activities in CEE countries and in Russia were comparable to those of Western developed nations, such as Germany and France.

Figure 1.3 R&D activities in Hungary and in its corporate sector, 1990–2009



Source : Authors' illustration based on official statistics available at the Hungarian Central Statistical Office website (http://portal.ksh.hu/) and Table 1.8.

ous section, FDI and foreign-affiliated companies played a crucial role in the revitalization of the Hungarian economy. Therefore, the preceding studies gave considerable attention to the relation between ownership forms of enterprises and their R&D/innovation activities in the first 15 years of transition.

According to these studies, foreign-affiliated corporations may have been more engaged in R&D activities than the wholly domestic enterprises from the early stage of transition. For instance, Inzelt (1998) already refers to the strong link between foreign ownership rates and R&D expenditure based on the enterprise survey conducted by the statistical office in 1996. Furthermore, she suggests that foreign investors have been constantly utilizing many of R&D units of Hungarian companies they bought with the aim of introducing new production licenses and know-how. Moreover, Nikodémis (2003) points out that MNEs in Hungary boosted their R&D spending by five times in real terms over the six-year period from 1995 to 2000. As a result, the share of MNEs in the total R&D spending in the corporate sector

increased from 22% to almost 80% during the period. The proportion of R&D spending by these multinationals in the Hungarian corporate sector is extremely high by international standards. Nikodémis (2003) states that this is further highlighted by the fact that domestically-owned corporations, especially small and medium size enterprises, were substantially cutting or restraining R&D expenditures in that period.

The same trend can be seen for innovation activities. The survey by the statistical office (KSH, 2003b) covering 26,495 manufacturing companies reveals that there is a certain gap between domestic and foreign companies in terms of achievements in innovation activities. **Table 1.9** shows that 3,441 or 15.1% of 22,186 wholly domestically-owned corporations surveyed conducted innovation activities during 1999 to 2001, while 1,055 or 28.7% of 3,679 foreign-affiliated enterprises carried out such activities during the same period, which is about 1.9 times larger than that of the former on a percentage basis. Meanwhile, the statistical office obtained similar results to the above based on another enterprise survey for 1997 to 1999 (KSH, 2001). Hence foreign-affiliated enterprises may have been continuously more active in innovation activities than domestic corporations.

Szalavetz (1999), who conducted an in-depth interview survey of fifteen manufacturing companies under the control of German capital, advocates that "the technological benefits of being owned by MNEs can be summarized by the fact that domestic firms were able to accelerate their technology accumulation process with the help of foreign direct investment", adding that the "Hungarian economy has been modernized at a remarkable scale as a result of technology transfer through foreign investment".

In addition to this paper, there are many other studies focusing on the achievements of technology transfer and spillover effects stemming from R&D and innovation activities by foreign corporations. For example, Antalóczy and Sass (2003b) found the effects of technology transfer in qualitative changes in Hungary's export structure from the late 1990s. As indicated in **Table 1.10**, Hungary's top 10 export goods for 2002, five of which were high-tech products, are products of foreign-affiliated enterprises that carried out greenfield investments within custom-free zones. The total export volume of high-tech products increased by as much as 5.3 times on a US dollar basis from 1992

Table 1.9 Innovation activities by form of corporate ownership, 1999–2001

		Innovative enterprises						Non-innovative enterprises	Grand total
		Innovation activities completed				Unfinished or cancelled innovation activities	Total		
		Products only	Processes only	Products and processes	Total				
Actual numbers	100% domestically-owned enterprise	1,230	669	1,169	3,068	373	3,441	19,375	22,816
	Enterprise with foreign participation[a]	279	122	255	656	56	712	1,368	2,080
	100% foreign-owned enterprise	123	40	118	281	62	343	1,256	1,599
	Total	1,632	831	1,542	4,005	491	4,496	21,999	26,495
Share (%)	100% domestically-owned enterprise	5.4	2.9	5.1	13.4	1.6	15.1	84.9	100.0
	Enterprise with foreign participation[a]	13.4	5.9	12.3	31.5	2.7	34.2	65.8	100.0
	100% foreign-owned enterprise	7.7	2.5	7.4	17.6	3.9	21.5	78.5	100.0
	Total	6.2	3.1	5.8	15.1	1.9	17.0	83.0	100.0

Note : [a]Excluding 100% foreign-owned enterprises.

Source : Compiled by the authors based on KSH (2003b, p. 23, 29).

to 2002. The total imports of high-tech products also expanded by 7.6 times during the same period partly due to foreign corporations' rising demand for plant and equipment investment. Based on statistical data, Hamar (2004) examined the role of foreign capital from the viewpoint of Hungary's technological catching-up and confirmed that industrial sectors requiring higher technologies have larger foreign participation rates (**Table 1.11**). These findings indicate the benefits of technology transfers brought about by FDI.

Szanyi (2002) focused on technological spillover effects arising from outsourcing contracts and from supplier agreements between MNEs and domestic companies, which has been rapidly spreading among Hungarian industrial firms in recent years. He found that small and medium size firms are actively involved in businesses outsourced from MNEs, and aim to adapt to a market economy as well as undergo restructuring. That is, these domestic enterprises regard outsourcing contracts with MNEs as "the most important sources of technologies, competitive products and markets, each of which is necessary for their modernization" (p. 20). Meanwhile, MNEs are also actively promoting

Table 1.10 Top 10 export commodities, 2002

Rank/Commodities	Export volume (1,000 USD)	Share in total export volume (%)	Manufacturing by foreign-affiliated enterprises	Greenfield investment	Production in custom-free zones	High-tech products
1 Mobile communication devices	2,691,198	7.84	△	△	○	○
2 Piston engine-type manufacturing	2,114,963	6.16	○	○	○	×
3 Passenger vehicles	1,481,180	4.31	○	○	△	×
4 Input/output devices	766,262	2.23	△	△	○	○
5 Parts for TV sets, radios and communication devices	706,874	2.06	○	○	○	×
6 Computer memory devices	550,146	1.60	○	○	○	○
7 TV sets	533,894	1.56	○	○	○	×
8 Video recorders	529,641	1.54	○	○	○	○
9 Automatic data processing equipment/units	508,393	1.48	△	△	○	○
10 Conductors	431,424	1.26	△	○	△	×
Total for 10 commodities	10,313,975	30.04	8.0	8.5	9.0	5.0

Notes: ○ indicates 'applicable', × indicates 'not applicable' and △ indicates 'partially applicable'. For the numerical estimate of the total for 10 commodities, each ○ mark is given 1.0 point, △ mark 0.5 point and × mark 0.0 point.
Source: Antalóczy and Sass (2003b, p. 26).

their subcontractors to introduce new management techniques and carry out other organizational innovations (Havas, 2002). In addition, these domestic corporations are devoting themselves to renewing their production facilities, developing new products, preparing to meet domestic needs, streamlining production systems, and improving designs on the basis of outsourcing contracts.

There have also been several empirical works on technological spillover effects brought about by foreign capital. For example, Novák (2003) confirms the existence of the FDI spillover effects by detecting a significant positive correlation between the TFP and the share of MNEs in the total sales in each industrial sector[18]. Furthermore, Sgard (2002) shows the high statistical significance of these spillover effects

[18] The coefficients of spillover effects had a positive sign with statistical significance regarding enterprises with 100 or more employees throughout the analytical period, while with enterprises with fewer than 100 employees, it had a negative sign with statistical significance for the first half of the 1990s and had no significance for the second half of 1990s.

Table 1.11 Shares of foreign companies in manufacturing sector by technological level, 2001

	Number of enterprises	Fixed assets	Sales	Exports	Number of employees
High-tech industries	10.4	80.5	91.5	97.5	66.5
Upper medium-tech industries	11.7	86.0	84.9	93.9	58.4
Lower medium-tech industries	10.7	74.6	71.6	73.7	42.5
Low-tech industries	8.2	58.3	57.0	71.8	36.3
Total	9.5	74.5	75.1	89.2	46.1

Notes : The following industries are included in each sector. (The numbers in parentheses are OECD industrial classification codes.) High-tech industries : aircraft and spacecraft (35.3), pharmaceuticals (24.4), office and computing machinery (30), communications equipment (32), and medical, precision and optical instruments (33.1). Upper medium-tech industries : electric machinery and apparatus (31), motor vehicles (34), chemicals (excluding pharmaceuticals) (24 excl. 24.4), railway locomotives and other transport equipment (35.2 + 35.4), general machinery and devices (29). Lower medium-tech industries : manufactured fuels (coke, refined petroleum products and nuclear fuel) (23), rubber and plastic products (25), non-metallic mineral products (26), basic metals (27), fabricated metal products (28) and ships and boats (35.1). Low-tech industries : Food, beverages and tobacco (15 + 16), textiles, apparel and leather products (17 + 18 + 19), wood products, paper products and printing (20 + 21 + 22), other manufacturing (36 + 37).
Source : Selected by the authors from Hamar (2004, pp. 48-49).

by introducing the share of foreign capital in the total equity capital by sector into the production functions[19]. On the other hand, he also reports that the northwest region between the border of the EU and Budapest is enjoying more positive spillover effects than the southern and eastern regions, which might have widened the regional gap in the productivity of local enterprises. This is noteworthy from the viewpoint of the role of FDI in the regional development in Hungary, as reported later.

As reported above, the FDI spillover effects originating from technology and knowledge transfer from MNEs to domestic companies became an important research subject regarding the relationship between advancement of foreign capital and restructuring of domestic

[19] However, from the panel-data analysis of 882 firms for the period of 1993-97, Bosco (2001) could not find positive spillover effects at all. Thus, this subject could be examined further.

firms in Hungary. Therefore, we examine this issue again in Part II of this book.

The above preceding studies highlight the major role played by foreign capital and MNEs in the restructuring process of industrial technologies in the corporate sector. As mentioned in the previous section, drastic structural changes in the Hungarian manufacturing sector as well as the significant improvement of its export competitiveness were leveraged by the introduction of foreign capital. In addition, it is clear that foreign-affiliated corporations supported the overall industrial sector in terms of R&D and innovation activities. It is also a noticeable trend that in recent years, foreign companies in Hungary have been actively hiring Hungarian researchers and strengthening ties with domestic universities and research institutes, as pointed out by Havas (2002)[20].

However, the above series of positive moves does not suggest that an internationally competitive R&D sector was and is now emerging in Hungary. Firstly, the quantitative analyses performed by Török and Petz (1999) and Knell (2000) show that R&D activities are not a strong explanatory factor for Hungary's enhanced export competitiveness and its improved productivity in the late 1990s[21]. Secondly, the number of national patent applications by Hungarian residents per 100 corporate researchers, a common indicator of productivity of R&D and innovation activities, dropped by 74.7% from 7.03 in 1994 to 1.78 in 2004, and this dismal trend continued until 2009, reaching 0.52. Thirdly, the already mentioned enterprise survey (KSH, 2003b) indicates that

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[20] Nevertheless, the collaboration among industry, universities, and government in the R&D sector is far from the desirable level. Therefore, Inzelt (2004) presses the Hungarian government for policy intervention to strengthen the ties of these entities.

[21] Török and Petz (1999) regressed the export-orientation ratio (ratio of exports to imports) to the R&D input ratio (ratio of R&D expenditures to GDP), skilled-labor ratio and foreign capital investment ratio, while Knell (2000) conducted regression analysis using the labor productivity improvement rate as a dependent variable and the R&D imput ratio and the manufacturing productivity growth rate as regressors. As a result, the former research confirmed that the coefficient of the R&D input ratio does not have economically-significant explanatory power, and the latter led to the conclusion that the R&D input ratio has no statistical significance.

83% of manufacturing companies polled did not carry out any innovation activities from 1999 to 2001, almost the same percentages as that recorded in the previous investigations by the statistical office (Inzelt 1994; KSH, 2001; Nagaoka and Iwasaki, 2003). The inactivity of domestic companies in innovation is regarded as a serious economic problem in Hungary, even after EU accession (Inzelt and Szerb, 2006; OECD, 2008). In summary, these findings strongly suggest that Hungary has a long way to go before achieving rationalization and revitalization of R&D and innovation activities. FDI and MNEs are expected to make a further contribution to this field.

1.5 Conclusions

This chapter presents analysis of the roles of FDI in the corporate restructuring in Hungary from a multilateral standpoint during the process of the EU accession of Hungary after the abolition of the socialist planned economy. From what has been discussed above, we can say that foreign capital and MNEs made a significant contribution to this development. Namely, active investment activities by foreign corporations lowered hurdles for Hungary to transform its economic system to a market economy by overcoming capital shortage, boosted the domestic corporate sector, and greatly improved the position of Hungary in the world economy through the substantial expansion of exports (Szekeres, 2001).

Notwithstanding, relying on the FDI to carry out economic transformation and to promote corporate restructuring poses many problems. First, there has been an increasing amount of profit repatriation by MNEs in recent years, which might further increase the current account deficit. In this sense, as indicated in **Table 1.1**, the direct investment income balance has tended to show a large deficit and to exceed the total FDI gross inflow in the past 10 years. The Hungarian government takes this situation very seriously.

Secondly, financial strains on domestic corporations and on the public arising from the preferential measures for foreign-owned enterprises have been distorting resource allocations and generating economic inequity between those who can enjoy the benefits of the FDI and those who cannot. Thirdly, regional disparity in income and unemployment has been widening due to the concentration of the FDI in

particular regions. Fourthly, behind the rapid growth of the foreign corporate sector, technology networks and inter-industrial relations forged during the socialist era have been completely abandoned, leading to the emergence of 'technological economic dualism' (Farkas, 2000; Farkas, 2004; Fink, 2006). Szanyi (2004) reports that the alliance between domestic companies and MNEs through supplier contracts and others is still a long way from being desirable in terms of scale and depth. Hence, resolving this problem remains a difficult policy challenge for the Hungarian government. Fifthly, the national economy's dependence on foreign capital has been creating anxiety among Hungarian citizens about the future of the country, putting them in fear of losing their national identity. And finally, the large-scale foreign capital inflow cannot solve many problems related to corporate restructuring in the country, as suggested by the analyses in the previous section referring to R&D and innovation activities. The remaining problems that have not been examined in this chapter include: (a) the underdevelopment of small and medium-size enterprises, (b) the unbalanced corporate capital structure heavily dependent on retained earnings, and (c) the insufficiency of supervision activities over managers by shareholders and financial institutions.

The following remarks were made by Szalavetz (2002) regarding policies to be taken up by the CEE countries after EU accession: "The transforming countries, in the 'long transition decade', have achieved remarkable success with minimal state intervention. By adapting a passive policy approach, they have allowed themselves to be driven forward by the modernizing effects of foreign direct investment. However, the challenges that follow EU accession will compel them to adopt an approach of more active state involvement. Local economic policy decision-makers will need to work out how to redefine the position of their countries in the world economy" (p. 5). We believe that her statement is still accurate even though Hungary's economic transformation has been in progress for 20 years.

Inspired by recommendations such as those presented above, more people in Hungary are calling for the modification of the current policies that focus on attracting foreign capital in order to achieve sustainable economic growth over the medium and long term. Currently, the revision of the development strategy is beginning to assume an urgent character in Hungary. The decline in attractiveness of Hun-

gary in comparison with other host countries, such as China, sharply reflects the decision-making process by foreign investors and MNEs that has resulted in the failure of the realization of new greenfield investment projects and continuous closure of big factories established by internationally famous foreign companies. Therefore, it seems reasonable to conclude that the Hungarian government and the business sector should reconsider their passive strategy of economic transformation and devote more effort to promoting the stable settlement of MNEs and deepening ties between these foreign companies and local industrial resources.

Acknowledgment

This chapter is a fully revised version of Iwasaki (2007a) based on the latest official statistics and literature. Iwasaki appreciates the permission of Palgrave Macmillan to reproduce the paper in this book.

Chapter 2

Privatization, Foreign Acquisition, and Firm Performance

2.1 Introduction

The privatization of public enterprises is becoming increasingly common throughout the world due to the globalization of market principles. This process began in the West with the U. K. as it adopted a denationalization program under the leadership of Margaret Thatcher, and it then spread to other industrialized states and developing countries. At the end of the 20th Century, when state socialism came to an end, privatization became an overriding trend in the international political and economic arena. The perception of the boundary separating public and private enterprises has changed considerably in the last 20 years. The denationalization process has grown steadily, even in such sectors as post services and social securities services, which were once believed to be traditional state-run businesses.

The philosophical foundation of the widespread privatization of public enterprises currently observed in many countries lies in the high degree of trust in the overwhelming advantage of private over public ownership in terms of efficiency. Many citizens now expect that the transfer of public firms to private owners could alleviate the financial burden of the state as well as significantly improve the management efficiency of privatized firms themselves, remarkably contributing to the betterment of society. Accordingly, it has become an impor-

tant subject of contemporary economics to ascertain whether such an expectation is feasible. In response to this demand, many studies pioneered by Megginson et al. (1994) and Boubakri and Cosset (1998) have been conducted, which repeatedly verified the positive change in firm performance before and after privatization through case analyses of industrialized and developing countries. Furthermore, it is almost certain that the effect of privatization was observed in enterprise privatization in the post-communist states. In fact, reviewing the recent literature on privatization in transition economies, Estrin et al. (2009) conclude that the effect of privatization has been mostly positive in Central and East European countries (CEECs). In contrast, it has been negligible or even negative in the Commonwealth Independent States. Nevertheless, privatization to foreign owners resulted in considerable improvement of the performance of former state-owned enterprises (SOEs) virtually everywhere.

On the other hand, however, most previous studies fall short in identifying whether these effects are due to the privatization process itself or to other factors (Omran, 2004). Furthermore, many studies focusing on the effect of a new ownership structure on a firm's performance following privatization fail to identify a statistically significant relationship between the two elements. This is particularly so for studies covering transition economies (Dewenter and Malatesta, 2001; Harper, 2002; Megginson, 2005; Aussenegg and Jelic, 2007). Therefore, despite the strong belief of economists in the superiority of the private sector over the state regarding ownership structure, no empirical study on privatization has presented a definitive conclusion regarding this point.

Using annual census-type data of Hungarian enterprises for the early 2000s, we analyze the impact of ownership transformation from the state to the private sector on firm performance in the post-privatization period. Unlike the early transitional period, which witnessed an economic crisis triggered by the collapse of the COMECON system and large-scale institutional changes leading toward a market economy, the early 2000s is a suitable time to investigate the relationship between the privatization and firm performance in Hungary because of the stability of the social and economic circumstances and the legal system at the time. Furthermore, as explained later, the data we employ cover almost all business firms, including SOEs, therefore

suring the representation of the Hungarian corporate sector. The ıta available, however, limits any study of performance among these ımpanies to two years after privatization. An insufficient observation ɜriod poses a significant obstacle to empirical analysis of the effects of ɜivatization policies.

To deal with this problem, we present a new empirical approach, hich nearly ensures the identification of the impact of ownership ansformation even if short-term data are used. The essence of the roposed methodology is to reject the null hypothesis, in which the ffects of ownership transformation are zero, by regressing a variety f performance indices into the scale and the type of ownership trans-ɔrmation and then synthesizing the estimates (effect size) using meta-ınalysis techniques in order to fully capture restructuring efforts by ıew owners and managers of privatized enterprises. Meta-analysis is ı precise scientific method to combine the results from individual studies for the purpose of integrating the research findings. There are plenty of examples of applications of meta-analysis in the fields of edu-cation, psychology, and the biomedical sciences (Hartung et al., 2008). Meta-analytic work can be broadly classified into two categories : (a) tests of the statistical significance of combined results and (b) methods for synthesizing estimates across studies (Hedges, 1992). Owing to great efforts by statisticians, we now have a variety of approaches from the vote-counting method to meta-regression analysis[1].

As the empirical literature grows, economists increasingly apply meta-analysis as a quantitative method in literature reviews with the aim of drawing a general conclusion on a targeted research topic. Although there are only a handful of studies, meta-analysis has also been applied to the literature on transition economies, such as Djankov and Murrell (2002) on enterprise restructuring, Fleisher et al. (2004) on returns to schooling and the speed of reforms, Égert and Halpern (2005) on equilibrium exchange rate, Fidrmuc and Korhonen (2006) on the business cycle correlation between the Euro area and the CEECs, and Iwasaki (2007b) on enterprise reform and corporate governance in Russia.

As described above, meta-analysis is a statistical method designed

[1] For more details on the meta-analysis methods, see Hedges and Olkin (1985), Hunter and Schmidt (2004), Keef and Roberts (2004) and Kulinskaya et al. (2008).

primarily to combine empirical results across studies conducted by different researchers and institutions. It is also quite effective, however, for summarizing various tests conducted within a single study (Borenstein et al., 2009). The approach in this study focuses on this latter function of meta-analysis. More concretely, we perform more than 4,000 regression trials using a large-scale panel data of Hungarian firms and integrate this large correction of estimation results by various meta-analysis techniques to test the hypothesis on the effect of enterprise privatization and foreign acquisition. Because everything is self-contained when conducting meta-analysis, we can prevent the so-called 'publication bias' and other problems from occurring due to the lack of commonality of model structures and variables. Moreover, the researcher's arbitrariness can be effectively eliminated by setting no limitations on the firm performance to be analyzed.

Our empirical analysis confirmed that the ownership transformation from the state to the private sector has statistically and economically significant impacts on post-privatization firm performance in Hungary. We also found that there are clear differences in the performance improvement effects among privatization implemented with no lower limit on the scale of ownership transformation, privatization with strategic control rights, and full privatization. Moreover, we found that ownership transformation to foreign investors has greater positive impacts on firm performance than that to domestic investors. These results were obtained with due consideration to the selection bias of the privatization decision by the Hungarian government and acquisitions by foreign investors and by controlling other potential determinants on firm performance in the post-privatization period. The advantage of using regression coefficients in meta-analysis over using odds rates or single correlation coefficients is that multivariate regression makes it easier to take such analytical measures when estimating the effect size of ownership transformation.

The remainder of this chapter is organized as follows : Section 2.2 reviews the privatization policy in Hungary. Section 2.3 contains testable hypotheses. Section 2.4 describes the data employed for this study. Section 2.5 explains our empirical methodology, and Section 2.6 presents the empirical results. Section 2.7 concludes.

2.2 Overview of Privatization Policy in Hungary

Unlike Russia and the Czech Republic, Hungary avoided, as much as possible, giving away public assets to private interests and, instead, thoroughly pursued the direct sale of public assets to strategic investors, including foreigners. This privatization strategy was, in principle, applied to all industries across the country. As a result, almost all of 1,859 former socialist enterprises designated in 1990 as to-be-privatized firms had become completely privately owned or liquidated by the end of the 1990s[2].

The policy approach during the large-scale privatization period was substantially passed on to the privatization process in the early 2000s or even strengthened under strong pressure from the European Commission to balance the national budget before accession to the EU (Iwasaki and Suganuma, 2009), leading to the steady privatization of dozens of government-owned companies left in the portfolio of the Hungarian Privatization and State Holding Company (ÁPV Rt.) and other public firms, mainly through open bidding. In fact, due to this firm policy of the Hungarian government, the share of SOEs in the total number of employees and total added-value for 2002 (2005) shrank to 15.0% (12.0%) and 17.6% (15.6%), respectively, suggesting that the state sector is now playing only a supplementary role in the Hungarian national economy (KSH, 2003c; KSH, 2006).

It is argued that one major bias when identifying the effect of privatization on changes in firm performance could be a deliberate policy to reserve better performing SOEs and concentrate privatization on weaker ones. The rationale in such a case is that revenues from state ownership can be redistributed according to political power rather than market mechanisms. The risk of this type of state failure

[2] There are many studies of enterprise privatization in Hungary during its early transition period : for the institutional framework and history of the privatization policies in Hungary, see Mihályi (1998), Macher (2000), Szanyi (2000), Major (2003), and Voszka (2003), and, for the evaluation of the privatization policies, see Bartlett (2000), Mihályi (2001), Hanley et al. (2002), and Báger and Árpád (2004).

has been emphasized by several authors[3]. However, this behavior did not determine Hungarian privatization in the 1990s. Many studies on Hungarian privatization contain general information on this issue stating that the primary aim of privatization was to gather as much cash revenue as possible to renovate the shaken state budget. This main policy aim limited the risk of this kind of bias, since the quickest and highest cash returns could be expected from the sales of the best companies. On the contrary, 'cherry picking' of foreign investors was a strong argument of the critiques of the Hungarian privatization way[4]. However, no systematic analysis and comparison of the privatized and the remaining state assets was carried out.

There is also some indirect information in the literature supporting our view that any existing bias, if at all, could influence comparisons of firm performance in the opposite direction during the 1990's. Mihályi (1997), for instance, referred to the 1995 Privatization Act, which listed items of long-term state property. The list contained companies that were regarded as strategic for some reason but had obviously not been selected because of their profitability. Éva Voszka, who regularly reviews Hungarian privatization policy, argued that, until 2001, privatization policy was determined by the intense desire of the central government for quick cash revenue to relieve the state budget deficit. For example, state ownership was drastically reduced in such 'cash cow' companies as the Hungarian Oil Company (MOL) and the National Savings Bank (OTP) (Voszka, 1998). When tensions in the state budget decreased, state asset management considerations changed. The privatization process slowed down, and long-term asset management priorities emerged (Voszka, 2001). However, this change in asset management and privatization happened exactly at the time of our sample observation; hence, selection bias did not occur prior to the observed period. Moreover, Voszka (2005) closely examined the recent privatization process in Hungary and concluded that state ownership should remain intact only in classic cases of market failure, suggesting that the room for political maneuver by the Hungarian government was extremely limited in the early 2000s.

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[3] See De Alessi (1980), Yarrow and Jasinski (1996), and Stiglitz (2000), among others.

[4] For example, see Boyco et al. (1996, p. 309) and Stiglitz (2000, p. 221).

2.3 Ownership Transformation and Firm Performance : Testable Hypotheses

Theoretically, privatization gain originates in the context of the relative inefficiency of the state compared with the private sector. From a political viewpoint, public enterprises should pursue strategies to achieve the public or political objectives of the politicians and bureaucrats who control them. However, such management goals often conflict with profit maximization, distorting the incentive structure and the constraints regarding company managers (Shleifer and Vishny, 1994). As seen in the fact that government subsidies are more likely to be criticized by tax payers and opposition parties when they are paid to specific private firms than when they are provided to public entities, privatization raises transaction costs for the use of political influences over firms' decision-making, thereby inhibiting intervention by politicians and bureaucrats and promoting firm restructuring (Sappington and Stiglitz, 1987).

From the viewpoint of corporate finance and firm organization, the governance structure in SOEs is particularly problematic. For instance, the lack of transferability of the property rights of public firms inhibits the capitalization of future consequences into current transfer prices, resulting in damaging incentives for managerial supervision by residual claimants(De Alessi, 1980). In addition, although the cash flow of SOEs ultimately belongs to the taxpayer, each share is trivial, which prevents citizens from organizing to overcome the free-rider problem and, hence, from exercising their influence over control-holding managers (Bennedsen, 2000). Moreover, compared with private firms, public companies are effectively protected from the threat of takeover and bankruptcy. As long as the government announces that no financial crisis is at hand, management discipline and budget constraints in SOEs are inevitably looser (Haskel and Szymanski, 1992; OECD, 2005). Furthermore, the fact that SOEs are remote from both capital and managerial markets poses a serious impediment to the development of managerial discipline and to securing effective monitoring from the outside. Transfer of ownership to the private sector greatly alleviates these governance problems and thus functions as a political measure for creating more effective control (Goldstein,

1997).

Nevertheless, some argue that private companies do not always outperform public ones (Boardman et al., 1986; Kole and Mulherin, 1997; Kwoca, 2005; Ang and Ding, 2006). It is also likely that some state regulations and administrative measures may make it possible for SOEs to achieve better performance than private firms operating in the same product market, and the fact that SOEs are fully government-dependent may give more confidence to markets and customers than private firms do, *ceteris paribus*. Normally, privatization is involved with the partial or complete removal of favorable conditions to state firms. There is no guarantee that privatized firms can achieve the same performance as they previously did under state protection, even after facing the worsening of the managerial environment in the above sense. As La Porta and Lopez-de-Silanes (1999) suggest, the financial and operating performance of privatized enterprises tends to converge to that of private firms. This rule is also assumed to be applicable when SOEs have an advantage over private firms. Accordingly, we present a neutral hypothesis with respect to the effects of ownership transformation on firm performance :

Hypothesis H_1 : Ownership transformation from state to private owners changes the financial and operating performance of privatized firms towards reducing the gap between the state and the private sector.

On the other hand, the effect of ownership transformation on post-privatization performance is not a monotonic increasing function for the degree of privatization even if there is room to seek privatization gains. Boycko et al. (1996) argue that privatization works when strategic control rights transfer from the state (or politicians) to managers. To achieve this goal, private investors must acquire at least a majority of ownership[5]. In fact, many earlier studies report that privatized firms exhibited stronger performance improvements after their majority control was sold by the government (Eckel et al., 1997; Bou-

[5] As in other OECD countries, the Corporate Law in Hungary stipulates that simple majority voting is the standard decision-making procedure, except for matters requiring an extraordinary resolution (*2006. évi* Ⅳ. *törvény—a gazdasági társaságokról 20 §* (*6*)).

bakri et al., 2005; Omran, 2007; Chen et al., 2008). Renunciation of strategic control by the state sends a good signal to company managers and private investors that it has no further intention of intensive political intervention and future re-nationalization, increasing the motivation of managers and private owners for firm restructuring.

Nevertheless, the retention of strategic control rights by private entities does not provide a satisfactory solution, although it makes it significantly easier for private investors to resist government interventions that are likely to damage the corporate value or to have a negative impact on profit maximization. Partial privatization is still not sufficient to eliminate conflicts of interest between the government and the private sector (Boardman and Vining, 1989; Hanousek and Kočenda, 2008). Empirical evidence that private firms outperform not only SOEs but also mixed enterprises is considered to support this statement (Vining and Boardman, 1992; Majumdar, 1998; Konings, 1997). Based on the above discussions, we derive the following hypothesis with respect to the effects of ownership transformation on the financial and operating performance of privatized firms :

Hypothesis H_2 : The effects of the transfer of strategic control rights on post-privatization firm performance are larger than those of ownership transformation without a lower limit, and the effects of full privatization surpass those of partial privatization.

The effects of ownership transformation are also greatly affected by the types of new ownership. In this regard, foreign participation can be a strong driving force for the restructuring of newly privatized firms. Foreign investors have a great deal of potential to provide enterprises acquired from the state with sophisticated expertise, including management know-how and production technologies accumulated in developed countries, as well as with greater access to new markets and new capital resources. In addition, they have a strong tendency to demand accountability in accordance with international standards from company managers in an effort to assess their performance on the basis of strict criteria (Dyck, 2001; D'Souza et al., 2005). With these advantages, foreign owners are highly likely to make remarkable positive contributions to former socialist economies, which are characterized by poor management and production techniques, a

closed domestic market, an underdeveloped financial system, and a weak corporate governance system. In fact, many researchers find a positive causality between foreign participation in management and firm performance in transition economies (Frydman et al., 1999; Kocenda and Svejnar, 2002; Weill, 2003; Yudaeva et al., 2003; Hanousek et al., 2007). As argued in Chapter 1, there are also many studies reporting similar empirical results with respect to Hungary (Szekeres, 2001; Novák, 2002; Hamar, 2004; Hasan and Marton, 2003; Perotti and Vesnaver, 2004; Makó, 2005; Brown et al., 2006; Colombo and Stanca, 2006).

In contrast to foreign investors, domestic investors in the post-communist states are more sensitive to political influence from regional governments and local magnates as well as more prone to be motivated by interests other than profit maximization, such as the attainment of social prestige or a relationship with local citizens. Furthermore, it has been repeatedly pointed out from both the theoretical and empirical perspectives that insiders, who often buy out privatized enterprises in transitional countries, are quite problematic as key players in corporate restructuring aimed at the improvement of profitability and productivity (Aoki and Kim, 1995; Blanchard and Aghion, 1996; Li, 1998; Filatotchev et al., 1999; Megginson and Netter, 2001). We, therefore, will test the following hypothesis with respect to the relationship between types of investors and firm performance :

Hypotheses H_3 : Ownership transformation to foreign investors has larger positive impacts on improvement in the financial and operating performance of privatized firms than that to domestic investors.

From the next section onwards, we will verify the three hypotheses discussed above by combining large-scale panel data of Hungarian firms and a new empirical methodology.

2.4 Data

The data underlying our empirical analysis are annual census-type data of Hungarian firms, which were compiled from financial statements associated with tax reporting submitted to the National Tax Authority in Hungary by legal entities using double-sided book-

keeping. The observation period is four years from 2002 through 2005. The data cover all industries and contain basic information of each entry, including the General Industrial Classification of Economic Activities within the European Communities (NACE) 4-digit industrial classification, annual average number of employees, and total assets, sales, and other financial indices. In addition, the locations of firms are identical to the extent that they are divided into the capital region, including Budapest and Pest County, the western region, made up of nine counties, and the eastern region, comprising nine counties[6].

Information about ownership structure includes the total amount of capital (subscribed equity) at the end of the calendar year and its share of state, domestic private investors, and foreign investors. The data, therefore, allow us to know the timing and scale of ownership transformation from the state to the private sector. In this chapter, the following definition applies : privatization has been carried out in year *t* if there was a relative decrease in the proportion of state ownership between the previous and current years.

All nominal values are deflated with the base year being 2002. As Sgard (2001) and Claessens and Djankov (2002) indicate, firm-specific price indices are not available in Hungary. Hence, following the steps taken by these two studies, we use the consumer price index, the *industrial producer price index, and the investment price index* reported by the Hungarian Central Statistical Office as alternative deflators.

Although the data are basically reliable, a number of values are missing, and unrealistic or inconsistent input values are included. To correct this problem, we carefully cleaned the data to remove inconsistencies and to eliminate samples containing missing values and, hence, posing an impediment to our empirical analysis.

The data form an unbalanced panel having additional new entry and exit of enterprises during the observation period. Since we have no information concerning these firms, none of these samples was used in the empirical analysis. In this regard, nothing was found to indicate that samples containing missing and abnormal values and newly enter-

[6] For details, see notes in **Table 2.1**. Due to the state regulation on the disclosure of official census data, more specific location information is not available for this research.

ing and exiting enterprises were much more biased toward certain categories of firms in terms of industrial sector, firm size, location, and financial performance than other samples.

With regard to the sample group for 2002, **Table 2.1** shows the total number of enterprises, the basic statistics of the number of employees and equity capital, and the composition by region and industrial sector for both private firms and SOEs. This table also reports the frequency distribution of the proportion of state ownership in the latter. One-man companies are excluded because ownership structure is not a crucial issue for corporate management in these firms. As a result of the extensive data cleaning and exclusion of one-man companies, 99,315 firms remain in our dataset. This is about half the number of samples in the original data. According to official statistics, the 98,367 private firms and 948 SOEs covered here account for 84.2% of all private firms and 81.6% of all public enterprises in Hungary, respectively, in terms of the total number of employees in 2002.

In **Table 2.1**, we can also confirm the following : first, the average size of SOEs is larger than that of private firms in terms of both the number of employees and the amount of equity capital; second, the degree of geographical concentration of SOEs in the capital region is slightly moderate compared with that of private firms; and third, the share of the agriculture, forestry, and hunting and fishing sector in the industrial composition of SOEs is as much as 20% higher than that of private firms, whereas the share of wholesale and retail trade companies in the total number of SOEs is 18% lower than that of private firms. Furthermore, **Table 2.1** reveals that more than half of SOEs are 100% government-owned and firms with less than 50% state ownership account for only 27% of all SOEs. We take these facts into account in the empirical analysis.

2.5 Empirical Methodology

As pointed out by Kocenda and Svejnar (2003), using a small and unrepresentative samples of firms as well as a short observation period could pose a serious impediment to empirically examining the effects of privatization policies in developing and transition economies. With the development of state statistical systems and private company information services, the problems associated with short obser-

Table 2.1 Comparison of private and state corporate sectors in Hungary, 2002

	A. Fully private firms	B. SOEs
Number of firms	98,367	948
Annual average number of employees (persons)		
Total	1,497,832	255,960
Mean	15	270***
Median	4	19†††
Equity capital		
Total (billion HUFs)	4,360	1,592
Mean (thousand HUFs)	44,325	1,679,550***
Median (thousand HUFs)	3,000	60,864†††
Composition by region (actual number/proportion)[a]		
Capital region (Budapest and Pest County)	44,422/0.45	392/0.41
Western region	25,883/0.26	254/0.27
Eastern region	28,062/0.29	302/0.32
Composition by industrial sector (actual number/proportion)[b]		
Agriculture, forestry, hunting, and fishinning and quarrying	4,095/0.04	226/0.24
Mining and quarrying	192/0.00	3/0.00
Manufacturing	17,490/0.18	116/0.12
Electricity, gas, and water supply	305/0.00	30/0.03
Construction	10,605/0.11	80/0.08
Wholesale and retail trade	30,255/0.31	122/0.13
Hotels and restaurants	4,780/0.05	18/0.02
Transport, storage, and communication	4,681/0.05	56/0.06
Financial intermediation	1,004/0.01	30/0.03
Real estate and renting	15,855/0.16	175/0.18
Other industries	9,105/0.09	92/0.10
Share of state ownership (actual number/proportion)		
1-25%	—	147/0.16
26-50%	—	101/0.11
51-75%	—	83/0.09
76-99%	—	118/0.12
100%	—	499/0.53

Notes : The western region consists of the following nine counties : Győr-Moson-Sopron; Komárom-Esztergom; Vas; Veszprém; Fejér; Zala; Somogy; Tolna; and Baranya. The eastern region also consists of nine counties : Nógrád; Bács-Kiskun; Csongrád; Békés; Jász-Nagykun-Szolnok; Hajdú-Bihar; Szabolcs-Szatmár-Bereg; Borsod-Abaúj-Zemplén; and Heves. The composition by industrial sector is based on the Classification of Economic Activities in the European Community (NACE). Other industries include public administration and defense and compulsory social security; education; health and social work; other community, social, and personal service activities; and household activities.

[a]Test for equality : $\chi^2 = 6.7446$, $p = 0.034$.

[b]Test for equality : $\chi^2 = 1246.8518$, $p = 0.000$.

***denotes that the difference between privave firms and SOEs is significant at the 1% level by the *t*-test.

†††denotes that the difference between private firms and SOEs is significant at the 1% level by the Wilcoxon rank-sum test.

Source : Authors' calculation.

vation periods and small samples are diminishing because of the increasing availability of large-scale sample sets. Although solutions are being found to overcome the short observations, the real difficulty is with the type of firm to be observed rather than with the observers. In other words, the shorter life cycles of firms and the more frequent changes in company profiles in developing and transitional countries than in developed countries are major obstacles to tracing the effects of enterprise privatization from a mid- and long-term perspective. The other related issue is the scarcity and distortion of information concerning the management and performance of SOEs, especially in former socialist states. This defect considerably limits the application of the empirical method advocated by Megginson et al. (1994) into transition economies for the detection of privatization gains through comparing firm performance before and after privatization. Unfortunately, there seems to be no instant solution to this situation.

Researchers often attempt to identify privatization gains by looking at changes in profitability and productivity in a narrow sense. This approach makes a lot of sense because those changes are directly related to improvements in corporate value and shareholder wealth. However, if profitability or productivity is increased as a result of multifaceted improvements in business strategies, firm organization, and production systems, the use of short-term observation data may lead to the failure to detect the end products of those managerial efforts. With this in mind, an empirical study should be conducted to cover a broad range of performance indices, including short-term ones, which are more operational for new owners and managers of ex-state companies, focusing on the byproduct of the process of firm restructuring at hand. By covering as many performance indices as practicable, the statistical power of hypothesis tests is also expected to be enhanced due to increased information about the effects of ownership transformation on firm performance. This is the reason that we perform panel data regressions taking a variety of performance indices as dependent variables and then synthesize these estimates using meta-analysis techniques to examine the testable hypotheses presented in Section 2.3.

Our empirical analysis broadly consists of five stages. At the first stage, as a prerequisite for verifying hypothesis H_1, we conduct comparative analysis using descriptive statistics of fully SOEs and 100%

private firms in order to identify in which aspects of firm performance state ownership is inferior or superior to private ownership. This procedure aims to identify the potential source of privatization gains. The comparison is carried out between 499 fully government-funded companies listed on **Table 2.1** and approximately 90,000 private firms whose distribution of firm sizes, locations, and industrial compositions is, for the most part, identical to that of the above fully SOEs. We exclude mixed enterprises, in which ownership structure and firm performance are highly likely to be determined endogenously, from all stages of our empirical analysis because the main research interest in this study lies in how the exogenous privatization decision made by the government affects firm performance in the post-privatization period.

The comparison is made with respect to a total of 23 financial and operating indices from 5 areas routinely utilized by company executives and investment analysts worldwide, including Hungary. They consist of the following : (a) 7 indices of profitability (ordinary income to total assets (ROI)/value-added to sales/operating income to sales/ordinary income to sales/return on equity (ROE)/return on total assets (ROA)/ordinary income on equity); (b) 7 indices of productivity (value-added per employee/operating income per employee/ordinary income per employee/sales per employee/sales to employment/sales to total costs/fixed investment efficiency); (c)2 indices of financial ability (total assets turnover/fixed assets turnover); (d) 2 indices of financial soundness (fixed ratio/capital adequacy ratio (CAR)); and (e) 5 indices of firm growth (sales growth/value-added growth/operating income growth/ordinary income growth/total assets growth)[7]. The number of employees and average employee salary are not investigated, since it is theoretically unclear how a change in these two variables would affect the corporate restructuring of privatized firms in contemporary Hungary after the dozen years since the collapse of the communist regime.

The second stage traces when and how much ownership of which companies was transferred to the private sector among the above 499

[7] The following indices are defined as shown : fixed investment efficiency = value-added/total fixed assets; total (fixed) assets turnover = sales/total assets (fixed assets); and fixed ratio = total fixed assets/equity capital.

SOEs in the 3 years from 2003 to 2005. At this stage, in order to identify the presence and extent of selection bias regarding the privatization decision of the government and foreign participation in the management of privatized firms, we carry out univariate comparisons of the privatized firms and remaining SOEs and the firms acquired by domestic investors and those by foreign investors in terms of pre-privatization company size and firm performance. We also perform multivariate regression, taking the probability of privatization and that of foreign acquisition as dependent variables.

In the third stage, we conduct a panel estimation of the impact of ownership transformation on post-privatization firm performance. The 23 performance indices reported above are regressed into the scale and type of ownership transformation while controlling the other potential determinants. We estimate the following regression equation :

$$y_{it} = \mu + \alpha x_i + \gamma' Z_i + \delta_i + \varepsilon_{it},\ Z_i = (z_{i1},...,z_{iK}), \tag{2.1}$$

where y_{it} represents firm i's performance for year t, x_i is an ownership variable, Z_i is a $K \times 1$ vector of control variables, μ is a constant term, α and γ are parameters of interest to be estimated, δ_i is the individual effects, and ε_{it} is an error term[8]. The regression model taking an ownership variable with no lower limit to the scale of ownership transformation is Model I. We use the estimation results of this model to examine hypothesis H_1. We also estimate Model II, in which limitations are placed on the scope of ownership variables to be investigated into the impact of the transfer of strategic control rights (i.e., 50% or more ownership), and Model III, which is exclusively applied to the cases of full privatization. The estimation results of the latter two regression models are used for verifying hypothesis H_2 with those of Model I. To test hypothesis H_3 regarding the relationship between types of new ownership and firm performance, we estimate Model IV and Model V, which regress post-privatization firm performance into an ownership transformation ratio to domestic investors and foreign investors, respectively, and compare the estimates of these two models.

Further, according to Claessens and Djankov (2002), who docu-

[8] We hypothesize that no change in ownership structure had been made for two years before privatization.

mented changes in the performance of over 6,000 firms in seven Eastern European countries in the early 1990s, it takes several years for the privatization benefits at the firm level to become noticeable. The panel data used in this study deals with time lags of up to two years. Thereupon, with regard to Model I, we estimate a regression equation that takes the ownership transformation ratio in the current year (x_{it}) as an ownership variable and call it Model Ia. We also perform estimations of Models Ib and Ic, which regress firm performance into a one-year lag ownership variable (x_{it-1}) and a two-year lag ownership variable(x_{it-2}), respectively. We label these three regression equations as the Model I family. The same estimation procedure is adopted for Models II to V. Consequently, our panel estimation is based on a total of 15 types of regression equations classified into one of 5 model families.

In order to fully identify the effects of ownership transformation, our regression model controls the following potential determinants of firm performance : the sales share of each firm to represent its position in the product market; the median of the dependent variable for the sector each firm belongs to, calculated from about 10,000 effective samples excluding the panel estimation sample, to capture the sector's market fluctuation; the sales-based Herfindahl index to proxy for the degree of market concentration of the sector each firm belongs to; industry fixed effects; time effects; and region-specific fixed effects. The firm's market position, the market fluctuation and market concentration level of the sector it belongs to, and industry fixed effects are all based on the NACE two-digit level. In addition, to avoid simultaneous bias with the dependent variable, a predetermined variable for the previous term is used for the firm's market position and the degree of market concentration of the sector it belongs to.

We estimate the above regression models using three panel estimators : fixed effects, random effects, and pooled OLS with cluster effects on the NACE two-digit level.

The fourth stage synthesizes the regression coefficients of ownership variables using the estimation results of models selected on the basis of the Hausman test to test the random-effects assumption and the Breusch-Pagan test to test the null-hypothesis that the variance of the individual effects is zero. We set the critical value for both of these specification tests at the 10% level of significance.

The following method is applied for synthesizing regression coef-

ficients. Suppose there are N independent studies. Here, the 'effect size' estimate of the n-th study is labeled as T_n, and the corresponding population and standard deviation, as θ_n and s_n, respectively ($n = 1, ..., N$). We assume that estimate T_n is normally distributed ($T_n \sim N(\theta_n, s_n^2)$). We also assume that $\theta_1 = \theta_2 = ... = \theta_N = \theta$, implying that each study in a meta-analysis estimates the common underlying population effect and the estimates differ only by random sampling errors. An asymptotically efficient estimator of the unknown true population parameter θ is a weighted mean by the inverse variance of each estimate :

$$\bar{T} = \sum_{n=1}^{N} w_n T_n \Big/ \sum_{n=1}^{N} w_n, \tag{2.2}$$

where $w_n = 1/v_n$ and $v_n = s_n^2$. The variance of $\bar{T}$ is given by :

$$\mathrm{var}(\bar{T}) = 1 \Big/ \sum_{n=1}^{N} w_n. \tag{2.3}$$

This is the meta fixed-effects model. In order to utilize this method, we need to confirm that the estimates are homogeneous. A homogeneity test uses the statistic :

$$H_T = \sum_{n=1}^{N} w_n (T_n - \bar{T})^2, \tag{2.4}$$

which has a Chi-square distribution with N-1 degrees of freedom. The null-hypothesis is rejected if H_T exceeds the critical value. In this case, we assume that heterogeneity exists among the studies and adapt a random-effects model that incorporates the sampling variation due to an underlying population of effect sizes as well as the study-level sampling error. If the deviation between estimates is expressed as δ_θ^2, the unconditional variance of the n-th estimate is given by $v_n^u = (v_n + \delta_\theta^2)$. In the meta random-effects model, the population θ is estimated by replacing the weight w_n with the weight $w_n^u = 1/v_n^u$ in Eq. (2.2)[9]. For the between-studies variance component, we use the method-of-moment estimator computed by the next equation using the value of the homogeneity test statistic H_T obtained from Eq.(2.4) :

[9] This means that the meta fixed-effect model is a special case based on the assumption that $\delta_\theta^2 = 0$.

$$\hat{\delta}_{\theta}^{2} = \frac{H_T - (N-1)}{\sum_{n=1}^{N} w_n^u - (\sum_{n=1}^{N} w_n^{u2} / \sum_{n=1}^{N} w_n^u)}. \tag{2.5}$$

In other words, the fourth stage verifies the testable hypotheses on the basis of the value of the synthesized regression coefficients and its statistical significance by adopting either the meta fixed-effects model or the meta random-effects model according to the results of the homogeneity test. At this stage, we also make use of the p-value combination method and the vote-counting method, both of which are more conventional meta-analysis techniques, to supplement the results from the synthesis of regression coefficients.

At the last fifth stage, we conduct a meta-regression analysis[10]. This quantitative method has a great advantage in strictly interpreting the differences in the results of panel estimation, and, thus, it can be an effective means for supplementing the results of meta-analysis at the fourth stage. We estimate the following meta-regression model :

$$T_n = \beta_0 + \sum_{m=1}^{M} \beta_m W_{nm} + e_n,\ n = 1,\ldots,N, \tag{2.6}$$

where β_0 represents the effects of ownership transformation under the default conditions $(W_{nm} = 0)$, W_{nm} is a meta-independent variable including the characteristics of the panel regression model and observations that are considered to create differences in estimation results, β_m denotes a meta-regression coefficient to be estimated, and e_n is an error term.

To reexamine our testable hypotheses, we use dummy variables that identify whether the dependent variable y_{it} in the panel regression model is a superior or inferior performance index to private firms in comparison with fully SOEs as well as dummy variables that capture the differences in the scale and type of ownership transformation.

[10] Called 'the regression analysis of regression analyses' (Stanley and Jarrell, 1989), this method is now intensively applied in economics to summarize the empirical literature. Among the recent studies using this technique are those by Connor and Bolotova (2006), Nelson (2006), Brander et al. (2007), and Doucouliagos and Paldam (2008).

In addition, we check the sensitivity of the overall estimation results of the panel regressions by incorporating into the meta-regression model such independent variables that capture the time lags of the ownership variables, the industrial sector, the qualitative difference in performance indices, and the difference in panel estimators, and a dummy variable, which is equal to one if an effect size is obtained from the regression model selected according to the model specification tests, as well as the number of observations used in the panel estimation.

To estimate meta-regression models, most preceding studies have employed one or a combination of a weighted least square (WLS) estimator with the number of observations or standard errors as analytical weights, a meta random-effects estimator using the restricted maximum likelihood (RML) method or the non-iterative moment method, or a meta mixed-effects estimator using the RML method. In order to check the robustness of the estimation results, we adopt all five of these estimators. We also perform regressions by using all panel estimates as the dependent variables and by exclusively using the estimates of models selected by the specification tests.

2.6 Results

Tables 2.2 through **2.8** present the main results of our empirical analyses. In this section, we summarize and interpret these results as well as explain the methodological procedure in detail.

2.6.1 Performance Comparison between Private and Full State-Owned Enterprises

Table 2.2 shows univariate comparisons between private and fully SOEs using 23 performance indices. According to the results covering the entire corporate sector (Panel A), Hungary's SOEs are generally inferior to its private firms. In fact, 18 of the 23 indices demonstrated the superiority of private firms over SOEs at the 10% or lower significance level either by a *t*-test or a Wilcoxon rank-sum test. These indices are hereinafter referred to as the 'SOE-inferior indices.' This is one of the political reasons that the Hungarian government has been and is still promoting the privatization of public firms.

Nevertheless, when looking into the four individual sectors (Panels

Table 2.2 Firm performance comparison of fully private and fully state-owned enterprises in Hungary, 2002

		A. Whole corporate sector			B. Agriculture, forestry, hunting, and fishing			C. Manufacturing			D. Construction			E. Services	
			Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs
Profitability																
Ordinary income to total assets (ROI)	Mean		−0.311	−0.334		−0.170	−0.467		−0.230	0.020		−0.502	−0.104		−0.305	−0.491
	Median	△	0.016	0.002†††	△	0.029	0.008†		0.029	0.043		0.025	0.010	△	0.010	−0.005†††
Value-added to sales	Mean	△	0.018	−0.239***		−0.135	0.229		0.116	0.154	△	0.112	−0.308**		0.003	−0.155
	Median		0.198	0.222	▼	0.152	0.318†††		0.255	0.305	△	0.190	0.140††		0.168	0.183
Operating income to sales	Mean		−0.344	−0.679		−0.339	0.024	△	−0.287	−1.662**		−0.253	−0.157		−0.372	−0.793
	Median		0.016	0.015		0.032	0.017		0.020	0.029		0.014	0.017		0.014	0.009
Ordinary income to sales	Mean	△	−0.419	−1.213***		−0.390	0.035	△	−0.303	−1.159*		−0.271	−0.210	△	−0.446	−1.136***
	Median	△	0.017	0.007†††	△	0.045	0.015††		0.023	0.029		0.016	0.011	△	0.014	0.002†††
Return on equity capital (ROE)	Mean		6.123	1.938		5.338	1.449		5.033	13.228		2.917	−1.029		4.249	2.522
	Median	△	0.089	0.034††		0.108	0.036		0.122	0.104		0.099	0.025		0.051	0.024
Return on total assets (ROA)	Mean		−0.390	−0.262		−0.222	−0.457		−0.339	0.011		−0.683	−0.085		−0.392	−0.394
	Median	△	0.019	0.009††		0.020	0.016		0.024	0.037		0.019	0.009		0.012	0.007
Ordinary income on equity capital	Mean		2.167	1.065		2.487	1.384	▼	2.062	12.062***		0.808	−1.410		1.842	1.273
	Median	△	0.054	0.003†††	△	0.124	0.027†		0.120	0.127	△	0.100	0.015††	△	0.032	−0.010†††
Productivity																
Value-added per employee[a]	Mean	△	2287	1233***		1375	1660		2232	2541	△	1784	867**	△	2389	1215***
	Median		1327	1426	▼	1107	1670††		1451	2147	△	1215	1046††		1318	1354
Operating income per employee[a]	Mean	△	590	−392***		525	−84		467	1099		340	580	△	643	−1209***
	Median		86	86		196	90		85	241		62	137		69	52
Ordinary income per employee[a]	Mean	△	540	−483***		658	−213		490	1010		393	94	△	610	−763***
	Median	△	105	29†††	△	328	66†††		128	75		101	91	△	90	1†††
Sales per employee[a]	Mean	△	14681	12636*	△	13852	7643*		11502	12540		12420	12616		16673	14386
	Median	△	6088	5597†	△	7123	5792†		5721	6822	△	5969	4344†		6727	5903
Sales to employment	Mean		42.421	25.271		49.282	14.788		27.692	7.394		37.611	11.280		46.587	35.686
	Median	△	6.780	3.325†††	△	7.370	3.176†††	△	5.345	3.410†††	△	6.878	2.614†††	△	7.746	4.278†††
Sales to total costs	Mean	△	1.133	1.003***		1.066	1.007	△	1.088	0.997*	△	1.079	0.838***	△	1.130	1.049***
	Median	△	1.051	1.018†††		1.014	0.998		1.063	1.054	△	1.046	0.935†††	△	1.045	1.026†††
Fixed investment efficiency	Mean	△	2.576	1.446**		0.649	0.065		2.698	3.471	△	3.269	0.819**	△	2.748	1.423*
	Median	△	0.932	0.592†††	▼	0.309	0.536††		1.191	1.347	△	1.444	0.119†††	△	0.893	0.775†
Financial ability																
Total assets turnover	Mean		3.622	3.236		2.348	2.868		2.851	2.236		5.756	5.312		3.609	3.425
	Median	△	1.545	1.127†††		0.871	0.891		1.593	1.393	△	2.044	0.788†††	△	1.558	1.235†
Fixed assets turnover	Mean	△	15.362	8.237***		5.115	2.485		10.848	11.329	△	17.487	3.043***		19.405	12.223
	Median	△	4.610	1.946†††		2.159	1.880		4.456	4.648	△	7.397	0.615†††	△	5.529	2.008†††

(continued)

Table 2.2 (continued)

		A. Whole corporate sector			B. Agriculture, forestry, hunting, and fishing			C. Manufacturing			D. Construction			E. Services		
			Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs		Fully private firms	Fully SOEs
Financial soundness																
Fixed ratio	Mean	△	19.426	7.997**		18.796	2.742		15.334	1.846		15.528	1.198		21.692	17.203
	Median	△	2.485	1.328†††	△	2.781	1.802††	△	2.502	0.879†††	△	2.485	1.185†††		2.509	1.730
Capital adequacy ratio (CAR)	Mean	▼	0.184	0.281***	▼	0.189	0.318***	▼	0.184	0.282***	▼	0.177	0.419***	▼	0.190	0.245***
	Median	▼	0.092	0.231†††	▼	0.103	0.283†††	▼	0.100	0.242†††	▼	0.088	0.448†††	▼	0.097	0.178†††
Firm growth[b]																
Sales growth	Mean		2.040	0.902		1.079	0.011		1.397	−0.030		2.157	−0.233		2.174	2.321
	Median	△	0.051	0.002†††		−0.022	0.025		0.021	−0.005	△	0.058	−0.239†††		0.051	0.024
Value-added growth	Mean	△	1.488	−1.244***		0.910	−0.011		1.174	−1.074	△	2.053	−4.155***	△	1.500	−0.980*
	Median	△	0.063	−0.034†††		−0.035	−0.001	△	0.032	−0.034†	△	0.038	−0.432†††		0.063	0.052
Operating income growth	Mean		0.190	−0.815		−0.154	0.240	△	0.223	−9.835*		0.248	−0.636		0.052	−4.972
	Median		0.023	0.044	▼	−0.192	0.085†		0.010	−0.285		−0.033	−0.282		0.030	0.046
Ordinary income growth	Mean		0.121	−0.420		−0.078	0.456		0.276	−4.568		0.232	−0.548		−0.037	0.520
	Median		0.038	−0.055	▼	−0.166	−0.041†	△	0.025	−0.451††		−0.046	−0.103		0.054	0.195
Total assets growth	Mean		1.292	0.116		1.021	0.034		0.844	0.085		1.722	0.051		1.290	0.104
	Median		0.021	0.007		0.008	0.028		0.026	0.004		0.040	0.071	△	0.009	−0.015†
Classification of performance indices (actual number/proportion)																
SOE-inferior indices (△)			18/0.78			7/0.30			8/0.35			12/0.52			13/0.57	
SOE-superior indices (▼)			1/0.04			6/0.26			2/0.09			1/0.04			1/0.04	
Difference-insignificant indices (no sign)			4/0.17			10/0.43			13/0.57			10/0.43			9/0.39	

Notes : The following indices are defined as follows : fixed investment efficiency = value-added/total fixed assets; total (fixed) assets turnover = sales/total assets (fixed assets); and fixed ratio = total fixed assets/equity capital. All nominal values are deflated with the base year being 2002 using the consumer price index, the industrial producer price index, and the investment price index reported by the Hungarian Central Statistical Office as deflators when we compute the firm growth indices. The service sector includes wholesale and retail trade; hotels and restaurants; transport, storage, and communications; and real estate and renting. The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices in which the mean or median for fully SOEs regarding the relevant indices are inferior (superior) to those for private firms with statistical significance at the 10% or lower level. The difference-insignificant indices refer to those that do not satisfy these conditions.

[a]The unit is one thousand HUFs.

[b]Real growth rate for 2002-03.

***, **, *Significant at the 1, 5, and 10% levels, respectively, by the t-test.

†††, ††, †Significant at the 1, 5, and 10% levels, respectively, by the Wilcoxon rank-sum test.

△ denotes that private firms are superior to full SOEs with statistical significance at the 10% or lower level. ▼ denotes that private firms are inferior to full SOEs with statistical significance at the 10% or lower level.

Source : Authors' calculation and estimation.

B-E), performance gaps between fully SOEs and private firms vary significantly from industry to industry. For example, in the service sector, 13 of the 23 performance indices apply to the SOE-inferior indices, whereas, in the agriculture, forestry, hunting, and fishing sector, only 7 indices apply. In addition, no particular common trend is observed among the four sectors regarding the structure of the comparison results. On the other hand, turning to the performance indices showing the statistically significant superiority of SOEs over private firms (hereinafter 'SOE-superior indices'), the capital adequacy ratio for SOEs is much higher than that for private firms in all sectors. Furthermore, in the agriculture, forestry, hunting, and fishing sector, SOEs outperform private firms in six performance indices, and, in the manufacturing sector, SOEs perform better than private firms in terms of the ordinary income-to-equity ratio. Moreover, there are 42 test results demonstrating no statistically significant performance gaps between the two corporate sectors (hereinafter 'difference-insignificant indices'), accounting for 46% of all results. As discussed in Section 2.3, if a privatization gain can be attributed to the comparative inefficiency of public firms, the effects of enterprise privatization are considered to have become noticeable in more limited situations than expected in Hungary of the early 2000s.

2.6.2 Privatization Process of State-Owned Enterprises and Selection Bias

Table 2.3 shows that, of 499 companies that were fully government-owned as of the end of 2002, 313, or 62.7%, partially or entirely transferred their property rights to the private sector over the three years up to 2005. This table also shows that most of these firms were privatized in 2003. This is probably due to the policies adopted by the Hungarian government[11] facing the need to restructure public finance

[11] In May 2002, Pétel Medgyessy formed a coalition government of the Hungarian Socialist Party (MSZP) and the Alliance of Free Democrats (SZDSZ) as a result of the fourth post-communist parliamentary elections. Aiming at early fulfillment of Hungary's EU accession and entry into the EURO zone, the Medgyessy administration took political measures to promote market-oriented structural reform and tight fiscal policies.

Table 2.3 Privatization process of state-owned enterprises in Hungary, 2002-2005

		2002	2003	2004	2005
Number of fully SOEs		499	223	203	186
Number of privatized firms		0	276	23	18
Number of firms acquired by domestic investors		0	262	21	17
Number of firms acquired by foreign investors		0	20	3	1
Number of firms that experienced privatization twice		0	0	3	1
Accumulated number of privatized firms		0	276	296	313
Scale of ownership transformation					
All privatized firms	Mean	—	0.99	0.84	0.82
	Median	—	1.00	1.00	1.00
Firms acquired by domestic investors	Mean	—	0.98	0.81	0.81
	Median	—	1.00	1.00	1.00
Firms acquired by foreign investors	Mean	—	0.80	0.83	1.00
	Median	—	1.00	1.00	1.00
Frequency distribution of the scale of ownership transformation (actual number/proportion)					
1-10%		—	0/0.00	2/0.09	2/0.11
11-25%		—	2/0.01	0/0.00	1/0.06
26-50%		—	1/0.00	1/0.04	0/0.00
51-75%		—	1/0.00	2/0.09	2/0.11
76-99%		—	0/0.00	4/0.17	1/0.06
100%		—	272/0.99	14/0.61	12/0.67
Composition of privatized firms by region (actual number/proportion)[a]					
Capital region (Budapest and Pest County)		287/0.58	160/0.58	11/0.48	10/0.56
Western region		95/0.19	55/0.20	9/0.39	1/0.06
Eastern region		117/0.23	61/0.22	3/0.13	7/0.39
Composition of privatized firms by industrial sector (actual number/proportion)[a]					
Agriculture, forestry, hunting, and fishing		43/0.09	12/0.04	1/0.04	2/0.11
Mining and quarrying		3/0.01	0/0.00	0/0.00	1/0.06
Manufacturing		63/0.13	32/0.12	4/0.17	4/0.22
Electricity, gas, and water supply		5/0.01	1/0.00	0/0.00	1/0.06
Construction		72/0.14	29/0.11	3/0.13	2/0.11
Wholesale and retail trade		86/0.17	79/0.29	4/0.17	0/0.00
Hotels and restaurants		16/0.03	16/0.06	0/0.00	0/0.00
Transport, storage, and communications		19/0.04	11/0.04	0/0.00	1/0.06
Financial intermediation		11/0.02	3/0.01	1/0.04	0/0.00
Real estate and renting		112/0.22	63/0.23	7/0.30	7/0.39
Other industries		69/0.14	30/0.11	3/0.13	0/0.00

Notes : The western region consists of the following nine counties : Győr-Moson-Sopron; Komárom-Esztergom; Vas; Veszprém; Fejér; Zala ; Somogy; Tolna; and Baranya. The eastern region also consists of nine counties : Nógrád; Bács-Kiskun; Csongrád; Békés; Jász-Nagykun-Szolnok; Hajdú-Bihar; Szabolcs-Szatmár-Bereg; Borsod-Abaúj-Zemplén; and Heves. The composition by industrial sector is based on the Classification of Economic Activities in the European Community (NACE). Other industries include public administration and defense and compulsory social security; education; health and social work; other community, social, and personal service activities; and household activities.

[a]The data for 2002 are the breakdown of state enterprises.

Source : Authors' calculation.

and to further promote deregulation in the domestic market toward EU accession in 2004[12]. This provides a favorable condition for measuring the time-lag effects of ownership transformation for two consecutive terms.

The statistics on the scale of ownership transformation indicate that a vast majority of these 313 SOEs, including 24, or 7.7%, acquired by foreign investors, are fully privatized. Looking at the regional and industrial compositions of privatized firms, we confirm that the sales of public enterprises were conducted in all industries on a nationwide scale. This reveals that the Hungarian government had been consistent in actively pursuing ownership transformation to strategic investors beyond industrial and regional boundaries.

Nevertheless, because the government's privatization decision is a highly political matter and because the sale of SOEs is also influenced by bidding private investors, a statistically significant bias may occur between privatized firms and the remaining SOEs. Hence, in measuring the effects of ownership transformation on firm performance in the post-privatization period, it is indispensable to know the presence and extent of the selection bias. In the case of this research, we should also consider possible differences in behavioral patterns between domestic and foreign investors.

To evaluate these aspects, we compare privatized firms and remaining SOEs and privatized firms acquired by domestic investors and those acquired by foreign investors in 2003 in terms of company size and firm performance in the previous year. According to the results presented in **Table 2.4**, the company size of privatized firms is much smaller than that of the remaining SOEs, while the firm performance of the former is better than that of the latter, especially in terms of productivity and financial ability indices (Panel A). Similarly, firms acquired by foreign investors are larger in size than firms acquired by domestic investors, while, by and large, the latter outperform the former (Panel B).

To test whether the above relationships can appear when control-

[12] All four enterprises, which had experienced privatizations twice until 2005, transferred more than 50% of their property rights to private investors at the first privatization, whereas they sold a much smaller percentage (8-12%) at the second privatization.

Table 2.4 Comparison between privatized firms and remaining state-owned enterprises and between firms acquired by domestic investors and those acquired by foreign investors

		A. Comparison of privatized firms and remaining SOEs			B. Comparison of firms acquired by domestic investors and those acquired by foreign investors		
			Privatized firms	SOEs		Firms acquired by domestic investors	Firms acquired by foreign investors
Company size							
Total number of employees (persons)	Mean	▼	16.558	677.833**	▼	14.863	46.909*
	Median	▼	3	61†††		3	5
Total sales[a]	Mean	▼	143304	3420213***		138589	226004
	Median	▼	18917	355055†††		18652	36188
Total assets[a]	Mean	▼	167591	11000000***	▼	129251	658348***
	Median	▼	10093	569656†††	▼	9322	27826†††
Profitability							
Ordinary income to total assets (ROI)	Mean	▼	−0.319	−0.019**		−0.338	−0.084
	Median		0.002	0.004		0.010	−0.050
Value-added to sales	Mean	△	0.050	−5.356*		0.029	0.416
	Median		0.173	0.274	▼	0.165	0.356†
Operating income to sales	Mean		−0.450	−20.561		−0.467	−0.155
	Median		0.017	0.016		0.017	0.018
Ordinary income to sales	Mean		−0.472	−20.682		−0.484	−0.260
	Median		0.009	0.008		0.010	−0.006
Return on equity capital (ROE)	Mean		7.148	0.410		7.677	0.625
	Median		0.096	0.027	△	0.120	−0.087†
Return on total assets (ROA)	Mean	▼	−0.145	−0.003*		−0.152	−0.055
	Median		0.017	0.009	△	0.024	−0.019††
Ordinary income on equity capital	Mean		3.801	0.219		5.029	−11.300
	Median		0.014	0.011	△	0.029	−0.213†
Productivity							
Value-added per employee[a]	Mean		3197	285		3166	3774
	Median		1417	1629		1417	986
Operating income per employee[a]	Mean		−902	−5952		−987	636
	Median		109	92		116	39
Ordinary income per employee[a]	Mean	△	846	−5244*		1027	−2390
	Median		43	31	△	50	−504†
Sales per employee[a]	Mean	△	17152	10376**		17063	18841
	Median	△	6963	5571††		6999	4031
Sales to employment	Mean	△	48.086	10.622*		50.422	7.025
	Median	△	6.706	2.204†††	△	6.864	2.550††
Sales to total costs	Mean	△	1.149	0.872***	▼	1.110	1.823***
	Median	△	1.032	0.961†††		1.035	1.017
Fixed investment efficiency	Mean		1.435	−1.282		1.505	0.295
	Median	△	0.825	0.372††		0.947	0.024
Financial ability							
Total assets turnover	Mean	△	4.494	1.023**		4.679	1.251
	Median	△	1.778	0.773†††	△	1.847	0.318†††
Fixed assets turnover	Mean	△	10.200	4.361***		10.773	0.849
	Median	△	4.894	1.539†††	△	5.714	0.127††
Financial soundness							
Fixed ratio	Mean	△	11.550	2.815**		12.074	6.412
	Median	△	1.951	1.266†††		1.800	6.909
Capital adequacy ratio (CAR)	Mean	▼	0.273	0.368***		0.269	0.330
	Median	▼	0.167	0.309†††		0.163	0.292

Notes : The sample is the same as that in Table 2.3.
[a]The unit is thousand HUFs.
***,**,*Significant at the 1, 5, and 10% levels, respectively, by the *t*-test.
†††, ††, †Significant at the 1, 5, and 10% levels, respectively, by the Wilcoxon rank-sum test.
△ denotes that privatized firms (those acquired by domestic investors) are superior to SOEs (those acquired by foreign investors) with statistical significance at the 10% or lower level. ▼ denotes that privatized firms (those acquired by domestic investors) are inferior to SOEs (those acquired by foreign investors) with statistical significance at the 10% or lower level.
Source : Authors' calculation and estimation.

ling other factors simultaneously, we perform probit regressions taking a discrete variable, which assigns a value of 1 to privatized firms or firms acquired by foreign investors in 2003 as the dependent variable. As independent variables, we employ the natural logarithm of total assets for 2002 to proxy for company size before privatization and a dummy variable, which takes a value of 1 for firms whose operating income was negative for 2002, as well as the six performance indices which differed at the 10% or lower significance level between the groups compared in **Table 2.4**. We also use dummy variables to capture the fixed effects of firm locations in the western and eastern regions and a dummy variable with a value of one if the firms operating in traditional public sectors[13] as control variables[14]. We estimate a regression model of the probability of being acquired by foreign investors using the two-step probit maximum likelihood estimator with the probability of privatization being the dependent variable at the first stage. **Table 2.5** presents the results of our regressions. The signs of the independent variables estimated with statistical significance at the 10% or lower level correspond to the results of the univariate comparison shown in **Table 2.4**. These findings strongly suggest the presence of selection bias in the Hungarian government's privatization decision as well as certain differences between domestic and foreign investors in terms of their behavior when purchasing state firms[15].

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[13] These sectors refer to the mining of uranium and thorium ores (NACE12); electricity, gas, steam, and hot water supply (40); collection, purification, and distribution of water (41); transport via railways (60.1); post and courier activities (64.1); central banking (65.11); public administration and defense and compulsory social security (75); education (80); health and social work (85); and sewage and refuse disposal, sanitation, and similar activities (90).

[14] The largest correlation coefficient between these independent variables in all combinations, including the 6 performance indices, is 0.41, well below the threshold of 0.70 for possible multicollinearity.

[15] Almost the same results were obtained by conducting the analyses reported in **Tables 2.4** and **2.5** while excluding all firms privatized in 2004 and onwards from the remaining SOEs as of 2003.

Table 2.5 Regression analysis of privatization decision and acquisition of privatized firms by foreign investors

Dependent variable	A. Probability of privatization			B. Probability of being acquired by foreign investors		
Estimator	Probit ML			Two-step probit ML		
Model	[1]	[2]	[3]	[4]	[5]	[6]
Pre-privatization company size						
Total assets (natural logarithm)	−0.409***	−0.470***	−0.476***	0.334**	0.420***	3.817*
	(−9.55)	(−10.54)	(−5.88)	(2.00)	(5.22)	(1.78)
Pre-privatization firm performance						
Firms with negative operating income		−0.344*			0.796***	
		(−1.87)			(2.87)	
Value-added to sales			0.082			3.787**
			(0.73)			(2.10)
Return on total assets (ROA)			−1.409			−8.301**
			(−1.21)			(−2.21)
Ordinary income per employee			0.0001*			−0.0002
			(1.77)			(−1.00)
Sales to total costs			0.594*			−7.655***
			(1.85)			(−2.84)
Total assets turnover			0.274*			−3.208**
			(1.95)			(−2.07)
Fixed ratio			0.056**			−0.340
			(2.19)			(−1.37)
Location						
Western region	−0.032	−0.118	−0.202	0.312	0.320	0.004
	(−0.18)	(−0.63)	(−0.62)	(0.95)	(1.22)	(0.08)
Eastern region	0.051	−0.034	0.209	−0.194	−0.220	−1.765
	(0.30)	(−0.19)	(0.78)	(−0.72)	(−0.83)	(−1.42)
Industrial sectors						
Traditional public sectors	−1.036***	−1.009***	−0.838*	0.449	0.601	−0.177**
	(−5.05)	(−5.12)	(−1.85)	(0.51)	(1.18)	(−2.27)
Const.	4.866***	5.738***	4.348***	0.000	−5.503***	0.682*
	(9.66)	(10.93)	(4.68)	(0.00)	(−8.44)	(1.88)
N	499	477	196	499	477	196
N (The second stage)	—	—	—	223	210	124
Pseudo R^2	0.41	0.44	0.40	—	—	—
Log likelihood	−203.60	−183.92	−65.09	−269.30	−244.58	−7.26
Wald test	126.93***	124.08***	57.94***	17.09***	48.85***	24.70***

Notes : The t-values are reported in parentheses beneath the regression coefficients. The Wald test tests the null-hypothesis that all coefficients are zero. All SOE samples used for the estimation of regression models are the same in Table 2.3.

***, **, *Significant at the 1, 5, and 10% levels, respectively.

Source : Authors' estimation.

2.6.3 Panel Estimation of the Effects of Ownership Transformation

In performing the panel estimation of the effects of ownership transformation, we take four measures to deal with the selection bias of privatization decision and acquisition by foreign investors. First, in our panel regressions, we do not use the level of firm performance, but, rather, the rate of its annual change as the dependent variable for the 18 indices of profitability, productivity, financial ability, and soundness. Secondly, we control the level of the dependent variable in the previous year, since the past performance level may strongly affect the range of the growth rate of the relevant performance index as a result of management efforts for the current term. Thirdly, to control firm size, we use the natural logarithm of total assets as an independent variable. Fourthly, we exclude every sample falling outside the mean ± 2 standard deviations of all samples with respect to the level of the performance index for 2002 to be analyzed[16].

We performed regressions using the panel data on 411 firms from the agriculture, forestry, hunting, and fishing, the manufacturing, the construction, and the service sectors, which made up for 82% of the 499 SOEs listed in **Table 2.3**. We carried out a total of 4,140 estimation trials (i.e., 15 types of regression equations defined in Section 2.5 × 23 types of performance indices × 3 types of panel estimators × 4 industrial sectors). Two-hundred and ninety-seven estimations of the Model V family were not successful due to the small sample size of the firms acquired by foreign investors or lack of data; hence, we did not adopt the corresponding estimates of the Model Ⅳ family for comparison of the two models on the same estimation basis. Consequently, we obtained a total of 3,546 estimates of ownership variables. The meta-analyses in the following two subsections use these 3,546 estimates. With respect to the composition by the panel estimator of the 1,182 models selected by the Hausman and Breusch-Pagan specification tests, 962, or 81.4%, are pooled OLS estimators, 153, or 12.9%, are

[16] The actual number of outliers excluded by this criterion is less than 0.5% of all samples in all cases, suggesting the significant homogeneity of Hungarian SOEs in firm performance.

random-effects estimators, and the remaining 67, or 5.7%, are fixed-effects estimators. These findings suggest that our panel regression model is well formulated in the sense that there is little need for distinguishing individual firm effects as fixed effects or random effects.

2.6.4 Synthesis of Regression Coefficients

Synthesis of regression coefficients is performed using the estimation results of the selected models according to the type of model family and the type of investor as well as by each of the three categories of performance index : the SOE-inferior, the SOE-superior, and the difference-insignificant. The results are detailed in **Table 2.6**. In addition to the synthesized values of regression coefficients based on the meta fixed-effects models and the meta random-effects models and the values of homogeneity tests, this table also presents the asymptotic z-values to test the null-hypothesis that the synthesized effect size is zero, the combined p-value obtained using the inverse Chi-square method and the inverse normal method[17], and the results of the vote-counting method.

If hypothesis H_1 is true, we expect that the synthesized effect size of Model I family based on the SOE-inferior indices is significantly positive due to the sources of privatization gains, whereas those based on the SOE-superior indices are negative. We also predict that it is more difficult to detect the positive effects of ownership transformation through meta-analyses based on the difference-insignificant indices than through those based on the SOE-inferior indices. If hypothesis H_2 is empirically supported, the synthesized effect size of Model II family whose scope of application is limited to the cases of transfer of strategic control rights should exceed those of the Model I family, which covers the ownership transformation effects without a lower limit, and further, the synthesized effect size of the Model III family, which tracks only the effects of full privatization, should be superior to

[17] If $p_1, p_2, ..., p_N$ are p-values of N estimates, the inverse Chi-square method uses the statistic : $-2\sum_{n=1}^{N}\log\ (p_n)$, which has a Chi-square distribution with $2N$ degree of freedom, and the inverse normal method uses the statistic : $1/\sqrt{N}\cdot\sum_{n=1}^{N}\Phi^{-1}(p_n)$, which has the normal distribution. $\Phi(\cdot)$ represents the standard normal distribution function (Hedges, 1992).

Table 2.6 Meta-analysis of the effects of ownership transformation on firm performance

	Synthesis of regression coefficients			*p*-value combination method		Vote-counting method			
	Meta fixed-effects (asymptotic *z*-value)[a]	Meta random-effects (asymptotic *z*-value)[a]	Homogeneity test	Inverse Chi-square method	Inverse normal method	Proportion of positive to negative estimates (*z*-value)[b]	Number of positively significant estimates (one-sided *z*-value)[c]	Number of negatively significant estimates (one-sided *z*-value)[c]	*N*
A. All performance indices									
Ownership transformation without a lower limit (Model I family)	−0.000	0.000	1459.143***	710.656***	5.801***	172/107***	33/276	24/276	276
	(−0.23)	(0.01)				(4.09)	(1.08)	(−0.72)	
Transfer of strategic control rights (Model II family)	−0.001	0.002	1490.377***	710.000***	5.803***	171/105***	33/276	23/276	276
	(−0.58)	(0.02)				(3.97)	(1.08)	(−0.92)	
Full privatization (Model III family)	−0.004*	0.052***	1682.125***	746.838***	5.854***	177/99***	36/276**	16/276	276
	(−1.68)	(2.92)				(4.70)	(1.69)	(−2.33)	
Ownership transformation to domestic investors (Model IV family)	−0.000	−0.005	294.200***	489.676***	4.707***	110/67***	19/177	9/177	177
	(−0.76)	(−0.90)				(3.23)	(0.33)	(−2.18)	
Ownership transformation to foreign investors (Model V family)	−0.041*	0.274***	699.528***	444.988***	4.694***	107/70***	28/177***	11/177	177
	(−1.89)	(3.75)				(2.78)	(2.58)	(−1.68)	
B. SOE-inferior indices									
Ownership transformation without a lower limit (Model I family)	0.005**	0.069***	551.471***	312.164***	3.861***	77/43***	16/120	6/120	120
	(2.08)	(4.41)				(3.10)	(1.22)	(−1.83)	
Transfer of strategic control rights (Model II family)	0.009***	0.078***	530.535***	313.094***	3.867***	77/43***	16/120	5/120	120
	(3.72)	(4.34)				(3.10)	(1.22)	(−2.13)	
Full privatization (Model III family)	0.013***	0.117***	499.806***	311.135***	3.897***	80/40***	13/120	3/120	120
	(4.08)	(4.99)				(3.65)	(0.30)	(−2.74)	
Ownership transformation to domestic investors (Model IV family)	−0.000	0.040**	105.037**	204.332***	3.067***	47/29**	7/76	3/76	76
	(−0.76)	(2.20)				(2.06)	(−0.23)	(−1.76)	
Ownership transformation to foreign investors (Model V family)	−0.021	0.466***	313.841***	220.249***	3.096***	49/27**	14/76***	6/76	76
	(−0.60)	(3.93)				(2.52)	(2.45)	(−0.61)	
C. SOE-superior indices									
Ownership transformation without a lower limit (Model I family)	−0.036***	−0.105***	282.294***	57.344	1.744*	13/17	3/30	9/30***	30
	(−5.67)	(−3.03)				(−0.73)	(0.00)	(3.65)	
Transfer of strategic control rights (Model II family)	−0.045***	−0.089***	312.985***	57.463	1.745*	13/17	3/30	9/30***	30
	(−7.32)	(−2.57)				(−0.73)	(0.00)	(3.65)	
Full privatization (Model III family)	−0.069***	−0.041	539.425***	68.870	1.772*	13/17	5/30	9/30***	30
	(−12.20)	(−1.06)				(−0.73)	(1.22)	(3.65)	
Ownership transformation to domestic investors (Model IV family)	−0.001	−0.032***	79.697***	28.087	1.094	5/7	1/12	6/12***	12
	(−0.46)	(−2.82)				(−0.58)	(−0.19)	(4.62)	
Ownership transformation to foreign investors (Model V family)	−0.041	−0.044	18.374*	19.662	1.125	5/7	1/12	2/12	12
	(−1.21)	(−0.82)				(−0.58)	(−0.19)	(0.77)	

(continued)

Table 2.6 (continued)

	Synthesis of regression coefficients			*p*-value combination method		Vote-counting method			
	Meta fixed-effects (asymptotic *z*-value)[a]	Meta random-effects (asymptotic *z*-value)[a]	Homogeneity test	Inverse Chi-square method	Inverse normal method	Proportion of positive to negative estimates (*z*-value)[b]	Number of positively significant estimates (one-sided *z*-value)[c]	Number of negatively significant estimates (one-sided *z*-value)[c]	*N*
D. Difference-insignificant indices									
Ownership transformation without a lower limit (Model I family)	−0.018	−0.044	586.949***	341.148***	3.967***	82/44***	14/126	9/126	126
	(−1.42)	(−0.82)				(3.39)	(0.42)	(−1.07)	
Transfer of strategic control rights (Model II family)	−0.009	−0.038	579.511***	339.442***	3.962***	81/45***	14/126	9/126	126
	(−0.56)	(−0.61)				(3.21)	(0.42)	(−1.07)	
Full privatization (Model III family)	0.018*	0.073	476.781***	366.833***	3.996***	84/42***	18/126**	4/126	126
	(1.88)	(1.35)				(3.74)	(1.60)	(−2.55)	
Ownership transformation to domestic investors (Model IV family)	0.043***	0.148***	102.168	257.257***	3.403***	58/31***	11/89	0/89	89
	(2.66)	(3.42)				(2.86)	(0.74)	(−3.14)	
Ownership transformation to foreign investors (Model V family)	−0.087*	0.395**	366.141***	205.077**	3.346***	53/36*	13/89*	3/89	89
	(−1.71)	(2.36)				(1.80)	(1.45)	(−2.08)	

Notes : The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices, in which the means or medians for fully SOEs regarding the relevant indices in Table 2.2 are inferior (superior) to those for private firms with statistical significance at the 10% or lower level. The difference-insignificant indices refer to those indices that do not satisfy these conditions.

[a]Null-hypothesis : The synthesized effect size is zero.

[b]Null-hypothesis : The proportion of positive to negative estimates is 50/50.

[c]Null-hypothesis : The proportion of estimates with statistical significance at the 10% or lower level is less than 10%.

***,**,*Significant at the 1, 5, and 10% levels, respectively.

Source : Authors' estimation.

those of the former two models. In addition, if hypothesis H_3 is correct, the synthesized effect size of ownership transformation to foreign investors (Model V family) will surpass those of ownership transformation to domestic investors (Model IV family).

The results shown in **Table 2.6** strongly support the above predictions. With the exception of ownership transformation to domestic investors using the difference-insignificant indices, we refer to the synthesized effect sizes based on the meta random-effects model to verify the hypotheses because the null-hypothesis is rejected by the homogeneity test at the 5% or lower significance level. The synthesized effect size for the Model I family based on the SOE-inferior indices is positively estimated at the 1% level, whereas that based on the SOE-superior indices is negative at the 1% level and that based on the difference-insignificant indices is statistically insignificant. Similar results are also obtained when comparing the synthesized effect sizes of other models. By comparing the results for the Model I, II, and III families, we confirm that the synthesized effect sizes of ownership transformation without a lower limit are always smaller than those of transfer of strategic control rights, and those of full privatization are larger than those of partial privatization in terms of the SOE-inferior indices in particular. Furthermore, the comparison of the synthesized effect sizes of the Model IV and Model V families indicates that the effects of ownership transformation to foreign investors are greatly superior to those to domestic investors except for the case of the SOE-superior indices. Although we do not go into detail here due to space limitations, the results from the p-value combination procedure and the vote-counting method also, by and large, support the conclusions derived from the meta-analysis of regression coefficients[18].

2.6.5 Meta-Regression Analysis

Table 2.7 contains the definitions and descriptive statistics of the variables used in the meta-regression analysis. The estimation results are presented in **Table 2.8**. Models [1] through [5] show the estimation results from the meta-regression models covering all panel esti-

[18] See Coggin and Hunter (1993) for how to interpret the results from the vote-counting method.

Table 2.7 Definitions and descriptive statistics of the variables used in the meta-regression analysis

Variable name	Definition	Mean	S. D.	Median
Effects of ownership transformation (dependent variable)	CV : Regression coefficients of ownership variables (effect sizes)	0.451	7.748	0.161
SOE-inferior indices	BD : 1 = if an SOE-inferior index is used as a dependent variable	0.433	0.496	0
SOE-superior indices	BD : 1 = if an SOE-superior index is used as a dependent variable	0.096	0.295	0
Transfer of strategic control rights	BD : 1 = An estimate of the effects of 50% or higher ownership transformation	0.234	0.423	0
Full privatization	BD : 1 = An estimate of the effects of full privatization	0.234	0.423	0
Ownership transformation to domestic investors	BD : 1 = An estimate of the effects of ownership transformation to domestic investors	0.150	0.357	0
Ownership transformation to foreign investors	BD : 1 = An estimate of the effects of ownership transformation to foreign investors	0.150	0.357	0
One-year lag	BD : 1 = An estimate of the one-year lag effects of ownership transformation	0.335	0.472	0
Two-year lag	BD : 1 = An estimate of the two-year lag effects of ownership transformation	0.330	0.470	0
Manufacturing	BD : 1 = if samples are manufacturing enterprises	0.292	0.455	0
Construction	BD : 1 = if samples are construction enterprises	0.246	0.431	0
Services	BD : 1 = if samples are service enterprises	0.287	0.452	0
Productivity index group	BD : 1 = if a productivity index is used as a dependent variable	0.283	0.450	0
Financial ability index group	BD : 1 = if a financial ability index is used as a dependent variable	0.085	0.278	0
Financial soundness index group	BD : 1 = if a financial soundness index is used as a dependent variable	0.085	0.278	0
Firm growth index group	BD : 1 = if a firm growth index is used as a dependent variable	0.228	0.420	0
Fixed-effects estimator	BD : 1 = if a fixed-effects estimator is used	0.333	0.471	0
Random-effects estimator	BD : 1 = if a random-effects estimator is used	0.333	0.471	0
Selected models	BD : 1 = An estimate obtained from regression models selected by the model specification tests	0.333	0.471	0
Number of observations	CV : A natural logarithm of the number of observations used in a panel estimation	5.352	0.647	5.142

Notes : The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices, in which the means or medians for full SOEs regarding the relevant indices in Table 2.2 are inferior (superior) to those for private firms with statistical significance at the 10% or lower level. The elements of each of the four index groups correspond with those in Table 2.2. CV and BD denote a continuous variable and a binary dummy variable, respectively. S. D. denotes the standard deviation.

Table 2.8 Meta-regression analysis

Dependent variable	Effects of ownership transformation (all models)					Effects of ownership transformation (selected models)				
Estimator	WLS [N]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML	WLS [N]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML
Independent variable (default category)/model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Effects of ownership transformation in default conditions (intercept)	2.527***	17.837	0.149***	0.178**	0.123	2.255**	11.130	0.047	0.061	4.065
	(3.45)	(1.36)	(4.70)	(2.09)	(0.03)	(2.44)	(0.39)	(0.47)	(0.36)	(0.60)
Performance differences (difference-insignificant indices)										
SOE-inferior indices	0.144	0.056	0.010***	0.046***	1.481***	0.707*	2.430***	0.038***	0.065***	0.675
	(0.54)	(0.11)	(2.89)	(4.42)	(4.73)	(1.67)	(3.22)	(3.46)	(2.96)	(1.33)
SOE-superior indices	−0.399	−5.192**	−0.137***	−0.149***	−1.087*	−0.759*	−2.259*	−0.324***	−0.192***	−0.946
	(−0.60)	(−2.49)	(−8.84)	(−9.21)	(−1.66)	(−1.71)	(−1.82)	(−9.81)	(−6.23)	(−0.90)
Scale of ownership transformation (privatization without a lower limit)										
Transfer of strategic control rights	−0.009	1.209*	0.008***	0.005	0.015	0.005	0.030	0.001	0.001	0.007
	(−0.02)	(1.75)	(3.91)	(0.47)	(0.04)	(0.01)	(0.03)	(0.34)	(0.03)	(0.01)
Full privatization	0.051	0.425	0.006**	0.021**	0.137	0.093	0.792	0.006	0.044**	0.184
	(0.14)	(0.61)	(2.54)	(2.12)	(0.37)	(0.16)	(0.78)	(1.59)	(2.11)	(0.31)
Types of ownership transformation (no classification)										
Ownership transformation to domestic investors	−0.229	−0.475	−0.015***	0.013	−0.079	−0.449	−2.843**	−0.001	0.008	−0.221
	(−0.59)	(−0.61)	(−7.45)	(1.07)	(−0.19)	(−0.72)	(−2.47)	(−0.33)	(0.31)	(−0.32)
Ownership transformation to foreign investors	1.700***	2.153***	0.063***	0.054***	1.379***	2.622***	7.991***	0.006	0.006**	2.390***
	(4.35)	(2.64)	(3.81)	(2.62)	(3.25)	(4.19)	(6.03)	(0.25)	(2.18)	(3.48)
Time-lag effects (no lag)										
One-year lag	−1.860***	−3.292***	−0.007***	−0.075***	−0.811***	−1.658***	−1.760	−0.007**	−0.121***	−0.711
	(−6.33)	(−5.05)	(−3.40)	(−8.17)	(−2.66)	(−3.52)	(−1.49)	(−2.01)	(−6.51)	(−1.44)
Two-year lag	−3.178***	−14.771***	0.004*	−0.021**	−2.890***	−2.500***	−12.784***	−0.006**	−0.026	−2.564***
	(−6.78)	(−8.07)	(1.69)	(−2.25)	(−9.44)	(−5.30)	(−4.99)	(−2.16)	(−1.34)	(−5.17)
Industrial sector (agriculture, forestry, hunting, and fishing)										
Manufacturing	0.457	5.154***	−0.034***	−0.021*	0.627	0.361	4.841*	0.066***	0.102***	0.111
	(0.82)	(3.24)	(−4.08)	(−1.80)	(1.33)	(0.40)	(1.84)	(6.68)	(4.00)	(0.14)
Construction	−1.185**	0.021	−0.059***	−0.091***	−1.242**	−0.439	−5.696*	0.034***	0.026	−0.692
	(−2.13)	(0.01)	(−7.94)	(−6.32)	(−2.20)	(−0.49)	(−1.65)	(2.66)	(0.90)	(−0.77)
Services	−0.215	9.142**	−0.070***	−0.023	−0.708	0.257	−8.633	0.067**	0.107*	−1.310
	(−0.43)	(1.96)	(−6.76)	(−0.83)	(−0.48)	(0.32)	(−0.86)	(2.01)	(1.89)	(−0.57)

(continued)

Table 2.8 (continued)

Dependent variable	Effects of ownership transformation (all models)					Effects of ownership transformation (selected models)				
Estimator	WLS [N]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML	WLS [N]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML
Independent variable (default category)/model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Performance index group (profitability index group)										
Productivity index group	−0.232	−3.159***	0.028***	0.010	−0.691	−0.278	1.329	−0.030***	0.035	−0.300
	(−0.72)	(−4.01)	(4.84)	(0.54)	(−0.60)	(−0.54)	(0.96)	(−3.40)	(1.15)	(−0.25)
Financial ability index group	−0.746	−3.017	0.010	−0.103***	−0.930	−0.991	0.529	−0.107***	−0.083**	−0.568
	(−1.46)	(−1.03)	(1.55)	(−5.08)	(−0.54)	(−1.21)	(0.12)	(−6.82)	(−2.33)	(−0.31)
Financial soundness index group	−0.512	−5.105	0.104***	0.067***	−1.174	−0.718	−3.024	0.142***	0.085**	−1.023
	(−0.75)	(−0.98)	(13.09)	(3.27)	(−0.67)	(−0.63)	(−0.34)	(10.16)	(2.27)	(−0.53)
Firm growth index group	−0.383	−2.152***	0.048***	0.016	−0.464	−0.683	−2.320***	−0.030***	0.017	−0.668
	(−1.22)	(−3.43)	(7.84)	(0.88)	(−0.37)	(−1.35)	(−2.62)	(−2.64)	(0.55)	(−0.52)
Estimators (pooled OLS estimator)										
Fixed-effects estimator	−0.335	0.390	0.056***	0.026***	0.029	0.204	−2.147	0.109***	0.139***	0.479
	(−0.66)	(0.29)	(7.61)	(2.62)	(0.07)	(0.16)	(−0.58)	(7.09)	(5.97)	(0.45)
Random-effects estimator	0.056	0.963	0.038***	0.001	−0.002	−0.799	−10.071***	−0.137***	−0.100**	0.214
	(0.11)	(0.76)	(6.45)	(0.08)	(−0.01)	(−0.97)	(−6.82)	(−4.86)	(−2.46)	(0.30)
Selected models (non-selected models)	0.083	−1.063	0.039	−0.005	0.012	—	—	—	—	—
	(0.17)	(−0.84)	(0.77)	(−0.57)	(0.03)					
Number of observations	—	−2.220	0.021***	−0.021	0.256	—	3.573	−0.006	−0.021	1.062
		(−0.82)	(3.03)	(−1.20)	(0.28)		(0.60)	(−0.29)	(−0.63)	(0.76)
N	3546	3546	3546	3546	3546	1182	1182	1182	1182	1182
Adjusted R^2	0.042	0.214	—	—	—	0.042	0.225	—	—	—
F-test	9.57***	51.66***	—	—	—	4.02***	20.10***	—	—	—
Wald test	—	—	1137.89***	555.36***	157.79***	—	—	1114.88***	257.57***	52.37***

Notes : t-statistics are reported in parentheses. The F-test and the Wald test test the null-hypothesis that all coefficients are zero.
***,**,*Significant at the 1, 5, and 10% levels, respectively.
Source : Authors' estimation. The definitions and descriptive statistics of the variables used in the estimations are listed in Table 2.7.

mates, and Models [6] through [10] show the estimation results using only the estimates of the selected models.

The results strongly support hypothesis H_1. In 7 of the 10 models, with the difference-insignificant indices as the default category, the dummy variables denoting that an SOE-inferior index is used as a dependent variable for the panel estimation have positive signs at the 10% or lower significance level, while the dummy variables designating the use of an SOE-superior index are significantly negative in 8 models. Similarly, hypothesis H_3 is supported by the results in which the dummy variables identifying the panel estimates on the effects of ownership transformation to foreign investors are positively estimated in 9 models. On the other hand, although all of the dummy variables relating to the effects of transfer of strategic control rights and those of full privatization have positive signs excluding one case in Model [1], they are not statistically robust enough to be used as supporting evidence for hypothesis H_2.

The estimation results of other meta-independent variables suggest the following four points with respect to the sensitivity of the panel estimation : (1) The effects of ownership transformation tend to wane over time. (2) No statistically robust differences are observed in the industrial sectors and the qualitative categories of the performance indices. (3) Although no apparent bias is seen in the overall estimation results arising from the differences among panel estimators, the random-effects estimators in the selected models tend to be more biased downward than OLS and the fixed-effects estimators. (4) The estimates of the selected models have no significant bias in comparison to those of the unselected models. The second point is particularly interesting from the viewpoint of policy implication.

2.7 Conclusions

In this study, we empirically examined the effects of ownership transformation from the state to the private sector on post-privatization firm performance focusing on the Hungarian enterprises in the early 2000s. We used annual census-type data compiled by the Hungarian National Tax Authority for the empirical analyses. Although this dataset presents an ample sample size in a cross section, it allowed us to trace the performance changes for up to two years after

privatization. The short observation period is a serious obstacle to the detection of the privatization effects. We attempted to overcome this data constraint by combining the panel estimation and regressing various performance indices into the scale and type of ownership transformation with the meta-analysis of the regression coefficients. Namely, we successfully performed 3,546 panel regression analyses dealing with possible selection bias and integrated this large correction of estimation results by meta-analysis methods to test our testable hypotheses on enterprise privatization and foreign acquisition stated in Section 2.3. This empirical methodology made it possible to wholly capture restructuring efforts of new owners and managers, leading to the successful detection of the statistically significant effects of ownership transformation. In other words, the synthesis of the regression coefficients of the ownership variables provided supporting evidence for all three testable hypotheses presented in Section 2.3, and the results of the meta-regression analysis verified hypotheses H_1 and H_3.

The most important finding from this research is that, to detect the effects of ownership transformation, it is necessary to identify the potential sources of privatization gains. It was revealed that, in Hungary at the beginning of the 21st Century, the performance gaps between public and private enterprises were more limited than had been anticipated. This fact in itself is considered to be on the positive side of this country's systemic transformation to a market economy. Yet, if it is impossible to know in advance in what aspects SOEs are inferior to private firms in performance, we might have overlooked the effects of ownership transformation that actually existed. In fact, according to **Table 2.6**, the null hypothesis, in which the synthesized effect size of the Model I family is zero, cannot be rejected ($z = 0.01$) when covering all performance indices. We expect that the feasibility of detecting the privatization effects will improve significantly if the potential source of privatization gains can be identified beforehand.

Another interesting finding in this chapter is the fact that foreign investors outperform domestic investors in a short period of time with regard to medium and small-sized SOEs sold in the early 2000s, which is reminiscent of the large-scale privatization period when foreign direct investment (FDI) made a critical contribution to the restructuring of large Hungarian corporations (Makó and Illéssy, 2007). The privatization drive in the early 2000s was forced on the Hungarian

government to get rid of what was left over from previous rounds of privatization. As we argued in Section 2.2, in this period, private investors could not cherry-pick because the best assets had already been sold and, in fact, often went for the less profitable SOEs. There is no doubt that this condition also applied to foreign investors[19]. Nevertheless, according to the empirical results reported in the previous section, unlike in the 1990s, foreign investors bought and successfully restructured the public enterprises that had not been in good financial condition before privatization. This constitutes counterevidence to the view that the effects of foreign participation in the management of privatized firms are overestimated due to a selection bias that drives foreign investors to select good companies for investment. If an appropriate policy framework is in place, there may be still plenty of room left for Hungary, one of the largest foreign capital recipients among the former socialist countries, to be able to receive further benefits from FDI.

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[19] We thank Michael Keren for his valuable contributions to the discussion with regard to this point.

Part II

Multinational Enterprises and Technology Transfer

Chapter 3

Multinational Enterprise, Technology Transfer, and Productivity Growth

3.1 Introduction

Foreign direct investment (FDI) draws attention as a driving force of economic growth in recipient countries mainly due to two factors. One is its macroeconomic effect of boosting the effective demand of a given host country owing to the intensive capital investment and employment activity carried out by incoming foreign firms. This aspect of inward FDI has such critical significance for developing countries and post-socialist transitional states experiencing serious capital shortages that plenty of studies have been conducted on it. The other factor is its external effects on domestic firms, that is, FDI spillovers arising from the new entry into the production market of host countries and subsequent business expansion of multinational enterprises (MNEs) that have superior management know-how and advanced production technology. Because the FDI spillover effects represent a unique social phenomenon, economists have been paying considerable attention to this characteristic of FDI from theoretical and empirical perspectives. In fact, the issues concerning the relationship between MNEs and domestic firms in the host countries raised in the 1960s witnessing the advent of the age of internationalization by Brash (1966) and Katz (1969) are still stimulating many researchers today, as is obviously demonstrated by the fact that a number of

microeconomic research works that empirically examine FDI spillover effects have been published in recent years with the remarkable enhancement of firm-level datasets worldwide (Görg and Strobl, 2001; Crespo and Fontoura, 2007; Meyer and Sinani, 2009).

Many economists agree that domestic firms in recipient countries gain positive externalities from FDI via the four main routes that follow. The first one is the imitation of the management system and production of MNEs. One transmission mechanism often reported in this regard is reverse engineering. Nowadays, industrial espionage is also considered to be an extreme form of imitation. The second route is the intermediate input of goods and services supplied by MNEs, which contributes to quality improvement and cost reductions in in-house products. The third route is the feedback of marketing information and transfer of techniques for quality control, inventory, and standardization through the provision of goods and services to MNEs. These foreign customers tend to actively encourage local suppliers in the form of sending experts to the latter, implementing joint research projects, and holding joint drills. The fourth route is the acquisition of human capital in the form of movement of experienced managers, engineers, and other skilled workers from MNEs to domestic firms, including not only voluntary career changes but also the active recruitment and headhunting of talent by local competitors that are quite common, in particular, in countries with a poor market for skilled labor. Now that the role of intangible assets and tacit knowledge is becoming increasingly important (Csaba, 2009), the latter two routes have the same degree of significance as the former two in order for FDI to make positive productivity spillovers to domestic firms.

On the other hand, many researchers unanimously assert that FDI can also have a negative impact on domestic firms in the recipient countries, namely crowding-out effects, which may surpass its positive competitive effect by breaking down ineffective, monopolized domestic markets and improving the managerial discipline of indigenous companies. This is especially true when MNEs strategically attempt an all-out effort to gain a significant share in the production markets of host countries with relatively closed economies, where the level of management skills and production technology of domestic firms is significantly poorer by international standards. In this way, FDI has pros and cons for domestic firms. Thus, substantial direct capital inflows from abroad

do not necessarily guarantee positive spillover effects for domestic companies[1].

It is easy to imagine that post-socialist transitional countries met almost all of the above conditions to generate negative externalities from inward FDI. There have been a wide variety of empirical studies carried out regarding FDI productivity spillover effects in transition economies, including those by Kinoshita (2001) on the Czech Republic, Dries and Swinnen (2004), Jensen (2004), and Marcin (2008) on Poland, Javorcik and Spatareanu (2008) and Altomonte and Pennings (2009) on Romania, Sinai and Meyer (2004) on Estonia, Javorcik (2004) on Lithuania, Yudaeva et al. (2003) on Russia, Lutz et al. (2008) on Ukraine, Hu and Jefferson (2002), Liu (2002), and Wang and Yu (2007) on China, and Konings (2001), Sabirianova et al. (2005), Gorodnichenko et al. (2007), and Kravtsova (2008) on the international comparison of several transitional countries. Nevertheless, the same conclusions were not reached in these studies regarding the roles of FDI in the restructuring process of domestic firms, probably because, in many transition economies, former socialist enterprises experience an enormous amount of damage from fierce competition with foreign companies and, consequently, positive externalities that domestic firms gain from MNEs through the above four routes are considerably offset by the negative effects of market competition between the two. Preceding studies on Hungary referred to later suggest that it is also the case in this country.

The studies listed above presented different but interesting conclusions by turning their attention to such factors as the level of market orientation and the type of business of foreign companies (depending on whether they were foreign-owned subsidiaries or joint-venture firms), the ownership structure and the technology absorption capability of domestic firms, the geographical relationship between MNEs and domestic firms, and the market concentration, labor intensiveness, and other characteristics of each target industry in an attempt to deter-

[1] We do not go into the details of this issue, on which many researchers have been working for years. For more details, see excellent survey articles by Blomström and Kokko (1998) and Görg and Greenaway (2004) as well as thorough literature reviews by Javorcik (2004), Sinani and Meyer (2004), Halpern and Muraközy (2007), and Kneller and Pisu (2007).

mine why statistically significant spillover effects cannot be detected from the estimations of baseline models. On the other hand, these studies do not consider any relationship between the multi-layered structure of industrial classifications and FDI productivity spillover effects, which are the focus of this chapter. To the best of our knowledge, the same can be said for preceding studies on industrialized and developing economies.

In this chapter, we present a new empirical model regarding the productivity spillover effects of horizontal FDI and an estimate of the model using large-scale panel data of Hungarian firms of the early 2000s. We argue that it is not necessary for domestic firms to treat all foreign firms that come under the same category of the 2-digit level of industrial classification in a homogenous manner. The market relationship between a domestic firm and foreign counterparts has a multi-layered structure arising from the sectoral differences among firms according to the lower levels of the classification. In contrast to the conventional model to capture the market presence of horizontal FDI using a single variable, the empirical model proposed in this chapter is designed to identify horizontal spillover effects on the productivity of domestic firms according to the industrial sector with different depths by expressing the FDI presence using multiple variables with a nested structure corresponding to the aggregated level of industrial classification[2]. As a result of the estimation of the econometric model with the nested spillover variables in the right-hand side, which is called 'the nested variable model' in this chapter, we confirmed the horizontal spillover effects in Hungary simultaneously taking place in sectors with a different depth that cannot be captured with the conventional model. In other words, foreign firms in Hungary have statistically significant spillover effects on the productivity of domestic firms in the same industry, but their direction and degree differ greatly depending on proximity in product and technological space (hereinafter referred to as 'industrial-technological proximity') between MNEs and domes-

[2] It is noteworthy that Ruane and Uğur (2004) and Haskel et al. (2007) found that the differences in the aggregate level of horizontal FDI resulted in a statistically significant gap between the estimation results of individual productivity spillover effects. Differently from the approach taken in this chapter, however, they do not pay attention to the nested structure of the industrial classification.

tic companies. Moreover, we found that, firstly, FDI productivity spillover effects are generated in patterns that are completely different between the manufacturing and service industries, even during the same period in the same country. Secondly, FDI exhibits different spillover effects on different productivity indicators, and thirdly, the estimation of productivity spillover effects is sensitive to the selection of business scale indices as the basis for calculating the market presence of FDI. In this sense, our empirical evidence may suggest new insights for the studies of both industrial organization and transnational investment.

The remainder of this chapter is structured as follows : Section 3.2 examines the relationship between the multi-layered structure of industrial classifications and productivity spillover effects of horizontal FDI. Section 3.3 specifies the objective and period of empirical analysis. Section 3.4 describes the data employed for this study. Section 3.5 discusses the empirical methodology. Section 3.6 presents the estimation results. Section 3.7 summarizes the major findings and concludes.

3.2 Multi-Layered Structure of Industrial Classifications and Productivity Spillover Effects of Horizontal FDI

To examine the productivity spillover effects of inward FDI to Hungary, we propose a new analytical framework, the essence of which is to refine the empirical methodology for estimating the externalities of horizontal FDI on the productivity of domestic firms by taking into account the multi-layered structure of industrial classifications arising from the sectoral differences among firms within an industry at the 2-digit classification level. The fundamental concept is based on our interview surveys of company managers and other executive officers of Central and Eastern European enterprises conducted in recent years in the framework of our Hungary-Japan joint research project and others. The empirical model developed in this study is based on our finding that domestic firms tend to have a substantially different scope of management interest and attitude towards MNEs operating in the same industry according to the 2-digit industrial classification, if

these foreign counterparts are distinguished at a lower classification[3].

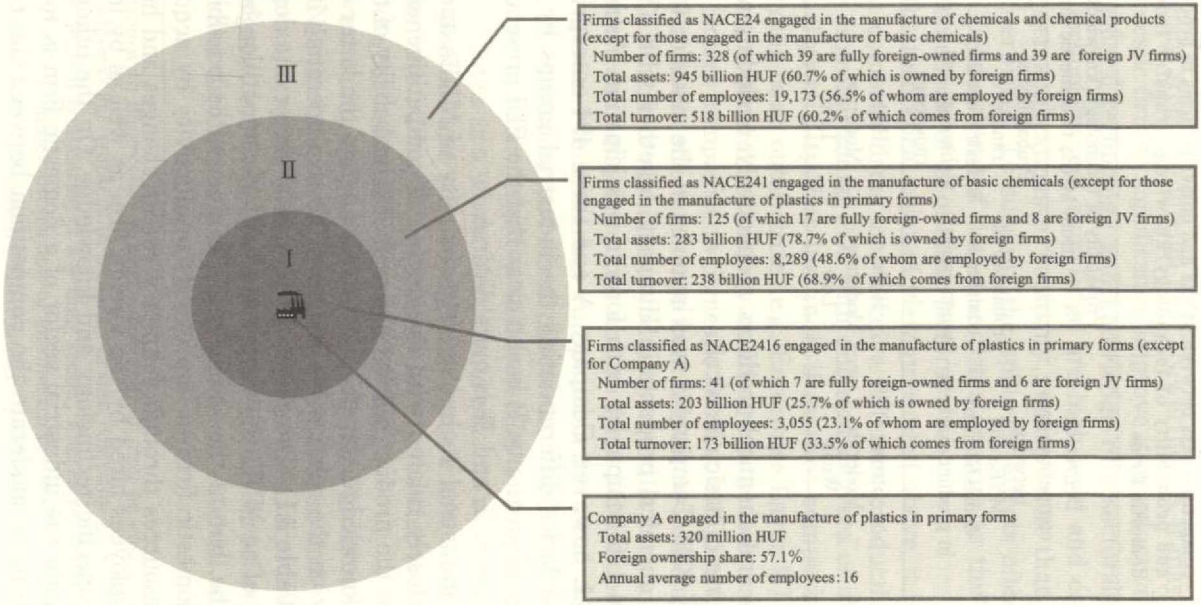
Using census-type data of Hungarian firms[4], we provide a concrete example of the multi-layered structure of industrial classifications as we assume it to be. In **Figure 3.1**, we focus on a manufacturing firm (hereinafter 'Company A') that is categorized as a manufacturer of plastics in primary forms according to Code 2416 of the General Industrial Classification of Economic Activities within the European Communities (NACE2416). Company A is a typical medium-sized Hungarian enterprise with 16 employees, a total turnover of 640 million Hungarian forints (HUF), and total assets of 3,200 million HUF, and 57.1% of its equity capital came from foreign investors as of 2003.

As **Figure 3.1** shows, Company A is surrounded by 41 firms that are also categorized as manufacturers of plastics in primary forms, of which 13 are foreign firms, including 7 fully foreign-owned companies. These firms are hereinafter collectively referred to as 'Enterprise Layer I' for brevity. The total assets, number of employees, and turnover for Enterprise Layer I, excluding Company A, are 203 billion HUF, 3,055 employees, and 173 billion HUF, and firms with foreign participation account for 25.7%, 23.1%, and 33.5% of these figures, respectively. These 42 firms engaged in the manufacture of plastics in primary forms, including Company A, are encompassed by 'Enterprise Layer II,' which consists of 125 firms involved in the manufacture of basic chemicals (NACE241). Of these 125 firms, 25 are foreign, which account for 78.7%, 48.6%, and 68.9% of the total assets, number of employees, and turnover for Enterprise Layer II, respectively. These percentages are much larger than those for firms engaged in the manufacture of plastics in primary forms. Furthermore, Enterprise Layer II is also externally surrounded by 'Enterprise Layer III,' consisting of 328 firms categorized as manufacturers of chemicals and chemical products (NACE 24). Of these 328 firms, 78 are foreign firms, which account for 60.7%, 56.5%, and 60.2% of the total assets, number of employees, and turnover for firms engaged in the manufacture of

[3] We also received relevant suggestions from field studies conducted by other researchers with respect to former state-owned enterprises privatized by Western MNEs and other foreign investors in transition economies. See Estrin et al. (2000) and Stephan (2006), for instance.

[4] We describe the details of the data in Section 3.4.

Figure 3.1 Multi-layered structure of industrial classifications : Example of Company A engaged in the manufacture of plastics in primary forms for 2003



Source : Authors' illustration.

Table 3.1 Relationship between industrial-technological proximity and degree of competitiveness between MNEs and domestic firms in product markets and probability of technology/knowledge transfer from MNEs to domestic firms

Industrial-technological proximity	Degree of competitiveness between MNEs and domestic firms in product markets	Probability of technology/knowledge transfer from MNEs to domestic firms		
		Probability of transfer of human capital	Probability of transfer of industry-specific technology and knowledge	Probability of transfer of general technology and knowledge
Close	Strong	High	High	
Moderate	Moderate	Moderate	Moderate	Homogenous
Far	Weak	Low	Low	

chemicals and chemical products, respectively, excluding those in the manufacture of basic chemicals.

As of 2003, Company A was involved in the manufacture of chemicals and chemical products in Hungary, together with 378 domestic firms and 116 companies with foreign participation. As indicated in **Figure 3.1**, however, Company A and these 494 enterprises outline clear boundaries differentiating the industrial groups by industrial-technological proximity. It is also clear that the FDI presence in Enterprise Layers I, II, and III is quite diverse.

The industrial-technological proximity of MNEs and domestic firms is closely related with the degree of competitiveness between the two in the product market and with the probability of the technology and knowledge transfer from the former to the latter even focusing solely on the relationship between the two operating in the same sector (**Table 3.1**). The closer the industrial sector of a domestic firm is to that of an MNE, the fiercer the market competition between the two will be, but, at the same time, the greater the possibility will be for the domestic firm to improve its productivity by acquiring good human resources through voluntary career changes and headhunting of the employees hired by the foreign firm as well as by imitating its industry-specific technology and knowledge. On the other hand, the more remote the industrial sector of a domestic firm is to that of an MNE, the more moderate the competition between the two will be, but, at the same time, the lesser the possibility will be for the domestic

firm to gain industry-specific technology and knowledge and transfer of human capital from the foreign firm[5]. Nevertheless, it may be possible for a domestic firm to significantly improve its productivity by imitating the general technology and knowledge of a sectorally remote MNE if its technology and knowledge are high level and can be utilized for wider applications to company management than those of domestic enterprises. To sum up, the spillover effects of horizontal FDI on the productivity of domestic firms emerge as the complex agglomeration effects of all of these factors.

From the theoretical point of view presented above, it is easy to predict that domestic firms may receive different productivity spillover effects from horizontal FDI with different degrees of industrial-technological proximity. For instance, if market competition with MNEs operating in an outer circle (e.g., Enterprise Layer Ⅲ) is in fact lower but more general technology and knowledge are transferable from these foreign companies to domestic firms, it is highly likely that positive FDI spillover effects emerge from this circle in the aggregate. In contrast, if there is significant industry-specific technology and knowledge that domestic firms can absorb from MNEs operating in Enterprise Layer I but market competition between them is so strong that this crowding-out effect offsets the benefits of technology and knowledge transfer, negative spillover effects may take place in this enterprise layer as a whole. Needless to say, the complete opposite situation is possible, and we can also anticipate a non-linear relationship between the FDI spillover effects and industrial-technological proximity between a domestic firm and MNEs.

In the real world, the market relationships and industrial linkages between MNEs and domestic firms are quite diverse and vary from country to country as well as industry to industry. Unless the research target is small enough, it is quite difficult, therefore, to theoretically predict the direction and degree of such external effects, and

[5] In comparison with blue-collar workers, however, it may be easier for management and white-collar workers to move from one company to another beyond the strictly defined boundaries of a 4-digit sector. Therefore, when we analyze an industry with a higher proportion of administrative staff in the total workforce, it is more likely that positive horizontal FDI spillovers from outer circles will be observed (i.e., Enterprise Layer Ⅱ and Ⅲ in **Figure 3.1**).

the issue has been the subject of empirical studies. Hungary is not an exceptional case.

3.3 Objective and Period of Empirical Analysis

In this section, we specify the objective and period of our empirical analysis by overlooking inward FDI to Hungary during the transition period and reviewing the preceding studies on the FDI productivity spillovers in the country.

As stressed in Chapter 1, Hungary is well known for having received a comparatively large amount of direct investment from abroad for its economic scale since the very first stage of its systemic transformation to a market economy. In fact, Hungary received the largest FDI among the Central and Eastern European (CEE) countries on an accumulated total amount basis from 1990 through 1997 due to such factors as its proactive open market policy, privatization of state-owned enterprises focusing on direct sales to strategic foreign investors, and geographical proximity to Western markets. Although Hungary was overtaken by Poland as the largest FDI-recipient country in the region from 1998 onward, it received 62.7 billion USD, or 17.8% of the total FDI that flowed into the ten CEE countries from 1990 to 2007, and its per-capita cumulative FDI for that 18-year period was 9,711 USD, the second highest after the 9,923 USD for the Czech Republic among these ten countries[6].

This vast inflow of FDI led to the emergence of a mega foreign sector within the Hungarian economy. The number of firms with foreign participation almost tripled from 9,117 to 27,177, and the total amount of FDI invested in those companies jumped from 215 billion HUF to 14.810 trillion HUF from 1991 to 2007. Foreign capital actively participated not only in the manufacturing sector but also in the service sector. In 2007, the manufacturing sector had 3,264 foreign firms, or 12% of the total number of foreign firms in all industries, and attracted 5.451 trillion HUF from foreign investors, or 36.8% of the total prescribed capital amount contributed by foreign investors in all industries, whereas the service sector had 21,015 foreign firms (or

[6] Authors' calculation based on UNCTAD official data (http://stats.unctad.org/fdi/) .

77.3% of the total) and attracted 6.436 trillion HUF (or 43.4% of the total)[7].

As discussed above, inward FDI to Hungary has contributed to the emergence of many foreign companies in a relatively short time, especially those in the manufacturing and services industries. The investment and business mode for MNEs has also continued to evolve over the years (Kiss, 2007). This movement may have had a significant impact on the direction and degree of the external effects of FDI on the productivity of domestic firms along with the dynamic changes in the presence of foreign companies in the domestic market and their relationship with domestic counterparts.

On the other hand, most researchers negatively evaluate the relationship between MNEs and domestic firms in Hungary by looking at the considerable disparities in financial standing and technological levels between the two and the low local procurement rate of entering firms[8]. The results of quantitative analyses concerning FDI spillover effects are also used to back up such negative assessments. As far as we surveyed with regard to this issue, 11 papers have been published in the past either devoted solely to the case study of Hungary or reporting empirical results limiting the scope of any estimation of Hungary as part of international comparative research. **Table 3.2** contains a summary of empirical methods and estimation results in these research works. It is difficult to determine from this table that the preceding studies as a whole strongly suggest the positive spillover effects of inward FDI to Hungary on the productivity of domestic firms; this is because the estimation results of the proxies for the market presence of FDI, that is, the spillover variables representing the comparative business scale of foreign companies within each industrial sector they belong to, are mixed. There is no denial that the non-uniformity of the empirical results is largely dependent upon the differences not only in the structure of the regression models and dataset used but also in the estimation period applied because the presence of

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[7] Authors' calculation based on KSH, the Statistical Year Book of Hungary (various years), and the official statistics of the Hungarian Central Statistical Office available at : http://portal.ksh.hu/.

[8] For instance, see Farkas (2000), Szanyi (2004), Fink (2006), Acs et al. (2007), and Rugraff (2008).

Table 3.2 Empirical studies on FDI productivity spillover effects in Hungary

Author	Sector	Period	Data	Productivity variable (dependent variable)	FDI spillover variable		Estimation result[a]			Control variables and their estimation results[a]
					Basic index for computation	Aggregation level	Horizontal effects	Vertical effects		
								Backward effects	Forward effects	
Bosco (2001)	NA	1993-1997	Panel	Turnover	Turnover	NACE2	no	NA	NA	Employment (+), capital (+), foreign ownership share (+)
Sgard (2001)	Manufacturing/ construction	1992-1999	Panel	Turnover	Capital/turnover	NACE2	no/+	NA	NA	Employment (+), capital (+), intermediate material (+), foreign ownership share (+)
Schoors and van der Tol (2002)	All industries	1997-1998	Cross-sectional	Labor productivity	Turnover	NACE2	+	−	+	Tangible assets to labor ratio (+), intangible assets to labor ratio (−), turnover to industrial average ratio (+), square of turnover to industrial average ratio (−), credit interest (−), foreign ownership share (+)
Damijan et al. (2003a)[b]	Manufacturing	1994-1998	Panel	Turnover	Turnover	NACE2	no	NA	NA	Employment (no), capital (+), intermediate material (+), R&D expenditure (no)
Damijan et al. (2003b)[b]	Manufacturing	1995-1999	Panel	Turnover	Turnover	NACE2	no	no	no	Employment (results not reported), capital (results not reported), intermediate material (results not reported), FDI dummy (+), dummy for firms dominated by foreign investors (no), R&D expenditure (+)
Torlak (2004)	Manufacturing	1994-2000	Panel	Turnover	Turnover	NACE2	+	NA	NA	Employment (+), capital (+), intermediate material (+)
Halpern and Muraközy (2005)	Manufacturing	1996-2001	Panel	Added-value	Turnover	NACE2	+	+	no	One-term lag in added-value (+), employment (results not reported), capital (results not reported), intermediate material (results not reported)
Muraközy (2007)	Manufacturing	1995-2003	Panel	Price-cost margin	Turnover	NACE2	−	+	no	Herfindahl index (−), market share (no), capital productivity (no), employment (−), share of imports by industry (no)
Halpern and Muraközy (2007)	Manufacturing	1996-2003	Panel	Added-value, TFP (Levinson and Petrin estimator)	Turnover	NACE2	no/no	+/+	no/no	Employment (results not reported), capital (results not reported)
Békés et al. (2009)	Manufacturing	1992-2003	Panel	TFP (Olley and Pakes estimator)	Turnover	NACE2	+	no	no	Herfindahl index (−), private ownership share (+)
Görg et al. (2009)	Manufacturing	1992-2003	Panel	Added-value, TFP (Levinson and Petrin estimator)	Turnover	NACE4	−/−	NA	NA	Employment (+), capital (+)

Notes: [a]Results are obtained from the estimation of baseline models, which include a single linear-term variable on the right-hand side of the regression equation and have no sample constraints. "+" denotes that the estimated results are positive and statistically significant. "−" denotes that the estimated results are negative and statistically significant. "no" denotes that the estimated results are not significant. "NA" denotes that no estimation is made.
[b]Study of international comparison.
Source: Authors' compilation.

FDI and the relationship between MNEs and domestic firms in Hungary are considered to have changed dynamically at each stage of the transition to a market economy from the 1990s to the early 2000s.

With this in mind, we reexamine FDI productivity spillover effects in Hungary only for the early 2000s, during which the business activity of foreign firms entered its mature, stable stage. It is highly likely that positive FDI spillover effects during this period exceed crowding-out effects for two reasons. First, the business activity of many MNEs has taken greater root in local communities, and their alliance with domestic firms has achieved larger scale and depth through parts supply and outsourcing than before. Second, many domestic firms have improved their management practices, and the weaker ones have been forced out of business through severe market competition over the past 15 years[9]. We also give great attention to the service sector, which has been completely ignored in previous studies, because, as reported above, the presence of foreign companies in services is just as remarkable as it is in the manufacturing industries and, hence, we expect that a significant amount of technology and knowledge has been transferred from MNEs to domestic firms in the service industries.

3.4 Data

Same as in Chapter 2, the data underlying the empirical analysis in this chapter are annual census-type data of Hungarian incorporated enterprises offered from the National Tax Authority of Hungary for academic research purposes. The data were compiled from financial statements associated with tax reporting submitted to the tax office by legal entities performing accounting and tax procedures by double-entry bookkeeping. The observation period was from 2002 through 2005. The data cover all industries, including manufacturing and service industries[10], and contain basic information for each sample

[9] Studies suggesting this possibility include those by Inzelt (2008), Mako et al. (2009), and Sass et al. (2009).

[10] The manufacturing industries include food products and beverages through recycling (NACE 15-37). The service sector refers to wholesale and retail trade : repair of motor vehicles, motorcycles, and personal and household goods

firm, including the NACE 4-digit codes, annual average number of employees, total assets, turnover, and other financial indices. In addition, the locations of the sample firms are identifiable to the extent that they are divided into the capital region, the western region, and the eastern region[11].

Information about the ownership structure includes the total amount of equity capital (prescribed capital) at the end of the term and its share of state, domestic private investors, and foreign investors. Thus, the data allow us to know whether a given sample firm is a fully domestically owned or a foreign firm and, when it is a foreign firm, whether it is a foreign joint-venture firm or a fully foreign-owned firm according to the ownership share of foreign investors in the total amount of subscribed equity.

All nominal values are deflated with the base year being 2002 to use the data[12]. As Sgard (2001) and Claessens and Djankov (2002) indicate, firm-specific price deflators, which are the most desirable for deflation, are not available in Hungary. Hence, following the steps taken by these two studies, the consumer price index, the industrial producer price index, and the investment price index reported by the Hungarian Central Statistical Office are used as alternative deflators for every aspect of the empirical analysis in this chapter. In addition, for using the data, samples including unrealistic and inconsistent input and missing values that pose an impediment to our empirical analysis are removed, and cleansing procedures are performed with due attention.

The data form an unbalanced panel with the new entry and exit

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(NACE 50-52), hotels and restaurants (NACE 55), transport, storage, and communication (NACE 60-64), and real estate, renting, and business activities (NACE 71-74).

[11] The individual regions consist of the following city and counties : the capital region consists of Budapest and Pest County; the western region consists of the following nine counties : Győr-Moson-Sopron, Komárom-Esztergom, Vas, Veszprém, Fejér, Zala, Somogy, Tolna, and Baranya; and the eastern region also consists of nine counties : Nógrad, Bács-Kiskun, Csongrád, Békés, Jász-Nagykun-Szolnok, Hajdú-Bihar, Szabolcs-Szatmár-Bereg, Borsod-Abaúj-Zemplen, and Heves.

[12] Unless otherwise specified, the unit used for the price data is 1,000 HUF.

of enterprises during the observation period. All of the effective data values concerning these newly entering and exiting firms are used for the computation of industry-level aggregated values, such as FDI spillover variables and Herfindahl indices reported later. The observations used for our empirical analysis are limited to those concerning companies with an average number of employees of five or more and to those available in the data at least for two terms in the analysis period in order to control a firm's individual effects using panel data estimators and to exclude so-called 'one-man companies' and micro firms from our estimation. Following many previous studies, we also exclude those companies that belong to industries with less than 5 active firms at the 4-digit level from the observations used in the empirical analysis.

The original data include almost the same number of sample firms as the official statistics. As a result of data cleaning and the exclusion of small-scale companies, with respect to 2003, 8,505 manufacturing firms and 17,232 service firms remain in our dataset. According to the data and official statistics, the proportions of these sample firms in the total number of incorporated enterprises and employees for 2003 account for 23.0% and 58.4% (540,146 employees) for manufacturing firms and 9.3% and 44.9% (567,078 employees) for service firms, respectively. Furthermore, the sample of manufacturing firms includes 1,520 foreign firms (of which 886 are fully foreign-owned firms), and that for service firms includes 1,825 foreign firms (of which 994 are fully foreign-owned firms). The proportion of these foreign firms in the total number of samples (13.0%) is almost identical to that of the official statistics if the company size is considered. The same has also been confirmed for the observations for the other years. In other words, the panel data used for our empirical analysis consist of samples representative for the manufacturing and service industries in Hungary.

3.5 Empirical Methodology

In this section, an empirical model is developed on the basis of the discussion in Section 3.2 regarding the relationship between the multi-layered structure of industrial classifications and the spillover effects of horizontal FDI on the productivity of domestic firms. The model is

designed to estimate multiple variables representing the market presence of horizontal FDI according to the degree of difference in industrial-technological proximity to a domestic firm to be analyzed. As in many preceding works, our sample firms include both fully domestically owned firms and foreign joint-venture companies. In the empirical analysis, the direct effects of foreign participation on productivity of a joint-venture company are controlled by the foreign ownership share in the total amount of subscribed equity of the company.

As demonstrated in **Figure 3.1**, in the case of Hungary, which adopts the NACE industrial classifications, the presence of FDI in the manufacturing and service industries is calculated at three classification levels for each industry, and the productivity of the i-th domestic firm is then regressed into these horizontal spillover variables using a panel data estimator. More specifically, if the i-th domestic firm belongs to NACE with sector P for the 4-digit level, sector Q for the 3-digit level, and sector R for the 2-digit level ($P \in Q \in R$), the market presence of FDI for the i-th domestic firm in sector P is defined as follows :

$$HORFDI4_{it} = \frac{\sum_{p \text{ for all } p \in P} x_{pt} \cdot FS_{pt} - x_{it} \cdot FS_{it}}{\sum_{p \text{ for all } p \in P} x_{pt} - x_{it}}, \tag{3.1}$$

where the subscript t refers to the year, x represents the business scale at the firm level, and FS stands for the ownership share held by foreign investors. As Equation (3.1) shows, if the i-th domestic firm is operating as a foreign joint-venture company, the business scale of the firm weighed by its foreign ownership share is subtracted from the numerator on the right-hand side.

The presence of foreign firms in the 3-digit aggregated level sector Q, excluding those categorized in the lower subsector P, is measured using the following formula :

$$HORFDI3N_{it} = \frac{\sum_{q \text{ for all } q \in Q} x_{qt} \cdot FS_{qt} - \sum_{p \text{ for all } p \in P} x_{pt} \cdot FS_{pt}}{\sum_{q \text{ for all } q \in Q} x_{qt} - \sum_{p \text{ for all } p \in P} x_{pt}}. \tag{3.2}$$

Similarly, the presence of FDI in the highest aggregated level sector R, excluding those categorized in the lower subsector Q, is given by :

$$HORFDI2N_{it} = \frac{\sum_{r \text{ for all } r \in R} x_{rt} \cdot FS_{rt} - \sum_{q \text{ for all } q \in Q} x_{qt} \cdot FS_{qt}}{\sum_{r \text{ for all } r \in R} x_{rt} - \sum_{q \text{ for all } q \in Q} x_{qt}}. \quad (3.3)$$

As is the case with the relationships among the three different enterprise layers drawn in **Figure 3.1**, the above horizontal spillover variables have a nested structure that varies depending on the level of aggregation. Namely, the numbers 2, 3, and 4 included in the names of the variables stand for the levels of aggregation in NACE, and N at the end denotes that the variable has a nested structure in the relationship with the lower categories. Empirical models that comprise these nested spillover variables of horizontal FDI in the right-hand side of the estimation equation are hereinafter called 'nested variable models' to distinguish them from the models with a single horizontal variable.

To compare the estimation results from the two different empirical approaches, we also estimate an additional horizontal spillover variable without giving any consideration to the multi-layered structure of industrial classifications. Specifically, the productivity variable of the i-th domestic firm is regressed into the market presence of FDI in sector R as a whole, which is expressed in the following formula :

$$HORFDI2_{it} = \frac{\sum_{r \text{ for all } r \in R} x_{rt} \cdot FS_{rt} - x_{it} \cdot FS_{it}}{\sum_{r \text{ for all } r \in R} x_{rt} - x_{it}}. \quad (3.4)$$

Furthermore, as Schoors and van der Tol (2002) and Damijan et al. (2003b) do, we also pay attention to the externalities of the vertical FDI, which consist of the backward and forward spillover effects generated by downstream industries and upstream industries, respectively. The backward spillover variable for the i-th domestic firm takes the presence of the foreign firms as its value after being weight-averaged by the share of each downstream industry in the total inputs supplied from sector R as follows :

$$BACFDI2_{it} = \sum_{S \text{ if } S \neq R} a_{SR} \cdot \left[\frac{\sum_{s \text{ for all } s \in S} x_{st} \cdot FS_{st}}{\sum_{s \text{ for all } s \in S} x_{st}} \right], \quad (3.5)$$

where a_{SR} represents the proportion of sector R's output supplied to downstream industry S at the 2-digit aggregated level. Likewise, the values of the forward spillover variable ($FORFDI2_{it}$) are calculated by weight-averaging the market presence of FDI with the proportion of

each upstream industry in the total inputs of sector R[13].

We adopt three indices for the i-th domestic firm's productivity as the dependent variables of our regression models. As summarized in **Table 3.2**, the estimation results of the previous studies suggest the possibility that FDI has a different impact on productivity of a different nature. In this chapter, we evaluate this point in detail. The first productivity variable is the output scale (Y) measured using the natural logarithm of the total annual turnover. The second productivity variable is a proxy for labor productivity (VA/L) using the natural logarithm of the total value added per employee. The third productivity variable is the total factor productivity (TFP) obtained as the residual of a Cobb-Douglas production function estimated using the semi-parametric method first contrived by Olley and Pakes (1996) and then developed by Levinsohn and Petrin (2003)[14]. Although the technical details are not given here due to space limitations, the Levinsohn-Petrin estimator is accepted as the means to accurately measure total factor productivity since it treats simultaneous bias arising from the endogenous relationship between factor inputs and productivity by adopting intermediate inputs as the firm-specific proxy of the productivity shock, which is unobservable for econometricians. By controlling for the shock, this method also solves the problem of endogeneity of input choices[15].

FDI spillover effects on the productivity of domestic firms are generated on the condition that MNEs have significantly better productivity than domestic firms. **Table 3.3** shows the results of univariate analysis regarding the productivity gap between different company groups in terms of ownership structure in the manufacturing and service industries using the above three productivity variables. We confirm that, as of 2003, foreign firms are superior to fully domestically owned firms in both sectors and in all three of the productivity

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[13] These backward and forward spillover variables are computed using the input-output table for 2005 compiled by the Hungarian Central Statistical Office (KSH, 2009).

[14] Petrin et al. (2004) describe how to estimate TFP using econometric software.

[15] According to Ackerberg et al. (2006), however, the Levinsohn-Petrin estimator may undergo collinearity problems, and, hence, there is still room for the development of the TFP estimation technique.

Table 3.3 Univariate analysis of productivity gaps among different types of firm ownership, 2003

Industrial sector	Manufacturing			Services		
Productivity variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
All firms	11.966	7.640	0.025	11.997	7.754	0.025
	(11.736)	(7.603)	(0.005)	(11.924)	(7.725)	(0.005)
Fully domestically owned firms	11.714	7.540	0.016	11.891	7.676	0.021
	(11.554)	(7.528)	(−0.001)	(11.834)	(7.656)	(0.003)
Foreign firms	13.144	8.096	0.065	12.900	8.411	0.059
	(13.115)	(8.012)	(0.039)	(12.911)	(8.476)	(0.029)
Foreign joint-venture firms	12.806	7.979	0.064	12.652	8.280	0.054
	(12.749)	(7.904)	(0.031)	(12.585)	(8.307)	(0.023)
Fully foreign-owned firms	13.390	8.180	0.066	13.106	8.522	0.064
	(13.363)	(8.091)	(0.048)	(13.165)	(8.673)	(0.033)
N	8505	8499	8461	17232	17200	17211
Comparative analysis between fully domestically owned and foreign firms						
t-test on the equality of means	−36.342***	−24.672***	−8.769***	−29.818***	−34.394***	−7.517***
Wilcoxon rank-sum test (*z*)	−29.933***	−22.837***	−9.366***	−25.889***	−30.775***	−8.786***
Kolmogorov-Smirnov equality-of-distributions test (combined *D*)	0.381***	0.276***	0.132***	0.298***	0.360***	0.131***
Multiple group comparison of the three company groups						
ANOVA (*F*)	698.280***	317.100***	38.470***	470.770***	610.500***	28.760***
Bartlett test (χ^2)	179.823***	23.859***	33.230***	210.567***	320.518***	235.091***
Kruskal-Wallis test (χ^2)	933.501***	539.389***	88.913***	698.953***	960.198***	78.999***
Scheffe multiple comparison of the three company groups						
Differences between fully domestically owned firms and foreign JV firms	1.092***	0.438***	0.048***	0.762***	0.603***	0.033***
Differences between fully domestically owned firms and fully foreign-owned firms	1.676***	0.640***	0.050***	1.215***	0.845***	0.043***
Differences between foreign JV firms and fully foreign-owned firms	0.584***	0.202***	0.002	0.453***	0.242***	0.010

Notes : The upper values are means, and the lower values in parenthesis are medians. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 3.8.

variables with statistical significance at the 1% level. Moreover, the results of the analysis of variance and the Scheffe multiple comparison of the three company groups indicate that fully foreign-owned firms are superior to foreign joint-venture firms in terms of productivity in general. In both industries, however, no statistically significant differences are evident between fully foreign-owned firms and foreign joint-venture firms in terms of total factor productivity. Almost the same results as those shown in **Table 3.3** are obtained from the analysis using 2004 and 2005 observations. Hence, we predict that FDI in Hungary had considerable potential for generating positive productivity spillover effects on domestic firms in the early 2000s.

The observations in our regressions are limited to those of fully domestically owned firms and foreign joint-venture firms since we focus on FDI productivity spillover effects on firms established by domestic investment. To avoid possible endogeneity between firm-level productivity and the market presence of FDI that may cause the simultaneous bias on the estimation results, the total asset at the end of year $t-1$ preceding the production activity for year t is used as the business scale index at the firm level, on the basis of which the FDI spillover variables are calculated. **Table 3.4** contains the correlation matrices of six FDI spillover variables computed using the formula reported earlier. We confirm from the table that the maximum correlation coefficient among the nested horizontal spillover variables of *HORFDI2N*, *HORFDI3N*, and *HORFDI4* is 0.234, suggesting that it is unlikely for the simultaneous estimation of these three variables to bring about serious multicollinearity to the estimation results. On the other hand, as is shown in Panel (a) of **Table 3.4**, the correlation coefficient for the manufacturing industry among the vertical spillover variables of *BACFDI2* and *FORFDI2* is 0.780, which is greater than the threshold of 0.700 for possible multicollinearity (Lind et al., 2004). Therefore, these vertical FDI spillover variables are estimated one by one. The correlation coefficient of vertical FDI spillover variables for the service industry is 0.246. Although it is not necessary to follow the same estimation procedure as that for the manufacturing industry, we estimate the vertical spillover variables separately for the service industry in order to compare the estimation results of the two types of industry.

Along with FDI spillover variables, we introduce three indepen-

Table 3.4 Correlation matrices of FDI spillover variables

(a) Manufacturing (N=22736)

	HORFDI2	*HORFDI2N*	*HORFDI3N*	*HORFDI4*	*BACFDI2*	*FORFDI2*
HORFDI2	1.000					
HORFDI2N	0.742	1.000				
HORFDI3N	0.087	−0.029	1.000			
HORFDI4	0.516	0.234	−0.089	1.000		
BACFDI2	0.240	0.213	−0.184	0.259	1.000	
FORFDI2	0.264	0.261	−0.126	0.201	0.780	1.000

(b) Services (N=48782)

	HORFDI2	*HORFDI2N*	*HORFDI3N*	*HORFDI4*	*BACFDI2*	*FORFDI2*
HORFDI2	1.000					
HORFDI2N	0.752	1.000				
HORFDI3N	0.283	−0.015	1.000			
HORFDI4	0.291	−0.047	0.094	1.000		
BACFDI2	−0.395	−0.323	−0.490	−0.002	1.000	
FORFDI2	0.013	−0.062	−0.111	0.018	0.246	1.000

Source : Authors' calculation. For definitions and descriptive statistics of the variables, see Table 3.8.

dent variables representing the input of capital stock (K), labor (L), and materials (M) into the right-hand side of the regression model, taking the production scale as the dependent variable, and the capital-labor ratio (K/L) into that of the regression model, taking labor productivity as the dependent variable. In addition to these input variables, we also adopt the firm's foreign ownership share (FS), government ownership share (GS), export propensity (export/total turnover) ($EXPPRO$), Herfindahl index at the NACE 4-digit level as the proxy for the market concentration of the sector the firm belongs to (HHI), location fixed-effects (i.e., the fixed effects of the western region and the eastern region), and year fixed-effects for all regression models as the control variables. It is natural to assume that ownership structure and export experience will exert actual influence on the firm productivity with a certain time-lag interval. Hence, we lag all these firm-level independent variables one year. We expect that factor inputs, foreign ownership, and the linkage with the international market through export activity have a positive impact on the firm's productivity, whereas state ownership and higher market concentration of the

industry the firm belongs to are negatively related to its productivity[16].

To control the firms' individual effects, we used three panel data estimators : pooling OLS, random-effects, and fixed-effects estimators. The selection of the estimation results reported in this chapter is carried out in accordance with the results of two model specification tests. One is the Breusch-Pagan test to examine the null hypothesis that the variance of the individual effects is zero, and the other is the Hausman test to examine the random-effects assumption (Greene, 2008). Furthermore, following Boschini and Olofsgård (2007), Taylor (2007), Geishecker and Görg(2008), and many others, we compute the standard errors for all specifications using the Huber-White sandwich estimator[17].

3.6 Estimation Results

The estimation results using all observations are shown in **Table 3.5**. The definitions and the descriptive statistics of the variables used for estimation are listed in **Table 3.8**. **Table 3.5** contains the 24 regression models to deal with all combinations of the two industrial sectors, the three dependent variables, and the four sets of the FDI spillover variables. Both the Breusch-Pagan and the Hausman tests rejected the null hypothesis in all cases at the 1% significance level[18]. Therefore, estimates of the fixed-effects models are exclusively reported in **Table 3.5**.

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[16] Girma et al. (2004) examine the causality between the export activity of British firms and their productivity and confirm that export is an important channel for improving the productivity of domestic firms. In Chapter 2, we verified the superiority of foreign ownership over domestic private ownership and the inferiority of government ownership compared to domestic private ownership in terms of productivity using the same data in this chapter.

[17] As a supplementary regression analysis, we estimated the effect of each FDI spillover variable separately and computed the standard errors of its coefficient adjusted for clustering on aggregated industry and confirmed that these estimation results do not significantly differ from those reported in Section 3.6.

[18] These specification test results apply to all the other estimation results reported in this chapter.

Table 3.5 Panel data analysis of FDI productivity spillover effects : Comparison of the conventional model and the nested variable model

(a) Manufacturing

Dependent variable	*Y*				*VA/L*				*TFP*			
Model[a]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Spillover variable[b]												
HORFDI2	0.0159		0.0168		0.0920*		0.0919*		0.0235		0.0230	
	(0.015)		(0.015)		(0.054)		(0.054)		(0.014)		(0.014)	
HORFDI2N		0.0236*		0.0239*		0.0722		0.0716		0.0236*		0.0230*
		(0.013)		(0.013)		(0.046)		(0.046)		(0.012)		(0.012)
HORFDI3N		−0.0225*		−0.0215*		−0.0222		−0.0219		−0.0194*		−0.0197*
		(0.012)		(0.012)		(0.043)		(0.044)		(0.012)		(0.012)
HORFDI4		0.0215**		0.0218**		0.0731**		0.0732**		0.0266***		0.0265***
		(0.011)		(0.011)		(0.037)		(0.037)		(0.010)		(0.010)
BACFDI2	0.0053	0.0091			0.0125	0.0196			0.0072	0.0103		
	(0.029)	(0.029)			(0.102)	(0.103)			(0.027)	(0.027)		
FORFDI2			−0.0242	−0.0225			−0.0021	−0.0008			0.0089	0.0108
			(0.033)	(0.033)			(0.117)	(0.118)			(0.031)	(0.031)
Input variable												
K	0.1328***	0.1326***	0.1328***	0.1326***								
	(0.004)	(0.004)	(0.004)	(0.004)								
L	0.1525***	0.1526***	0.1525***	0.1526***								
	(0.004)	(0.004)	(0.004)	(0.004)								
M	0.7014***	0.7014***	0.7013***	0.7014***								
	(0.003)	(0.003)	(0.003)	(0.003)								
K/L					0.4770***	0.4767***	0.4770***	0.4767***				
					(0.011)	(0.011)	(0.011)	(0.011)				
Control variable												
FS[b]	0.0399***	0.0399***	0.0400***	0.0401***	0.1292**	0.1290**	0.1292**	0.1290**	0.0282**	0.0282**	0.0281**	0.0282**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.052)	(0.052)	(0.052)	(0.052)	(0.014)	(0.014)	(0.014)	(0.014)
GS[b]	0.0145	0.0131	0.0145	0.0132	0.0452	0.0423	0.0452	0.0423	−0.0001	−0.0015	−0.0001	−0.0015
	(0.022)	(0.022)	(0.022)	(0.022)	(0.078)	(0.078)	(0.078)	(0.078)	(0.021)	(0.021)	(0.021)	(0.021)
EXPPRO[b]	−0.0098	−0.0165	−0.0105	−0.0172	0.0281	0.0131	0.0279	0.0128	−0.0129	−0.0195	−0.0128	−0.0194
	(0.017)	(0.017)	(0.017)	(0.017)	(0.060)	(0.060)	(0.060)	(0.060)	(0.016)	(0.016)	(0.016)	(0.016)
HHI	−0.0120	−0.0121	−0.0119	−0.0121	−0.0282	−0.0284	−0.0282	−0.0283	−0.0132	−0.0134	−0.0133	−0.0134
	(0.011)	(0.011)	(0.011)	(0.011)	(0.038)	(0.038)	(0.038)	(0.038)	(0.010)	(0.010)	(0.010)	(0.010)
Const.	1.8484***	1.8435***	1.8609***	1.8568***	3.4707***	3.4595***	3.4772***	3.4688***	−0.0090	−0.0136	−0.0093	−0.0132
	(0.047)	(0.047)	(0.048)	(0.048)	(0.105)	(0.105)	(0.105)	(0.105)	(0.014)	(0.015)	(0.015)	(0.015)
Location fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	22677	22677	22677	22677	22716	22716	22716	22716	22677	22677	22677	22677
R^2	0.973	0.973	0.973	0.973	0.382	0.383	0.382	0.383	0.007	0.009	0.009	0.011
F-test[c]	6122.89***	5310.22***	6123.14***	5310.37***	187.90***	159.36***	187.90***	159.35***	12.51***	11.44***	12.51***	11.44***
Breusch-Pagan test[d]	11272.36***	11254.11***	11203.96***	11179.24***	7436.66***	7420.40***	7285.83***	7266.89***	10751.30***	10742.74***	10618.21***	10606.77***
Hausman test[e]	178.88***	189.26***	195.25***	221.99***	63.22***	67.94***	65.23***	75.67***	95.18***	90.56***	91.63***	98.38***

(Continued)

Table 3.5 (continued)

(b) Services

Dependent variable	*Y*				*VA/L*				*TFP*			
Model[a]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
Spillover variable[b]												
HORFDI2	−0.0391**		−0.0355*		−0.0683		−0.0676		−0.0412**		−0.0375**	
	(0.020)		(0.020)		(0.074)		(0.074)		(0.018)		(0.018)	
HORFDI2N		−0.0251*		−0.0225		0.0037		0.0062		−0.0178		−0.0149
		(0.015)		(0.015)		(0.055)		(0.055)		(0.013)		(0.013)
HORFDI3N		0.0046		0.0069		0.0486*		0.0535*		−0.0072		−0.0046
		(0.008)		(0.008)		(0.029)		(0.031)		(0.008)		(0.008)
HORFDI4		−0.0062		−0.0064		−0.0154		−0.0194		−0.0117		−0.0122
		(0.009)		(0.009)		(0.034)		(0.034)		(0.008)		(0.008)
BACFDI2	−0.0939**	−0.0885*			−0.1892	−0.1367			−0.0989**	−0.1002**		
	(0.046)	(0.046)			(0.172)	(0.175)			(0.042)	(0.042)		
FORFDI2			−0.0436	−0.0434			0.1186	0.1226			−0.0415	−0.0417
			(0.039)	(0.039)			(0.147)	(0.147)			(0.036)	(0.036)
Input variable												
K	0.1064***	0.1064***	0.1064***	0.1064***								
	(0.002)	(0.002)	(0.002)	(0.002)								
L	0.1399***	0.1399***	0.1400***	0.1400***								
	(0.003)	(0.003)	(0.003)	(0.003)								
M	0.7339***	0.7338***	0.7338***	0.7337***								
	(0.002)	(0.002)	(0.002)	(0.002)								
K/L					0.4440***	0.4440***	0.4438***	0.4439***				
					(0.007)	(0.007)	(0.007)	(0.007)				
Control variable												
FS[b]	0.0206*	0.0208*	0.0207*	0.0209*	0.0553	0.0565	0.0551	0.0564	0.0170	0.0168	0.0171	0.0170
	(0.012)	(0.012)	(0.012)	(0.012)	(0.045)	(0.045)	(0.045)	(0.045)	(0.011)	(0.011)	(0.011)	(0.011)
GS[b]	−0.0169	−0.0172	−0.0167	−0.0171	0.0692	0.0677	0.0696	0.0679	−0.0034	−0.0033	−0.0032	−0.0032
	(0.015)	(0.015)	(0.015)	(0.015)	(0.057)	(0.057)	(0.057)	(0.057)	(0.014)	(0.014)	(0.014)	(0.014)
EXPPRO[b]	−0.0309	−0.0296	−0.0291	−0.0274	0.0916	0.1034	0.0914	0.1046	−0.0027	−0.0018	−0.0010	0.0007
	(0.022)	(0.023)	(0.022)	(0.023)	(0.084)	(0.085)	(0.084)	(0.085)	(0.020)	(0.021)	(0.020)	(0.021)
HHI	0.0040	0.0039	0.0047	0.0046	0.0516	0.0516	0.0532	0.0527	−0.0035	−0.0036	−0.0028	−0.0028
	(0.009)	(0.009)	(0.009)	(0.009)	(0.035)	(0.035)	(0.035)	(0.035)	(0.008)	(0.008)	(0.008)	(0.008)
Const.	1.9094***	1.9032***	1.8869***	1.8828***	3.8996***	3.8476***	3.7836***	3.7502***	0.0594***	0.0560***	0.0335**	0.0295**
	(0.033)	(0.034)	(0.031)	(0.031)	(0.096)	(0.096)	(0.083)	(0.082)	(0.018)	(0.018)	(0.014)	(0.014)
Location fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	48690	48690	48690	48690	48585	48585	48585	48585	48690	48690	48690	48690
R^2	0.967	0.967	0.967	0.967	0.398	0.398	0.401	0.401	0.001	0.001	0.001	0.001
F-test[c]	17001.55***	14733.73***	16999.75***	14732.47***	376.82***	318.96***	376.76***	318.97***	27.94***	23.23***	27.51***	22.88***
Breusch-Pagan test[d]	29844.06***	29456.88***	29393.10***	29157.38***	17620.28***	17016.20***	17112.15***	16557.33***	26671.95***	26189.33***	25858.19***	25510.96***
Hausman test[e]	599.80***	730.86***	717.54***	794.54***	117.06***	620.01***	228.17***	828.29***	172.25***	330.39***	386.16***	483.66***

Notes : [a]All models are estimated using the fixed-effects estimator. The Huber-White heteroskedasticity-consistent standard errors are reported in parentheses beneath the regression coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

[b]Lagged variable.

[c]Null hypothesis : All coefficients are zero.

[d]Null hypothesis : The variance of firm-independent effects is zero.

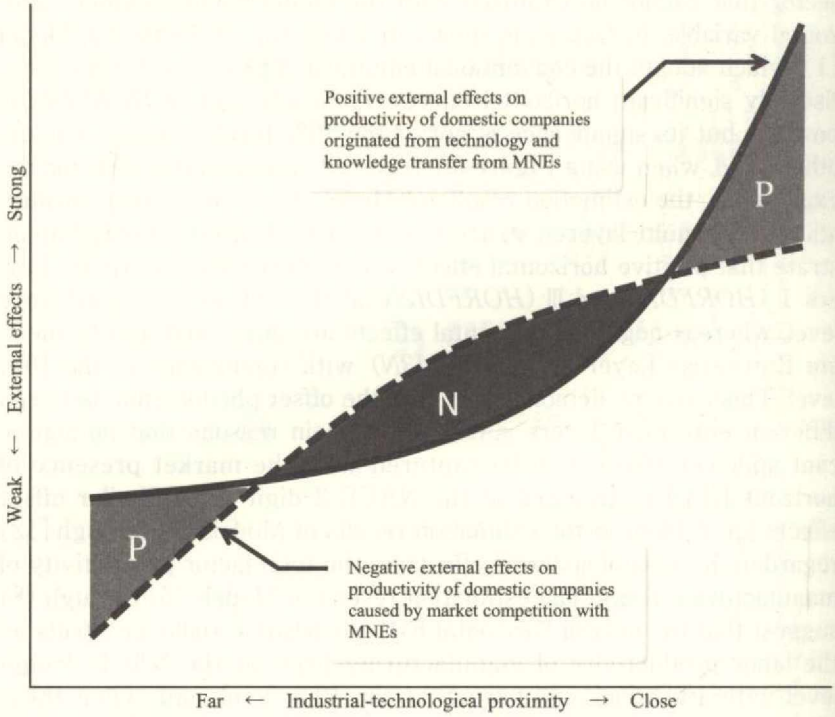
[e]Null hypothesis : The random-effects estimation is effective and consistent.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 3.8.

The nested variable model succeeds in identifying the horizontal spillover effects originating from the different depths of the industrial sector that cannot be captured with the model having a single horizontal variable. In fact, as is shown in Panel (a) of **Table 3.5**, Model [1], which adopts the conventional empirical approach, detects no statistically significant horizontal effects. The coefficient of *HORFDI2* is positive, but its significance is not at the 10% level or below. On the other hand, when using **Figure 3.1** reported earlier as the basis for the explanation, the estimation results of Model [2], which gives consideration to the multi-layered structure of industrial classifications, demonstrate that positive horizontal effects are observed for Enterprise Layers I (*HORFDI4*) and Ⅲ (*HORFDI2N*) at the 10% or less significance level, whereas negative horizontal effects are generated at intermediate Enterprise Layer Ⅱ (*HORFDI3N*) with significance at the 10% level. This outcome demonstrates that the offset phenomenon between different enterprise layers is one of the main reasons that no significant spillover effects can be captured with the market presence of horizontal FDI aggregated at the NACE 2-digit level. Similar offset effects are evident in the estimation results of Models [9] through [12] regarding horizontal spillover effects on the total factor productivity of manufacturing firms. The estimation results of Models [5] through [8] suggest that the overall horizontal FDI has positive spillover effects on the labor productivity of manufacturing firms at the NACE 2-digit level with statistical significance at the 10% level, and, when these effects are decomposed into those from each enterprise layer, the impact from Enterprise Layer I, as well as that on production scale and labor productivity, is solely found to be positive and significant at the 5% level, indicating that the nested variable model is effective to identify the more particular source of external effects of horizontal FDI.

The estimation results in Panel(a)of **Table 3.5** as a whole strongly demonstrate that there is a non-linear correlation between the industrial-technological proximity between a domestic firm and MNEs and the spillover effects of horizontal FDI in the Hungarian manufacturing sector. Based on the empirical evidence that the FDI presence has a positive effect in Enterprise Layers I and Ⅲ and a negative effect in Enterprise Layer Ⅱ, we conjecture that there is a relationship, as illustrated in **Figure 3.2**, between the positive external effects on the pro-

Figure 3.2 Likely relationship between MNEs and domestic companies in the Hungarian manufacturing sector from the viewpoint of productivity spillover effects of horizontal FDI



Source : Authors' illustration.

ductivity of domestic companies originated from technology and knowledge transfer from MNEs and the negative external effects caused by market competition with MNEs[19]. As the figure shows, if

[19] Positive external effects on productivity of domestic firms can also be anticipated from market competition with MNEs through the managerial discipline of local companies and other channels. Therefore, here, we refer to the negative effects of market competition in net terms. As presented in the Introduction, in former socialist economies, market competition with foreign companies tends to bear heavily on domestic counterparts. Hungary is not an exception. Thus, in **Figure 3.2**, we assume that competition with MNEs has a net negative effect on the

both effects are an increasing function of industrial-technological proximity between a domestic firm and MNEs, on the one hand, the external effects of technology and knowledge transfer draw an upward convex curve ($f'(x)>0, f''(x)>0$), and, on the other, the external effects of market competition give a down-ward convex curve ($f'(x)>0, f''(x)<0$). In that case, it is possible that the net positive FDI spillover effects explicitly emerge in a range in which industrial-technological proximity is far enough or very close between a domestic firm and MNEs (i.e., zone P in **Figure 3.2**) while the net negative spillover effects clearly appear in an internal range of industrial-technological proximity between the two (i.e., zone N), the threshold values of which are defined by the intersections of the two curves. It is likely that the nested variable model empirically captured such circumstances in the manufacturing sector of Hungary. Needless to say, these arguments are only an inductive inference derived from our empirical results. The theoretical and empirical foundations for understanding the relationship between the industrial-technological proximity between a domestic firm and MNEs and the FDI spillover effects remain to be discussed further.

On the other hand, as indicated in Panel (b) of **Table 3.5**, the horizontal FDI spillover effects on service firms are generated in a completely different pattern from those on manufacturing firms. We found that foreign competitors generally have negative impacts on the production scale and total factor productivity of domestic firms in the same sectors they belong to, whereas, in Enterprise Layer II, they have a positive spillover effect on the labor productivity of domestic firms with statistical significance at the 10% level. These estimation results are quite interesting, as they suggest that the market behavior of MNEs may have diverse impacts on the production performance of indigenous companies in recipient countries[20].

With regard to the vertical FDI spillover effects, we did not

productivity of domestic firms.

[20] In some cases, such as Models [21] through [24] in Panel (b) of **Table 3.5**, insignificant estimation results can be obtained if the horizontal effects are dissolved for each enterprise layer. Thus, it would be desirable to estimate conventional models as well and compare the results with the estimation results of nested variable models.

detect in our regression analysis any statistically significant backward spillover effects on manufacturing firms, whereas the analysis confirms significantly negative effects on the production scale and total factor productivity of service firms, suggesting that, in the Hungarian service sector, advancement of MNEs into downstream industries tends to result in downsizing and a loss of efficiency in production of domestic firms operating in upstream industries. It is likely that intense market competition between MNEs and domestic firms negatively affects the production activities of local suppliers as a result of management deterioration and/or exit of their traditional client companies. As for forward FDI spillovers, their impacts are insignificant for both manufacturing and service firms.

Our estimations have produced positive and significant coefficients on the input variables. Among the control variables, as has been confirmed in many studies regarding FDI into Hungary, *FS* shows positive and robust estimates, particularly for manufacturing firms, suggesting that foreign participation is a crucial channel for Hungarian domestic firms to improve their productivity in the manufacturing sector. The statistical significance of other control variables, namely, *EXPPRO*, *GS*, and *HHI*, never reaches the 10% level.

Table 3.6 shows the estimation results when classifying the observations into those for fully domestically owned firms and those for foreign joint-venture firms. The estimates reported in this table are those for FDI spillover variables only using regression models with the backward variable on the right-hand side. **Table 3.6** reveals that fully domestically owned firms are the main recipients of external effects originating from inward FDI, whether they are positive or negative. We presume that, on average, the chances of a Hungarian foreign joint-venture firm acquiring the technology and knowledge from other MNEs are greatly diminished due to the existence of foreign ownership as a direct endogenous channel for improving its productivity and to the relatively small productivity gap with fully foreign-owned firms, as confirmed in **Table 3.3**.

As explained in the preceding section, the FDI spillover variables estimated in **Table 3.5** are calculated on the basis of total assets. In most previous studies, however, the market presence of FDI is expressed using an index other than assets. With this in mind, we also estimate the FDI spillover variables using the next four indices : (a)

Table 3.6 Estimation results by differentiating observations between fully domestically owned firms and foreign joint-venture firms

(a) Fully domestically owned firms

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2N	0.0244*	0.0632	0.0226*	−0.0282*	−0.0083	−0.0191
	(0.014)	(0.050)	(0.013)	(0.015)	(0.056)	(0.014)
HORFDI3N	−0.0273**	−0.0146	−0.0217*	0.0079	0.0631*	−0.0058
	(0.013)	(0.046)	(0.012)	(0.009)	(0.033)	(0.008)
HORFDI4	0.0270**	0.0654*	0.0312***	−0.0080	−0.0166	−0.0117
	(0.011)	(0.038)	(0.011)	(0.009)	(0.035)	(0.008)
BACFDI2	0.0098	0.0122	0.0105	−0.0938*	−0.1336	−0.0975**
	(0.030)	(0.109)	(0.029)	(0.049)	(0.183)	(0.044)
N	20902	20906	20902	46357	46254	46357
R^2	0.972	0.363	0.007	0.966	0.391	0.001

(b) Foreign joint-venture firms

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2N	0.0682	0.2304**	0.0711*	−0.0181	0.1447	0.0029
	(0.044)	(0.113)	(0.037)	(0.067)	(0.299)	(0.062)
HORFDI3N	0.0045	−0.0458	−0.0128	−0.0166	−0.0248	−0.0273
	(0.041)	(0.105)	(0.035)	(0.032)	(0.135)	(0.030)
HORFDI4	−0.0046	0.0978	−0.0053	−0.0112	0.0463	−0.0372
	(0.036)	(0.090)	(0.031)	(0.041)	(0.171)	(0.038)
BACFDI2	−0.1418	−0.0785	−0.0105	−0.0435	0.2991	−0.1049
	(0.111)	(0.285)	(0.095)	(0.165)	(0.701)	(0.155)
N	1775	1810	1775	2333	2331	2333
R^2	0.972	0.446	0.001	0.971	0.365	0.003

Notes : All models are estimated using the fixed-effects estimator. FDI spillover variables are lagged variables. For brevity, the coefficient estimates of other independent variables are not reported here. All specifications include a constant and location, year, and firm fixed-effects. The Huber-White heteroskedasticity-consistent standard errors are reported in parentheses beneath the regression coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 3.8.

total turnover, (b) total added-value, (c) total equity capital, and (d) annual average number of employees. **Table 3.7** shows the results. The table reveals that there are certain differences among individual

Table 3.7 Estimation results of FDI spillover variables computed using total turnover, total added-value, total equity capital, and annual average number of employees

(a) Total turnover

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2TN	0.0274**	0.0640	0.0254**	−0.0332**	−0.0848	−0.0309**
	(0.013)	(0.046)	(0.012)	(0.015)	(0.057)	(0.014)
HORFDI3TN	−0.0200	−0.0150	−0.0176	0.0047	0.0681**	−0.0047
	(0.012)	(0.043)	(0.012)	(0.009)	(0.035)	(0.009)
HORFDI4T	0.0082	0.0603*	0.0156*	0.0043	−0.0178	0.0012
	(0.011)	(0.036)	(0.009)	(0.010)	(0.038)	(0.009)
BACFDI2T	−0.0079	−0.0438	−0.0086	−0.0426	0.0393	−0.0725*
	(0.028)	(0.100)	(0.027)	(0.041)	(0.156)	(0.038)
N	22677	22716	22677	48690	48585	48690
R^2	0.973	0.381	0.006	0.967	0.400	0.001

(b) Total added-value

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2VN	0.0294**	0.0531	0.0264**	0.0084	0.0582	−0.0033
	(0.012)	(0.042)	(0.011)	(0.013)	(0.050)	(0.012)
HORFDI3VN	−0.0280***	−0.0668**	−0.0235***	0.0087	0.0675**	0.0018
	(0.009)	(0.032)	(0.009)	(0.008)	(0.028)	(0.007)
HORFDI4V	−0.0052	−0.0111	−0.0007	0.0040	−0.0083	−0.0059
	(0.009)	(0.031)	(0.008)	(0.009)	(0.032)	(0.008)
BACFDI2V	0.0203	0.0516	0.0130	−0.0405	0.0547	−0.0645
	(0.028)	(0.100)	(0.027)	(0.045)	(0.169)	(0.041)
N	22677	22716	22677	48690	48585	48690
R^2	0.973	0.382	0.005	0.967	0.398	0.001

(Continued)

estimation results in terms of how FDI spillover effects are generated. For instance, according to the estimation results for manufacturing firms, the productivity spillover effects of horizontal FDI are stronger within the external enterprise layers (i.e., at the Enterprise Layers Ⅱ and Ⅲ) than within the sector of the firms to be analyzed when turnover and added-value are used as the basic indices for the computation of FDI spillover variables. On the other hand, when equity capital and the number of employees are used as the basis to calculate the

Table 3.7 (continued)

(c) Total equity capital

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2EN	0.0206	0.0427	0.0170	−0.0265**	−0.0670	−0.0233**
	(0.013)	(0.047)	(0.013)	(0.011)	(0.042)	(0.010)
HORFDI3EN	−0.0116	−0.0333	−0.0094	−0.0025	−0.0155	−0.0080
	(0.011)	(0.039)	(0.010)	(0.008)	(0.031)	(0.007)
HORFDI4E	0.0280***	0.0917***	0.0266***	−0.0086	−0.0449	−0.0149**
	(0.009)	(0.033)	(0.009)	(0.008)	(0.030)	(0.007)
BACFDI2E	−0.0503	−0.2304**	−0.0463*	−0.1048**	−0.1881	−0.1045***
	(0.031)	(0.110)	(0.027)	(0.042)	(0.157)	(0.038)
N	22677	22716	22677	48690	48585	48690
R^2	0.973	0.377	0.001	0.967	0.402	0.007

(d) Annual average number of employees

Industrial sector	Manufacturing			Services		
Dependent variable	*Y*	*VA/L*	*TFP*	*Y*	*VA/L*	*TFP*
HORFDI2WN	0.0179	0.0385	0.0136	0.0140	0.1596**	−0.0048
	(0.018)	(0.063)	(0.017)	(0.021)	(0.078)	(0.019)
HORFDI3WN	−0.0267*	−0.0333	−0.0227	−0.0069	−0.0140	−0.0107
	(0.015)	(0.052)	(0.014)	(0.015)	(0.055)	(0.014)
HORFDI4W	0.0308**	0.0987**	0.0325**	0.0240	0.0007	0.0030
	(0.014)	(0.049)	(0.013)	(0.015)	(0.055)	(0.013)
BACFDI2W	−0.0101	−0.0364	−0.0187	−0.1586***	−0.4843***	−0.1595***
	(0.037)	(0.133)	(0.035)	(0.048)	(0.179)	(0.043)
N	22677	22716	22677	48690	48585	48690
R^2	0.973	0.382	0.006	0.967	0.393	0.001

Notes : All models are estimated using the fixed-effects estimator. FDI spillover variables are lagged variables. For brevity, the coefficient estimates of other independent variables are not reported here. All specifications include a constant and location, year, and firm fixed-effects. The Huber-White heteroskedasticity-consistent standard errors are reported in parentheses beneath the regression coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 3.8.

market presence of FDI, the horizontal effects generated closer (i.e., at Enterprise Layer I) to the firms to be analyzed are emphasized. As for the service industry, there are significant differences in the statistical evaluation of the spillover effects on labor productivity between cases in which turnover and added-value are used as the basic indices and those in which the number of employees is used. Different man-

Table 3.8 Definitions and descriptive statistics of the variables used for empirical analysis

Variable name	Definition	Descriptive statistics					
		Manufacturing			Services		
		N	Mean	S. D.	N	Mean	S. D.
Productivity variable (dependent variable)							
Y	Annual total turnover (natural logarithm)	22684	11.790	1.395	48719	11.927	1.365
VA/L	Value-added per employee (natural logarithm)	22722	7.566	0.799	48642	7.694	0.863
TFP	Total factor productivity (Levinsohn-Petrin semi-parametric estimation method)	22677	0.012	0.203	48690	0.014	0.202
Spillover variable							
HORFDI02	Share of foreign capital in assets ownership in the industry the firm belongs to (NACE 2-digit level)	22736	0.499	0.127	48782	0.356	0.128
HORFDI02N	Share of foreign capital in assets ownership in the industry the firm belongs to (NACE 2-digit level : nested variable)	22736	0.520	0.170	48782	0.345	0.154
HORFDI03N	Share of foreign capital in assets ownership in the industry the firm belongs to (NACE 3-digit level : nested variable)	22736	0.347	0.251	48782	0.203	0.223
HORFDI04	Share of foreign capital in assets ownership in the industry the firm belongs to (NACE 4-digit level)	22736	0.384	0.229	48782	0.265	0.191
BACFDI02	Share of foreign capital in assets ownership in downstream industries (NACE 2-digit level)	22736	0.453	0.086	48782	0.408	0.049
FORFDI02	Share of foreign capital in assets ownership in upstream industries (NACE 2-digit level)	22736	0.441	0.129	48782	0.367	0.053
HORFDI02TN	Share of foreign capital in turnover in the industry the firm belongs to (NACE 2-digit level : nested variable)	22736	0.492	0.183	48782	0.290	0.122
HORFDI03TN	Share of foreign capital in turnover in the industry the firm belongs to (NACE 3-digit level : nested variable)	22736	0.332	0.250	48782	0.178	0.199
HORFDI04T	Share of foreign capital in turnover in the industry the firm belongs to (NACE 4-digit level)	22736	0.367	0.241	48782	0.243	0.173
BACFDI02T	Share of foreign capital in turnover in downstream industries (NACE 2-digit level)	22736	0.421	0.083	48782	0.362	0.045
HORFDI02VN	Share of foreign capital in added-value in the industry the firm belongs to (NACE 2-digit level : nested variable)	22736	0.490	0.171	48782	0.307	0.143
HORFDI03VN	Share of foreign capital in added-value in the industry the firm belongs to (NACE 3-digit level : nested variable)	22736	0.346	0.255	48782	0.205	0.225
HORFDI04V	Share of foreign capital in added-value in the industry the firm belongs to (NACE 4-digit level)	22736	0.364	1.415	48782	0.258	0.184
BACFDI02V	Share of foreign capital in added-value in downstream industries (NACE 2-digit level)	22736	0.440	0.083	48782	0.380	0.045
HORFDI02EN	Share of foreign capital in equity capital in the industry the firm belongs to (NACE 2-digit level : nested variable)	22736	0.572	0.194	48782	0.385	0.199
HORFDI03EN	Share of foreign capital in equity capital in the industry the firm belongs to (NACE 3-digit level : nested variable)	22736	0.406	0.286	48782	0.218	0.241
HORFDI04E	Share of foreign capital in equity capital in the industry the firm belongs to (NACE 4-digit level)	22736	0.406	0.245	48782	0.280	0.227
BACFDI02E	Share of foreign capital in equity capital in downstream industries (NACE 2-digit level)	22736	0.475	0.101	48782	0.397	0.052
HORFDI02WN	Share of foreign capital in employment in the industry the firm belongs to (NACE 2-digit level : nested variable)	22736	0.337	0.167	48782	0.156	0.077
HORFDI03WN	Share of foreign capital in employment in the industry the firm belongs to (NACE 3-digit level : nested variable)	22736	0.219	0.189	48782	0.112	0.128
HORFDI04W	Share of foreign capital in employment in the industry the firm belongs to (NACE 4-digit level)	22736	0.259	0.188	48782	0.140	0.114
BACFDI02W	Share of foreign capital in employment in downstream industries (NACE 2-digit level)	22736	0.311	0.078	48782	0.247	0.043
Input variable							
K	Total assets (natural logarithm)	22696	11.321	1.513	48737	11.185	1.451
L	Annual average number of employees (natural logarithm)	22736	3.027	1.043	48782	2.609	0.836
M	Total amount of intermediate materials (natural logarithm)	22690	11.349	1.519	48712	11.590	1.529
K/L	Total assets per employee (natural logarithm)	22730	8.382	1.026	48673	8.673	1.162
Control variable							
FS	Ownership share of foreign investors	22736	0.047	0.182	48782	0.027	0.136
GS	Government ownership share	22736	0.006	0.070	48782	0.006	0.072
EXPPRO	Proportion of exports in total turnover	22736	0.124	0.260	48782	0.035	0.142
HHI	Herfindahl index (NACE 4-digit level)	22736	0.104	0.148	48782	0.038	0.062

agement indices capture different aspects of firm activity. The regression results reported in **Table 3.7** indicate that the empirical evaluation of FDI spillover effects on the productivity of domestic firms greatly differs depending on what aspect of the activity of MNEs the researcher focuses on most, suggesting that careful attention should be given to the selection of the proxy variable for the marker presence of FDI in the recipient country as well as to the productivity indices of domestic firms[21].

As discussed above, our estimation results are sensitive to the selection of indices as the basis for computation of FDI spillover variables. Yet the signs of the FDI spillover variables estimated at the 10% or less significance level are exactly the same among the different estimation results reported in **Tables 3.5** and **3.7**. Therefore, we can safely say that the FDI spillover effects repeatedly detected in different model specifications with 10% or less significance level are highly robust estimates.

3.7 Conclusions

It is not necessary for domestic firms to treat all foreign companies that come under the same category of industrial classification in a homogenous fashion. In fact, local company managers are looking at the structure of their industries in a more multi-layered manner and paying strong attention to how close or far their firms are to and from foreign counterparts in the context of industrial-technological proximity. This is our conviction, acquired through several field surveys, and it provides the basic concept for this study.

Previous empirical works on the spillover effects of inward FDI have given significant attention to the differences between horizontal and vertical FDI, whereas they have not given sufficient consideration

[21] In particular, the estimation results when added-value is used to compute productivity or market presence of horizontal FDI are entirely different from other results. This may relate to the transfer pricing operation by MNEs with the aim of reducing the tax burden. The strong influence of this factor possibly leads to over- or underestimation of the activity level of foreign companies based on added-value, and this type of measurement error may result in biased estimations.

to the internal structure of horizontal FDI itself. In this chapter, a new empirical framework is presented by looking at the multi-layered structure of industrial classifications arising from the sectoral differences among firms. The essence is that the market presence of horizontal FDI, which has been traditionally treated using a single variable, is expressed as multiple variables with the nested structure corresponding to the depth of industrial classification in order to identify the horizontal spillover effects on domestic firms by the enterprise layer illustrated in **Figure 3.1**. As explained in Section 3.5, our empirical methodology is simple and can be used for a wide range of applications.

We estimated the new empirical model using large-scale panel data of Hungarian manufacturing and service firms for the early 2000s and succeeded in detecting FDI horizontal effects that could not be captured with the conventional model. The estimation results of the nested variable model proposed in this chapter strongly suggest that foreign firms in Hungary have statistically significant spillover effects on production scale and labor productivity as well as total factor productivity of domestic firms in the same industry, but their direction and degree differ greatly between individual enterprise layers. It is impossible for the single spillover variable, which is aggregated at a certain industrial classification level, to capture such complex effects of horizontal FDI[22]. In this sense, this chapter sheds light on a blind spot in the empirical study regarding the external effects of horizontal FDI and proposes a solution to overcome this problem.

Moreover, this chapter presents the following estimation results. First, FDI productivity spillover effects are generated in patterns that are completely different in different industries, that is, the manufacturing and service industries, even during the same period in the same country. Secondly, FDI exhibits different spillover effects on different productivity indicators. Thirdly, the estimation of productivity spillover effects is sensitive to the selection of business scale indices as the

[22] As almost all preceding studies, which divide FDI into the horizontal type and the vertical type by simply using the industry classification code, the empirical analysis in this chapter cannot strictly distinguish between the spillover effects of the two types of FDI either. Reconsideration of the empirical strategy is a topic reserved for future research.

basis for calculating the market presence of FDI. We conclude, on the basis of the above empirical results, that the transfer of technology and knowledge from MNEs to domestic firms in a recipient country occurs on the basis of a very complex economic mechanism. Therefore, careful attention should be given to the selection of variables and the model specifications so that they fit well into the scope of a micro-economic empirical examination of FDI spillover effects.

Chapter 4

Do Domestic Firms Learn to Export from Multinational Enterprises?

4.1 Introduction

Export promotion for domestic firms enriches the nation's foreign reserves. It also contributes to stability in the management and employment of these firms by obtaining a broad and diversified product market (Bernard and Jensen, 1999; Das et al., 2007). This is an important policy effect, especially for developing and post-communist transition economies that suffer from a great shortage of capital and the vulnerability of domestic economies. It is, therefore, natural for these countries to intently seek the benefits of export promotion. In the context of linkages with the global market, another economic policy intensely promoted by the governments of developing and transitional countries is the attraction of foreign direct investment (FDI). Multinational enterprises (MNEs) from developed economies not only contribute to the creation of new markets and jobs in the host counties but also have great potential to vitalize the domestic economies through the cross-border transfer of advanced technology and knowledge.

A number of recent studies have revealed that these two policy measures for deepening integration with the world economy are closely connected to each other in the sense that the attraction of FDI stimulates the export activity of local firms. It is argued that there are

two main channels that tie FDI and the overseas advancement of domestic companies through the export of products and services. One is the direct participation of foreign investors in company management. This works as an internal channel that increases the trading business-related information and know-how of a domestic firm with foreign participation and has the effect of significantly increasing the company's export potential. Another is an externality that is brought to indigenous firms by the export activity of MNEs. Domestic firms might be able to more easily overcome various barriers associated with new entry into export markets by observing and imitating the sophisticated export operations of foreign companies. This positive externality of FDI is considered to have originated mainly in the reduction of information costs that domestic firms would have had to bear without the MNEs, and it is, consequently, called the 'information spillover effect' (Aitken et al., 1997; Kneller and Pisu, 2007).

The export-promoting effect of FDI through the two channels above has greatly attracted academic interest. The number of empirical analyses on this topic, however, remains at a low level compared to that of studies concerning the productivity spillover effect (Görg and Greenaway, 2004). Studies on transition economies are even more limited, and they tend to concentrate on China (Ma, 2006; Swenson, 2007; Sun, 2009). Lutz et al. (2008), who analyzed the effect of FDI on the export activity of Ukrainian manufacturing firms, is probably the only previous study on an Eastern European country. However, as the authors recognize, their study does not discriminate externalities from the export-promoting effects of direct investment due to data limitations.

In this chapter, we empirically examine the direct and indirect impacts of FDI on the export decision of domestic firms using census-type data of Hungarian firms and make a contribution to this research field from the standpoint of European transition economies. Hungary has received quite massive direct investment from the early stages of its transition to a market economy. With its drastic market liberalization and the open privatization of state-owned enterprises, many foreign joint-venture (JV) firms as well as wholly-owned subsidiaries of MNEs were established in Hungary (Kiss, 2007). As of 2002, 1,718 firms (7.0%) out of a total of 24,555 manufacturing firms were operating as firms that were 100 percent owned by foreign investors (fully

foreign-owned firms), and 1,447 firms (5.9%), as foreign JV firms. In Hungary, direct investment in the service industry is also very vigorous. In fact, the 114,313 firms in the service industry included 8,777 (7.7%) fully foreign-owned firms and 4,576 (4.0%) foreign JV firms in 2002[1]. With regard to the export-promoting effect of FDI on domestic firms, it is a more notable fact that the foreign companies in Hungary have a substantial export orientation compared to local firms. **Table 4.1** reports the export intensity by ownership structure in 2002. As the table shows, the percentage of export firms in the total number of foreign companies substantially surpasses that of fully domestically owned firms in almost all subsectors constituting the manufacturing and service industries. This fact suggests that Hungary is an ideal research subject to assess the effects of FDI on the export behavior of domestic firms under systemic transformation. As we expected, the empirical analysis in this chapter detected a statistically significant positive effect of FDI on the entry of domestic firms into export markets.

This chapter also makes a contribution from a methodological aspect by proposing and estimating a new empirical model focusing on the multi-layered structure of the NACE industrial classification. Our new model is designed to identify the externality of the export propensity of MNEs in relation to domestic firms according to the industrial sector at different depths using multiple variables corresponding to the nested structure of NACE. We confirmed that the new model makes it possible to detect an information spillover effect that is difficult to identify using a conventional model expressing the presence of FDI in the export market with a single variable.

Furthermore, in this chapter, we examine the relationship of the heterogeneity of FDI and domestic firms with regard to the information spillover. The transferability of knowledge and technology from MNEs to domestic firms greatly depends on the firm-level characteristics of both sides. This fact has been repeatedly demonstrated by Blomström and Kokko (1998) and other preceding studies on the productivity spillover effect of FDI. It is an important viewpoint also for the empirical examination of FDI externality with respect to the export activity of domestic firms. We found that the investment mode

[1] Authors' calculation based on the census data reported in Section 4.2.

Table 4.1 Export intensity by ownership structure in the Hungarian manufacturing and service industries, 2002

(a) Manufacturing (N=24555)

NACE industry	Percent of firms	Percent of export firms			
		All firms	Foreign firm		Fully domestically owned firm
			Fully foreign-owned firm	Foreign joint-venture firm	
15 Food products and beverages	12.31	19.85	52.69	55.37	15.45
16 Tobacco products	0.02	83.33	100.00	100.00	50.00
17 Textiles	3.32	35.17	74.00	68.75	25.92
18 Apparel	5.77	29.10	67.89	68.12	23.51
19 Leather tanning and dressing	1.49	44.38	76.92	69.70	33.33
20 Wood, wood products, and cork, except furniture	6.38	22.92	69.88	63.01	18.09
21 Pulp, paper, and paper products	1.38	29.88	87.50	55.56	21.88
22 Publishing, printing, and reproduction of recorded media	14.31	11.55	36.50	30.77	9.64
23 Coke, refined petroleum products, and nuclear fuel	0.03	37.50	100.00	100.00	0.00
24 Chemicals and chemical products	2.20	43.70	75.71	82.35	33.65
25 Rubber and plastic products	5.03	42.38	80.27	74.75	33.50
26 Other non-metallic mineral products	3.92	20.06	64.06	46.15	14.65
27 Basic metals	1.02	51.60	87.10	77.78	43.78
28 Fabricated metal products, except machinery and equipment	14.88	29.41	80.66	68.97	23.58
29 Machinery and equipment	8.98	31.16	70.27	74.48	24.84
30 Office machinery and computers	0.83	15.27	53.85	41.67	10.67
31 Electrical machinery and apparatuses	3.03	31.59	82.56	85.11	20.29
32 Radio, television, and communication equipment and apparatus	2.45	33.39	89.29	81.58	19.79
33 Medical, precision and optical instruments, watches, and clocks	3.99	23.06	72.09	71.43	17.59
34 Motor vehicles, trailers, and semi-trailers	0.91	52.91	85.42	80.00	38.00
35 Other transport equipment	0.68	31.33	100.00	72.73	26.49
36 Furniture	6.56	20.79	57.97	66.28	16.35
37 Recycling	0.52	19.69	50.00	66.67	14.91
Manufacturing total	100.00	26.07	70.37	64.41	19.92

(b) Services (N=114313)

NACE industry	Percent of firms	Percent of export firms			
		All firms	Foreign firm		Fully domestically owned firm
			Fully foreign-owned firm	Foreign joint-venture firm	
50 Sale, maintenance, and repair of motor vehicles and motorcycles	6.64	8.38	37.78	30.73	6.77
51 Wholesale trade and commission trade, except for motor vehicles and motorcycles	18.68	22.46	34.52	42.22	18.39
52 Retail trade, except for motor vehicles and motorcycles; repair	19.87	4.04	6.00	19.87	3.49
55 Hotels and restaurants	6.43	1.10	3.38	5.18	0.78
60 Land transport; transport via pipelines	3.70	21.32	64.38	51.25	19.96
61 Water transport	0.07	17.11	100.00	42.86	11.94
62 Air transport	0.04	34.78	75.00	28.57	31.43
63 Supporting and auxiliary transport activities; activities of travel agencies	2.20	23.65	49.03	44.00	19.52
64 Post and telecommunications	0.54	8.59	50.00	40.91	4.65
70 Real estate activities	9.30	3.10	6.14	5.58	2.35
71 Rental of machinery, equipment, and personal and household goods	0.87	5.92	28.57	16.22	4.29
72 Computer and related activities	5.87	8.63	47.11	41.90	6.14
73 Research and development	0.79	20.33	41.94	47.22	18.38
74 Other business activities	25.01	5.76	35.60	26.01	4.23
Service industry total[a]	100.00	9.45	22.57	28.82	7.43

Note : [a]Excluding financial intermediation.
Source : Authors' calculation.

and size of a foreign organization and ownership structure and size of a domestic organization, as well as differences in the human resource and organizational capacity, are closely associated with the potential for information spillover from MNEs to local firms.

The remainder of this chapter is organized as follows : Section 4.2 describes the data employed for this study. Section 4.3 discusses the empirical methodology. Section 4.4 examines the characteristics of export firms and their possible endogeneity with the export market entry. Section 4.5 reports the baseline estimation results of the export decision model. Section 4.6 looks at the relationship between the heterogeneity of FDI and domestic firms with the information spillover effect. Sèction 4.7 summarizes the major findings and concludes.

4.2 Data

Same as in Chapter 2 and 3, the data underlying the empirical analysis in this chapter are the annual census-type data of Hungarian firms, which were compiled from financial statements associated with tax reporting submitted to the National Tax Authority in Hungary by legal entities performing accounting and tax procedures using double-entry bookkeeping. The observation period covers four years from 2002 through 2005. The data includes all industries from manufacturing and service and contains basic information for each sample firm, including the NACE 4-digit codes, the annual average number of employees, overseas turnover, and other major financial indices. In addition, the locations of the sample firms are identifiable to the extent that they are divided into the capital, western, and eastern regions[2].

Information about the ownership structure includes the total amount of equity capital (prescribed capital) at the end of the term and the proportional share held by the state, domestic private inves-

[2] The individual regions consist of the following city and counties, respectively : the capital region consists of Budapest and Pest County. The western region consists of the following nine counties : Győr-Moson-Sopron; Komárom-Esztergom; Vas; Veszprém; Fejér; Zala; Somogy; Tolna; and Baranya. The eastern region consists of nine counties as well : Nógrad; Bács-Kiskun; Csongrád; Békés; Jász-Nagykun-Szolnok; Hajdú-Bihar; Szabolcs-Szatmár-Bereg; Borsod-Abaúj-Zemplen; and Heves.

tors, and foreign investors.

All nominal values in the Hungarian forint are deflated with the base year being 2002[3]. The consumer price index, the industrial producer price index, and the investment price index reported by the Hungarian Central Statistical Office are used as deflators. In addition, sample firms with unrealistic and inconsistent input and missing values that are impediments to our empirical analysis have been removed, and the cleansing procedures have been diligently performed.

The data form an unbalanced panel with the new entry and exit of firms during the observation period. All of the effective data values concerning these newly entering and exiting firms are used for the computation of industry-level aggregated values including the FDI spillover variables discussed later. The observations used for our estimation of empirical models are limited to those concerning foreign JV firms and fully domestically owned firms available in the data for two or more consecutive terms in the observation period with an average number of employees of five or more. This aims to exclude so-called 'one-man companies' and micro firms from the panel data estimation of the export decision model for domestic firms.

As a result of data cleaning and the exclusion of small-scale companies, our final sample consists of 12,854 firm-year observations in the manufacturing industry and 26,692 firm-year observations in the service industry. According to the official statistics, the proportion of our sample in the total number of employees in 2003 is 35.0% for manufacturing firms (4,276 companies including 456 foreign JV firms with 261,837 employees) and 33.9% for service firms (8,916 companies including 576 foreign JV firms with 261,958 employees). An almost identical proportion had been confirmed for the other years. In other words, the panel data used for our empirical analysis consist of sample firms that are representative of the manufacturing and service industries in Hungary.

4.3 Empirical Methodology

The export of products and services to overseas markets requires

[3] The unit used for the price data is 1,000 HUF.

an initial investment which cannot be diverted or recouped, including the development of distribution channels and customers, research and expertise in trading and customs business, and the development of products and product packages adapted to foreign markets (Baldwin, 1989; Dixit, 1989). The disregard of this aspect of export activity may lead to a serious omitted-variable bias when estimating the impact of FDI on export decisions made by domestic firms. Thus, we adopt a model of exporting with sunk costs of market entry to underlie the empirical analysis in this chapter.

We assume that a firm always selects the volume of exports that maximizes its profits depending on the market conditions once it enters foreign markets and can consequently achieve sales s^*. The firm may engage in exports $(y=1)$ when the sales exceed the total costs consisting of fixed costs F for market entry and variable costs c. We also assume that the firm does not need to bear fixed costs F again in the current year when it has actual experience of exporting in the previous year. The net profit of the i-th firm in year t is :

$$\pi_{it}^* = s_{it}^* - c_{it} - F(1-y_{it-1}) = s(V_t) - c(X_{it}, Z_{it}|s_{it}^*) - F(1-y_{it-1}), \quad (4.1)$$

where V_t is a vector of the exogenous factors that affect overseas sales, X_{it} and Z_{it} are vectors of the exogenous market conditions and firm-specific factors that determine variable costs, respectively.

The i-th firm implements exports if the expected net profit is positive, namely,

$$y_{it} = \begin{cases} 1 & \text{if} \pi_{it}^* > 0, \\ 0 & \text{otherwise.} \end{cases} \quad (4.2)$$

In the empirical analysis, we estimate a binary-choice model of the form :

$$y_{it} = \begin{cases} 1 & \text{if} \beta'_V V_t + \beta'_X X_{it} + \beta'_Z Z_{it} - F(1-y_{it-1}) + \varepsilon_{it} > 0, \\ 0 & \text{otherwise,} \end{cases} \quad (4.3)$$

where β_V, β_X and β_Z are vectors of the parameters, and ε_{it} is an error term[4].

[4] This simple model that restricts the company managers' time horizon to one year can be easily generalized by adopting a profit function that maximizes the unlimited profit stream facing the future. For details, see Roberts and Tybout

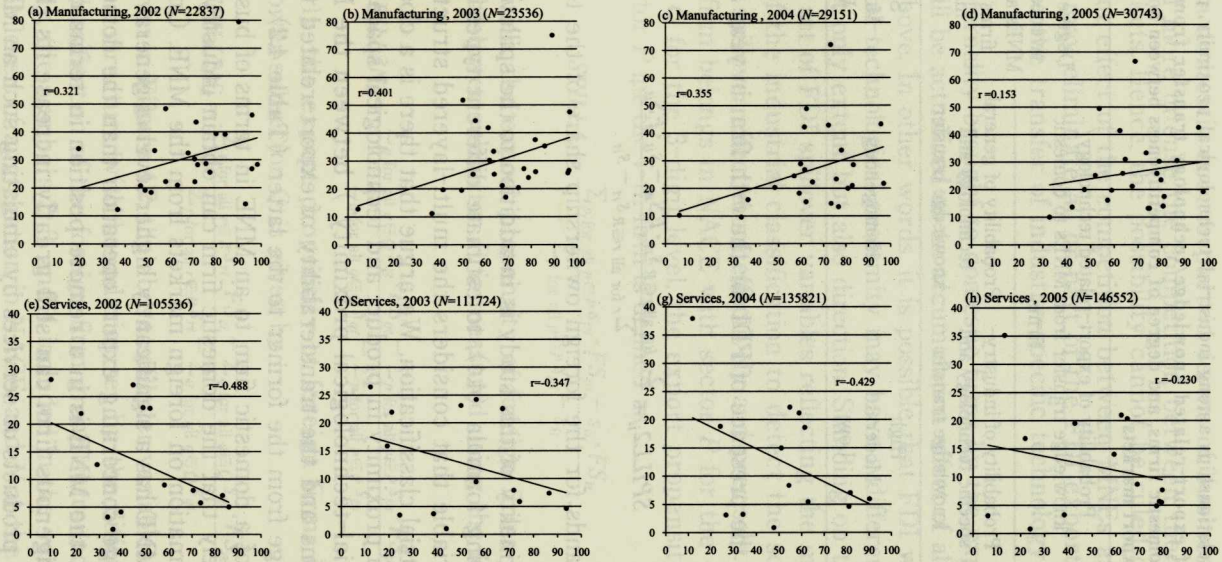
In this chapter, we focus on two factors as exogenous factors that affect the overseas sales of Hungarian domestic firms. One is the terms of trade (TT) defined as the ratio of the export price index to the import price index. The other is the annual GDP real growth rate of 15 EU countries ($EU15$) weighted according to the market size of those countries, which are major destinations for Hungarian exports. Hereinafter, we refer to these two variables as the 'trade environment variables' for simplicity.

The market environment determining the variable costs for product and service exports denotes the presence of MNEs in an export market, which is one of the main research interests in this chapter. **Figure 4.1** illustrates the relationship between the share of the foreign firms, which is weighted according to the foreign ownership share, of the total export volume for the NACE 2-digit level sectors for 2002 through 2005 and the proportion of export firms in the total number of domestic firms. As shown in Panels (a) to (d) of **Figure 4.1**, in the manufacturing industry, there is a relationship in which the greater the FDI presence in export markets, the higher the probability that domestic firms in the same sector will export their products. In fact, the correlation coefficient is always positive through the four years, and all the approximation lines slope upwards from left to right. On the other hand, Panels (e) to (h) of the same figure indicate that, in the service industry, there is a negative correlation between the FDI presence in the export market and the probability that domestic firms will enter foreign markets.

To examine this relationship by multivariate regression analysis, we use the so-called 'FDI spillover variable.' It is argued that the greater the presence of MNEs in the export market, the greater the information spillover effect brought to domestic firms by MNEs (Ruane and Sutherland, 2004). To capture this externality, it is appropriate to use the degree of the contribution of foreign capital to the total export volume in the entire industrial sector to which the i-th firm belongs as the proxy for the FDI presence in the export market. In particular, if the i-th firm belongs in NACE with sector R for the

(1997) and Clerides et al. (1998). Nevertheless, the empirical model derived from a generalized theoretical model also results in the same estimation model as formula (4.3).

Figure 4.1 Correlation between the export propensity of foreign firms and the probability of export market entry of domestic firms, 2002–2005



Note : The vertical axis is the share of foreign firms weighted by the foreign ownership share of the total export volume in each of the NACE 2-digit level sectors, and the horizontal axis is the percentage of export firms in the total number of domestic firms in that sector.
Source : Authors' illustration.

Table 4.2 Relationships among industrial-technological proximity, probability of export-related knowledge/technology transfer from MNEs to domestic firms, and degree of competitiveness between both sides in export markets

Industrial-technological proximity	Probability of export-related technology/knowledge transfer from MNEs to domestic firms		Degree of competitiveness between MNEs and domestic firms in export markets
	Probability of industry-specific technology and knowledge transfer	Probability of general technology and knowledge transfer	
Close	High		Strong
Moderate	Moderate	Homogenous	Moderate
Far	Low		Weak

2-digit level, the presence of FDI for the i-th firm in year t is defined by :

$$SPILL2_{it} = \frac{\sum_{r \text{ for all } r \in R} s_{rt} \cdot FS_{rt} - s_{it} \cdot FS_{it}}{\sum_{r \text{ for all } r \in R} s_{rt} - s_{it}}, \tag{4.4}$$

where FS stands for the foreign ownership share of the total equity capital.

The originality of this study is, in addition to the spillover variable computed using formula (4.4), to estimate different types of the FDI spillover variable that considers the multi-layered structure of the NACE industrial classification. We argue that there is a close relationship between proximity in product and technological space (hereinafter 'industrial-technological proximity') between the MNEs and domestic firms and the transferability of export-related technology and knowledge from the former to the latter (**Table 4.2**). The closer the position of a domestic firm to an MNE in terms of business type, the more likely that the domestic firm can obtain industry (sector)-specific information on foreign markets from the MNE. On the other hand, if the MNE has a significantly higher level of general technology and knowledge concerning export operation than the domestic firms, even though the MNE is in a remote position in terms of business type, an indigenous firm can still greatly increase its chances for exporting its products or services by emulating such an MNE. At the same time, we also expect that the more homogenous an MNE is with

respect to a domestic counterpart in terms of business type, the greater and more intense the competition between them will be in export markets. Hence, the possibility cannot be ruled out that the crowding-out effect of the competition between MNEs and domestic companies may eliminate all or part of the FDI export-promoting effect due to the transfer of industry-specific technology and knowledge.

The externality brought to domestic firms by the export activity of MNEs will be actualized as an accumulation effect of all the factors described above. In other words, it is possible that FDI with a different industrial-technological proximity may have a different impact in terms of not only extent but also direction. Standing on this premise, we adapt a set of FDI spillover variables reflecting the multi-layered structure of the industrial classification to detect the source of the information spillover effect more effectively and precisely. Specifically, if the i-th firm belongs in NACE with sector P for the 4-digit level and sector Q for the 3-digit level, the export propensity of foreign firms in sector P for the i-th firm is defined as :

$$SPILL4_{it} = \frac{\sum_{p \text{ for all } p \in P} s_{pt} \cdot FS_{pt} - s_{it} \cdot FS_{it}}{\sum_{p \text{ for all } p \in P} s_{pt} - s_{it}}. \tag{4.5}$$

In addition, the export propensity of foreign firms in sector Q, excluding the lower subsector P, is measured using the following formula :

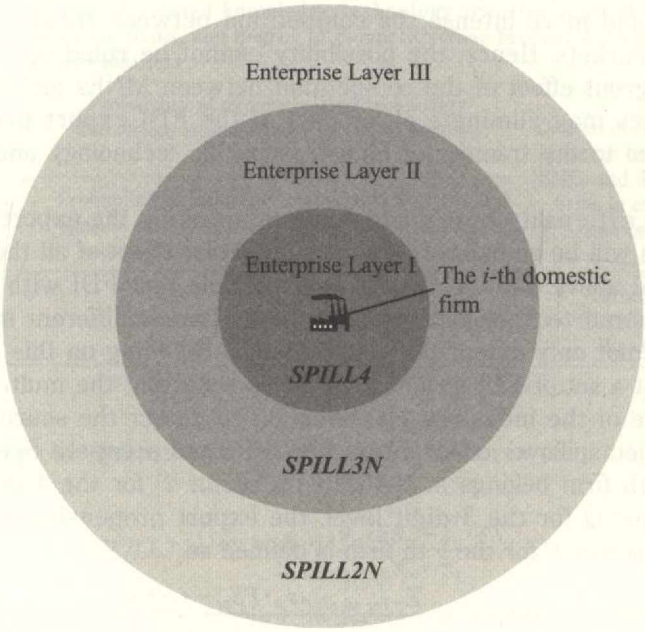
$$SPILL3N_{it} = \frac{\sum_{q \text{ for all } q \in Q} s_{qt} \cdot FS_{qt} - \sum_{p \text{ for all } p \in P} s_{pt} \cdot FS_{pt}}{\sum_{q \text{ for all } q \in Q} s_{qt} - \sum_{p \text{ for all } p \in P} s_{pt}}. \tag{4.6}$$

Similarly, the export propensity of foreign firms in sector R, excluding lower subsector Q, is given by :

$$SPILL2N_{it} = \frac{\sum_{r \text{ for all } r \in R} s_{rt} \cdot FS_{rt} - \sum_{q \text{ for all } q \in Q} s_{qt} \cdot FS_{qt}}{\sum_{r \text{ for all } r \in R} s_{rt} - \sum_{q \text{ for all } q \in Q} s_{qt}}. \tag{4.7}$$

As shown in **Figure 4.2**, the above spillover variables express the triple nested structure with boundaries set by the difference in the industrial classification of the foreign firm group surrounding the i-th firm. Namely, the numbers 2, 3, and 4 included in the variable names stand for the levels of aggregation in NACE, and N at the end denotes that the variable has a nested structure in the relationship with the

Figure 4.2 The nested structure of FDI spillover variables



Source : Authors' illustration.

Table 4.3 Correlation matrices of FDI spillover variables

(a) Manufacturing (N=12854)

	SPILL2	*SPILL2N*	*SPILL3N*	*SPILL4*
SPILL2	1.000			
SPILL2N	0.691	1.000		
SPILL3N	0.023	−0.087	1.000	
SPILL4	0.495	0.228	−0.107	1.000

(b) Services (N=26692)

	SPILL2	*SPILL2N*	*SPILL3N*	*SPILL4*
SPILL2	1.000			
SPILL2N	0.683	1.000		
SPILL3N	0.025	0.054	1.000	
SPILL4	0.457	0.105	0.107	1.000

Source : Authors' calculation. For definitions and descriptive statistics of the variables, see Table 4.10.

lower categories. As we defined in Chapter 3, the empirical model including these three nested spillover variables in the right-hand side is hereinafter called the 'nested variable model' and is distinguished from the conventional model expressing the export propensity of foreign firms with only a single variable, namely, *SPILL2*. **Table 4.3** reports the correlation matrices of the four types of FDI spillover variables that are actually calculated using the census data described in the previous section. As the table shows, the correlation coefficient of the nested variables, *SPILL2N*, *SPILL3N*, and *SPILL4*, is a little under 0.228 even with the maximum combination. It is, hence, unlikely that the simultaneous estimation of these spillover variables may cause a serious multicollinearity problem.

Together with the direct management participation of foreign investors, which is another matter of concern in this chapter, we pay attention to the organizational and technological innovativeness, capital intensity, quality of human capital, research and development capacity, organization size, and company location as firm-specific factors affecting the level of variable costs. The extent of management participation by foreign investors is captured using the aforementioned foreign ownership share (*FS*). The organizational and technological innovativeness is measured by the total factor productivity (*TFP*) estimated using the semi-parametric method first developed by Olley and Pakes (1996) and further improved by Levinsohn and Petrin (2003)[5]. The Levinsohn-Petrin estimator is widely used as the means to accurately measure TFP, since it treats simultaneous bias arising from the endogenous relationship between factor inputs and productivity by adopting intermediate inputs as the firm-specific proxy of the productivity shock, which is unobservable for econometricians[6]. As proxies for the capital intensity, the human capital quality, and the research and development capacity, we use the total assets per employee (*K/L*), labor costs per employee (*LC*), and intangible assets per employee (*R&D*), respectively. The organizational size is measured by the

[5] Petrin et al. (2004) describe a specific estimation method using econometric software.

[6] According to Ackerberg et al. (2006), however, the Levinsohn-Petrin estimator may undergo collinearity problems, and, hence, there is still room for the development of the TFP estimation technique.

annual average number of employees (*SIZE*). In the empirical analysis, the natural logarithms of these four variables are used. As for the company location, the fixed-effects of the capital region and the eastern region are controlled by the capital region location dummy variable (*CAPITAL*) and the eastern region location dummy variable (*EAST*), respectively. The default category consists of the firms located in the western region. Hereinafter, *FS* and the other seven variables are collectively called the 'firm characteristics variable' for brevity.

When estimating formula (4.3), in addition to the three groups of independent variables specified above, the time fixed-effects dummy variable and industry fixed-effects dummy variable are also included in the right-hand side of the estimation equation. The firm-level individual effects are controlled by using the random-effects probit panel estimator following Heckman (1981)[7].

Our empirical analysis proceeds through a three-step approach : first, we identify the specific characteristics of export firms and check the possibility of reverse causality between such firm-level characteristics and the probability of export market entry. Second, we estimate the baseline model of export decision. Finally, by extending the empirical model, we analyze the relationship of the heterogeneity of FDI and domestic firms to the information spillover effect.

4.4 Export Premia and Market Entry

A series of previous studies repeatedly confirms the predominance of export firms over non-export firms, beyond the difference of countries and industrial sector, in terms of productivity, capital and technology intensity, human capital, and firm size. In addition, according to Bernard et al. (2007), such differences in firm characteristics

[7] The dynamic bivariate dichotomous choice model can be estimated by the fixed-effects linear probability model besides the random-effects probit model propounded by Heckman (1981). However, the former is an estimation method using two terms of the lagged value of independent variables as instruments, and it is difficult to use this method with data with an insufficient length of time-series. Therefore, as in other previous studies, we apply the random-effects probit estimator to all export decision models reported in this chapter.

between the two firm categories precede entry into foreign markets. In addition, some empirical studies strongly suggest that foreign ownership is one of the outstanding characteristics of exporters (Willmore, 1992; Kimura and Kiyota, 2006; Blanes-Cristóbal et al., 2008).

Using the firm characteristics variables mentioned in the previous section, we examine whether the above relationship can also be observed in Hungarian firms. **Table 4.4** presents the results. Here, sample firms are divided into the 'exporters' ($y_{i2002}=1$) and the 'nonexporters' ($y_{i2002}=0$) depending on an actual export experience in the current term (i.e., 2002 in the case of **Table 4.4**). Furthermore, the exporters are split into two subgroups depending on their actual export experience in the subsequent term (i.e., in 2003), the 'always exporters,' which continued their export business for two consecutive terms ($y_{i2002}=1$; $y_{i2003}=1$) and the 'export stoppers,' which exited the export market in the subsequent term ($y_{i2002}=1$; $y_{i2003}=0$). Similarly, the nonexporters are split into two subgroups, the 'never exporters,' which have had no actual export experience for two consecutive terms ($y_{i2002}=0$; $y_{i2003}=0$) and the 'export starters,' which entered foreign markets in the subsequent term ($y_{i2002}=0$; $y_{i2003}=1$).

Table 4.4 shows that, with the only exception of the comparison based on the *TFP* variable in the manufacturing industry, exporters significantly outperform nonexporters in terms of firm characteristics variables. The difference between the two groups of firms is statistically significant at the 1% level according to the *t*-test or Wilcoxon rank-sum test. Among the four subgroups, the always exporters outstrip the three remaining groups of firms in all cases excluding the comparative results on the basis of the *TFP* variable in the manufacturing industry and the *R&D* variable in the service industry. On the other hand, the never exporters are inferior to the other groups of firms. The export stoppers and export starters lie between the always exporters and the never exporters, and it is difficult to determine which is better. According to the results of the ANOVA or Kruskal-Wallis test, this relationship is also statistically significant at levels of 5% or less. In addition, regarding the *R&D* variable in the service industry, the difference between the export starters and the always exporters is very narrow (2.6925 versus 2.6673).

Next, we examine whether the relationship indicated in **Table 4.4** between the actual export experience and the firm characteristics can

Table 4.4 Univariate analysis of the relationship between the actual export experience of domestic firms and the firm-specific factors, 2002

(a) Manufacturing (N=4276)

Export status	*FS*	*TFP*	*K/L*	*LC*	*R&D*	*SIZE*
All firms	0.0696	0.0299	8.4650	7.2312	1.9522	3.2877
	(0.000)	(0.015)	(8.452)	(7.171)	(1.700)	(3.091)
Exporters	0.1201	0.0254	8.6081	7.3373	2.1791	3.7497
	(0.000)	(0.013)	(8.622)	(7.307)	(2.003)	(3.638)
Always exporters	0.1302	0.0245	8.6273	7.3542	2.2051	3.8376
	(0.000)	(0.011)	(8.641)	(7.323)	(2.031)	(3.738)
Export stoppers	0.0391	0.0323	8.4542	7.2028	1.9714	3.0471
	(0.000)	(0.027)	(8.445)	(7.131)	(1.674)	(2.890)
Nonexporters	0.0204	0.0344	8.3253	7.1276	1.7307	2.8369
	(0.000)	(0.017)	(8.298)	(7.046)	(1.488)	(2.708)
Never exporters	0.0158	0.0349	8.2820	7.1134	1.6996	2.8144
	(0.000)	(0.017)	(8.243)	(7.037)	(1.447)	(2.708)
Export starters	0.0606	0.0297	8.7025	7.2512	2.0008	3.0326
	(0.000)	(0.018)	(8.672)	(7.147)	(1.692)	(2.944)
Comparative analysis between exporters and nonexporters						
t-test on the equality of means	15.386***	−1.573	9.880***	15.352***	11.020***	28.796***
Wilcoxon rank-sum test	16.588***	−1.935*	10.619***	15.853***	10.778***	26.304***
Multipul comparison of four subcategories						
ANOVA (F)	95.800***	1.000	48.900***	93.810***	46.200***	329.780***
Bartlett test (χ^2)	1700.000***	11.885***	2.865	12.133***	31.717***	241.603***
Kruskal-Wallis test (χ^2)	318.316***	4.105	160.331***	292.426***	131.989***	796.148***

(b) Services (N=8916)

Export status	*FS*	*TFP*	*K/L*	*LC*	*R&D*	*SIZE*
All firms	0.0367	0.0349	8.8100	7.2463	2.2336	2.6979
	(0.000)	(0.013)	(8.828)	(7.165)	(2.028)	(2.485)
Exporters	0.0918	0.0391	9.3105	7.4639	2.6491	2.8836
	(0.000)	(0.019)	(9.344)	(7.421)	(2.485)	(2.708)
Always exporters	0.1010	0.0392	9.3532	7.4935	2.6673	2.9317
	(0.000)	(0.020)	(9.374)	(7.462)	(2.494)	(2.773)
Export stoppers	0.0490	0.0387	9.1130	7.3270	2.5649	2.6610
	(0.000)	(0.014)	(9.176)	(7.225)	(2.451)	(2.565)
Nonexporters	0.0203	0.0336	8.6614	7.1817	2.1102	2.6428
	(0.000)	(0.011)	(8.665)	(7.104)	(1.904)	(2.398)
Never exporters	0.0181	0.0335	8.6274	7.1719	2.0750	2.6423
	(0.000)	(0.011)	(8.638)	(7.094)	(1.865)	(2.398)
Export starters	0.0571	0.0360	9.2244	7.3441	2.6925	2.6513
	(0.000)	(0.015)	(9.228)	(7.286)	(2.555)	(2.485)
Comparative analysis between exporters and nonexporters						
t-test on the equality of means	18.320***	1.104	25.442***	21.757***	15.461***	10.554***
Wilcoxon rank-sum test	19.488***	3.205***	26.682***	21.477***	15.580***	11.152***
Multipul comparison of four subcategories						
ANOVA (F)	131.780***	0.430	268.420***	183.420***	105.590***	46.160***
Bartlett test (χ^2)	2400.000***	27.809**	81.211***	43.523***	21.423***	44.316***
Kruskal-Wallis test (χ^2)	434.977***	10.869**	853.706***	534.409***	312.272***	146.998***

Notes: The upper values are means, and the lower values in parentheses are medians. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimation.

be confirmed for the whole analysis period. To this end, we regress the pooled firm characteristics variable (z_{it}) into the export statuses defined above while controlling the firm size (*SIZE*) (except for those cases in which the firm size itself is a dependent variable), location fixed-effects (*CAPITAL* and *EAST*), industry fixed-effects, and time fixed-effects, as in :

$$z_{it} = \mu + \gamma y_{it} + \sigma' W_i + \phi_i + \varepsilon_{it}, \tag{4.8}$$

and in :

$$z_{it} = \mu + \delta ALWAYS_{it} + \theta STOP_{it} + \vartheta START_{it} + \sigma' W_i + \phi_i + \varepsilon_{it}, \tag{4.9}$$

where

$$ALWAYS_{it} = 1 \text{ if } (y_{it} = 1) \text{ and } (y_{it+1} = 1),$$
$$STOP_{it} = 1 \text{ if } (y_{it} = 1) \text{ and } (y_{it+1} = 0),$$
$$START_{it} = 1 \text{ if } (y_{it} = 0) \text{ and } (y_{it+1} = 1),$$

and μ is a constant term, γ, δ, θ and ϑ are parameters of the export statuses, σ is a parameter vector of the control variables, W_i is a vector of the control variables, and ϕ_i is the firm-level individual effects.

Panel (a) of **Table 4.5** shows the estimation results. We use White's heteroskedasticity-consistent standard errors for all specifications. As the time-invariant variables are contained in the part of the control variables of Equations (4.8) and (4.9), the pooling OLS or random-effects model are the available estimation methods for them. Because the Breusch-Pagan test rejected the null hypothesis that the variance of the individual effects is zero for all models at the 5% significance level, the estimation results of the random-effects model are reported in **Table 4.5**.

The estimation results of Equation (4.8) show that the exporters in both the manufacturing and service industries have a significantly higher value of all the six firm characteristics variables than the non-exporters. Furthermore, according to the estimation results of Equation (4.9), the firms with actual export experience either in the current term or the subsequent term outperform the never exporters in all cases except the *TFP* variable of the export stoppers and export starters. Moreover, we confirm that the always exporters have variable values that leave those in other firm categories far behind. The estimation results, in which a clear relationship of superiority or inferi-

Table 4.5 Panel data analysis of the characteristics of export firms and endogeneous relationship between firm characteristics and actual export experience, 2002–2005

(a) Level

Industrial sector	Manufacturing (N=12854)				Services (N=26692)			
Estimation equation	(4.9)	(4.10)			(4.9)	(4.10)		
Export status	Export firms	Always exporters	Export stoppers	Export starters	Export firms	Always exporters	Export stoppers	Export starters
FS	0.0106***	0.0238***	0.0091***	0.0110***	0.0108***	0.0239***	0.0087***	0.0101***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
TFP	0.0065*	0.0079*	−0.0013	−0.0059	0.0084***	0.0111***	0.0022	−0.0027
	(0.004)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)
K/L	0.0848***	0.2088***	0.0871***	0.1147***	0.1027***	0.2165***	0.1127***	0.1133***
	(0.011)	(0.015)	(0.014)	(0.013)	(0.009)	(0.013)	(0.012)	(0.011)
LC	0.0664***	0.1117***	0.0536***	0.0363***	0.0736***	0.1453***	0.0636***	0.0701***
	(0.009)	(0.011)	(0.010)	(0.009)	(0.007)	(0.009)	(0.009)	(0.008)
R&D	0.1536***	0.2911***	0.1335***	0.1558***	0.2038***	0.3749***	0.2020***	0.2297***
	(0.024)	(0.031)	(0.033)	(0.031)	(0.020)	(0.026)	(0.028)	(0.026)
SIZE	0.1246***	0.2513***	0.1042***	0.0926***	0.0733***	0.1380***	0.0723***	0.0588***
	(0.011)	(0.017)	(0.014)	(0.013)	(0.008)	(0.012)	(0.011)	(0.010)

(b) Ex-post change

Industrial sector	Manufacturing (N=12854)				Services (N=26692)			
Estimation equation	(4.9)	(4.10)			(4.9)	(4.10)		
Export status	Export firms	Always exporters	Export stoppers	Export starters	Export firms	Always exporters	Export stoppers	Export starters
Δ*FS*	0.1109*	0.1168*	0.0730	0.0018	0.0001	0.0268	0.0201	0.1071
	(0.057)	(0.066)	(0.058)	(0.061)	(0.036)	(0.034)	(0.047)	(0.083)
Δ*TFP*	0.4147	0.3644	−0.1164	−0.8776	−0.6674	−1.5015	3.4386	1.0879
	(0.641)	(0.748)	(0.848)	(0.719)	(3.847)	(4.545)	(3.573)	(1.426)
Δ*K/L*	−0.0041***	−0.0048***	0.0005	0.0007	−0.0008	−0.0010	−0.0024	−0.0051*
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)
Δ*LC*	−0.0015	−0.0009	−0.0013	0.0035*	0.0020	0.0047	−0.0149	−0.0109
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.007)	(0.012)	(0.012)
Δ*R&D*	−0.0478	−0.0378	0.0393	0.1545*	−0.0811**	−0.0962**	−0.0576	−0.0841**
	(0.035)	(0.039)	(0.064)	(0.081)	(0.035)	(0.040)	(0.054)	(0.043)
Δ*SIZE*	0.0126***	0.0193***	−0.0007	0.0130**	0.0069***	0.0136***	−0.0005	0.0228***
	(0.003)	(0.003)	(0.005)	(0.006)	(0.002)	(0.003)	(0.004)	(0.005)

Notes : All models are estimated using the random-effects estimator. The estimation results of control variables are not reported here. The robust standard errors are reported in parentheses. ***, **, and* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source : Authors' estimation.

ority cannot be observed between the export stoppers and the export starters, also closely correspond to the results of the univariate analysis reported in **Table 4.4**.

The estimation results above support the self-selection hypothesis in the sense that, with respect to Hungarian firms in the early 2000s,

the better the organization and human capital, the higher the productivity, and the larger the firm size, the greater the probability of export market entry (Clerides et al., 1998; Bernard and Jensen, 1999). In theory, however, the learning-by-exporting hypothesis, according to which the export activity triggers fierce market competition overseas and contact with the foreign firms and customers and, consequently, such activity brings ex-post positive changes to the exporter's firm organization and management, can also hold true (Wagner, 2002; Girma et al., 2004). It is conceivable that the larger the ex-ante gap in productivity and technological level is between the domestic firms and their counterparts in foreign countries, the more the potential learning-by-exporting effect is enhanced. In this sense, it is not a coincidence that studies of developing economies provide strong supporting evidence for the learning-by-exporting hypothesis (Biesebroeck, 2005; Yasar and Rejesus, 2005).

The learning-by-exporting hypothesis can also be applied to Hungary, which belongs to the former communist bloc, which was regarded as a technologically underdeveloped region. In addition, there may be a reverse causality between the actual export experience and the ownership structure in the sense that the foreign investors willingly sink their capital into prospective firms entering foreign markets by overcoming the significant sunk costs. To examine this possibility, we re-estimate Equations (4.8) and (4.9) by replacing their left-hand side with the ex-post change in the firm characteristics variable. From the estimation results in Panel (b) of **Table 4.5**, it is difficult to determine whether the start of an export business by a Hungarian local firm brings about a notable ex-post improvement in the firm's characteristics, including the foreign ownership share[8]. The only exception is firm size measured by the annual average number of employees, suggesting that Hungarian exporters tend to keep increasing employment after an overseas advance.

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[8] Namely, the results indicate that it is less likely that foreigners cherry pick the best, most productive and profitable domestic firms, which are also more likely to export. Although the details are omitted due to space limitations, we obtained a similar result from a comparative analysis of export firms and non-export firms using the propensity score matching method practiced by Yasar and Rejesus (2005) and Wagner (2002).

In contrast to the self-selection hypothesis, we cannot obtain strong supporting evidence for the learning-by-exporting hypothesis in the case of Hungary. However, an endogenous relationship between the export activity and the firm characteristics is not completely ruled out. In addition, it is natural to assume that an information transfer from an MNE to a local firm will exert actual influence on the latter's export activity with a certain time-lag interval. Thus, in order to avoid the endogeneity of export market entry and the firm characteristics and other possible simultaneity problems and to take the possible time-lag effect of information spillover into consideration, we lag all the independent variables one year following Bernard and Jensen (2004). Accordingly, the goal of our empirical analysis is to estimate the export decision model of the form :

$$\Pr[y_{it}=1] = \alpha+\beta_V' V_{t-1}+\beta_X' X_{it-1}+\beta_Z' Z_{it-1}+Fy_{it-1}+\phi_i+\varepsilon_{it}, \quad (4.10)$$

where α is a constant term.

4.5 Determinants of Export Decision : Baseline Estimation

We first present the estimation results of the baseline model. **Table 4.6** contains the estimated parameters for the conventional model expressing the export propensity of MNEs with a single variable as Models [1] and [3] and those of the nested variable model considering the multi-layered structure of the NACE industrial classification as Models [2] and [4]. Since lagged variables are used as independent variables, the dependent variable is limited to the export market entry probability of domestic firms for the three years from 2003 through 2005.

From the estimation of the FDI spillover variables, we obtained interesting evidence : in the conventional model [1], the spillover variable *SPILL2* is estimated with a positive sign with statistical significance at the 5% level. In other words, the domestic firms in the manufacturing industry enjoy a positive externality promoting the export of products from MNEs belonging to the same sector of the industrial classification at the 2-digit level. In other words, the export activity of foreign-owned manufacturing firms, as a whole, brings to domestically owned companies an information spillover effect that overtops the crowding-out effect arising from interfirm competition. The nested

Table 4.6 Baseline estimation of the export decision model

Industrial sector	Manufacturing		Services	
Model[a]	[1]	[2]	[3]	[4]
Trade environment variables				
TT_{t-1}	0.0117	0.0085	−0.0470	−0.0222
	(0.074)	(0.075)	(0.061)	(0.057)
$EU15_{t-1}$	0.0519	0.0456	−0.0334	−0.0040
	(0.070)	(0.070)	(0.057)	(0.054)
FDI spillover variables				
$SPILL2_{it-1}$	0.5639**		0.0230	
	(0.233)		(0.266)	
$SPILL2N_{it-1}$		0.6907***		0.6859***
		(0.192)		(0.131)
$SPILL3N_{it-1}$		−0.1458**		−0.0489
		(0.072)		(0.050)
$SPILL4_{it-1}$		0.1315*		0.0564
		(0.068)		(0.054)
Firm characteristics variables				
FS_{it-1}	0.5665***	0.5655***	0.5194***	0.5142***
	(0.091)	(0.092)	(0.070)	(0.070)
TFP_{it-1}	−0.0930	−0.0985	−0.1627**	−0.1569**
	(0.095)	(0.095)	(0.075)	(0.075)
K/L_{it-1}	0.2101***	0.2060***	0.1862***	0.1877***
	(0.020)	(0.020)	(0.015)	(0.015)
LC_{it-1}	0.0789*	0.0872*	0.1046***	0.1107***
	(0.045)	(0.046)	(0.029)	(0.029)
$R\&D_{it-1}$	0.0304**	0.0320**	0.0395***	0.0387***
	(0.013)	(0.013)	(0.009)	(0.009)
$SIZE_{it-1}$	0.3375***	0.3360***	0.1266***	0.1318***
	(0.018)	(0.018)	(0.013)	(0.013)
$CAPITAL_{it-1}$	−0.0665*	−0.0658*	0.0688**	0.0679**
	(0.038)	(0.038)	(0.029)	(0.029)
$EAST_{it-1}$	−0.0850**	−0.0860**	−0.0441	−0.0459
	(0.040)	(0.040)	(0.033)	(0.033)
Lagged endogenous dependent variable				
y_{it-1}	2.0504***	2.0466***	2.1804***	2.1723***
	(0.031)	(0.032)	(0.025)	(0.025)
Const.	−6.3453	−6.0569	0.3227	−2.7008
	(7.523)	(7.534)	(6.217)	(5.812)
Time fixed-effects	Yes	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes	Yes
Firm-level individual effects	Yes	Yes	Yes	Yes
N	12854	12854	26692	26692
Log likelihood	−4259.46	−4251.80	−7147.02	−7131.27
Wald test[b]	6196.55***	6188.17***	10669.01***	10648.19***

Notes : [a]All models are estimated using the random-effects probit estimator. The robust standard errors are reported in parentheses. ***, **, and *denote statistical significance at the 1%, 5%, and 10% levels, respectively.

[b]Null hypothesis : All coefficients are zero.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 4.10.

variable model [2] presents more detailed information about its source. The information spillover effect on domestic firms comes not only from the foreign firms belonging to the same sector at the NACE 4-digit level (Enterprise Layer I in **Figure 4.2**) but also from the foreign firms operating at the most peripheral position in the industrial classification (Enterprise Layer Ⅲ). At the same time, Model [2] also indicates that the foreign firms covered by *SPILL3N* variables (Enterprise Layer Ⅱ) have a negative externality on domestic firms. However, we confirmed that the FDI externalities coming from these three different enterprise layers are positive by rejecting the null hypothesis that the sum of the coefficients of the nested FDI spillover variables is zero at the 1% significance level according to the Wald test ($\chi^2=7.93$, $p=0.005$).

Meanwhile, a statistically significant FDI externality is not detected by the conventional model [3] that deals with the service industry. However, according to the estimation result of the nested variable model [4], domestic firms enjoy a positive export-promoting effect from the foreign firms with the most distant proximity in terms of industrial classification, and, in addition, the Wald test strongly rejects the null hypothesis that the FDI spillover effect is zero as a whole ($\chi^2=16.35$, $p=0.000$). We interpret these results as evidence that the information spillover effect originating from the export activity of MNEs certainly exists in both the manufacturing and service industries in Hungary even though the channels and extent are largely different.

We also obtained supporting evidence for another FDI export-promoting effect which is examined in this chapter, namely, the effect of direct participation of foreign investors in company management. Indeed, the foreign ownership share (*FS*) is positive and significant at the 1% level in all specifications, and its regression coefficient presents an economically meaningful value, suggesting that FDI into Hungary also plays a very important role as an internal channel for converting domestic firms into exporters[9].

The trade environment variables do not exert a significant impact on the export activity of domestic firms in either the manufacturing or

[9] However, in our preliminary estimation work, the state ownership share did not produce a significant estimate for the manufacturing and service industries.

the service industries. On the other hand, among the firm characteristics variables, in addition to foreign ownership share, the *K/L*, *LC*, *R&D*, and *SIZE* variables, which are the proxies for capital intensity, human capital quality, research and development capacity, and organizational size, respectively, obtain relatively robust and positive estimates. These results are consistent with the large majority of previous studies on developed and developing economies. However, the *TFP* variable, which reflects the organizational and technological innovativeness, contrary to our expectations, is insignificant for the manufacturing industry and negative at the 5% significance level for the service industry.

The location fixed-effects presented by the *CAPITAL* and *EAST* variables vary considerably between manufacturing firms and service firms : in the case of the manufacturing industry, the further west in the country a firm is located, the greater the potential for product export is, *ceteris paribus*. In the service industry, the export market entry probability of firms located in the capital region is significantly higher than that of firms located in the western and eastern regions. The physical accessibility to the EU market, the most important market for Hungarian exports, may exercise a considerable effect on the export activity of manufacturing firms, probably through the impact on logistics costs. In contrast, service firms are relatively free from such physical restraints, and the possibility of having a home base in the capital region suggests an advantageous effect on the acquisition of market information and customers of foreign countries. This is an interesting empirical finding from the viewpoint of firm location theory.

The estimation results reported in **Table 4.6** further demonstrate that the burden of an initial investment concerning export market entry is a critical management issue to be overcome for Hungarian domestic firms. In both industries, the estimate of the lagged endogenous dependent variable is positive and significant at the 1% level, and its coefficient exceeds the value of 2.00 in all specifications. The coefficient of the lagged endogenous dependent variable in the export decision model of U. S. firms estimated by Bernard and Jensen (2004) is from 0.203 through 0.665 (Table 5, p. 567). The estimate in the study of Blanes-Cristóbal et al. (2008) concerning the sunk costs for Spanish exporters is 1.316 (Table 2, p. 112). Therefore, although it is not a pre-

cise comparison, we conjecture that the sunk costs of export market entry, which Hungarian domestic firms face, are likely to be much higher than those in the U. S. and Western Europe. The relatively high initial cost of advancing overseas may be a characteristic of former socialist transition economies, where the market economy was still underdeveloped even in the early 2000s.

4.6 Information Spillover and Heterogeneity of FDI and Domestic Firms

The estimation results of the baseline models reported in the previous section strongly suggest a close association between the industrial-technological proximity of MNEs to domestic firms and the information spillover effect. The emergence of the FDI spillover, however, can also be greatly influenced by the heterogeneity of the foreign firms, as originators of the externality, and domestic firms, as benefit recipients. In this section, we empirically examine this issue through the extension of the empirical model.

4.6.1 Heterogeneity of FDI

From the viewpoint of the heterogeneity of foreign firms, we pay attention to their investment mode and organizational size. Compared to a wholly-owned local subsidiary, it is relatively difficult for a joint venture with domestic investors to maintain secrecy with respect to its technology or information provided by the parent firm. In addition, JV firms tend to have a stronger organizational and human connection with the local business community. Consequently, as a channel for information diffusion from MNEs to domestic firms, a JV firm is assumed to play a more active role than that played by a wholly-owned local subsidiary, *ceteris paribus*. Indeed, Javorcik and Spatareanu (2008) found a strong positive externality of JV firms in comparison with fully foreign-owned firms from their empirical analysis on the FDI productivity spillover effect in Romania.

The firm size is also relevant to the information spillover effect. If other conditions are equal, the possibility of the leakage of internal knowledge and information may increase along with the expansion of the firm organization and operation. In addition, it is believed that

because of its major presence in business communities and the strong social disclosure requirements, including government regulations in incoming countries, a large firm can easily become the target of information extraction by local firms.

To examine the above hypothesis, we divide foreign firm samples into two groups depending on investment mode or organizational size and estimate the FDI spillover variables calculated for each individual sample group. The division by investment mode is based on whether the foreign ownership share is 100%, and that by organizational size is based on the 75 percentile of the annual average number of employees.

The estimation results are shown in **Table 4.7**. Although all models include the same trade environment variables, firm characteristics variables, lagged endogenous dependent variable, and time and industry fixed-effects dummy variables as the baseline model in their right-hand sides, the table reports solely the estimated parameters of the FDI spillover variables for brevity. Panel (a) of **Table 4.7** shows the estimate of the spillover variables of fully foreign-owned firms and foreign JV firms; *FUL* is added to the variable name of the former, and *JV* is added to that of the latter. Panel (b) of the same table reports the estimation results of the spillover variables of large MNEs and small MNEs in terms of the total number of employees; *BIG* is added to the variable name of the upper group, and *SME* is added to that of the lower one.

From these results, we confirm that an information spillover effect in the manufacturing industry, regardless of its extent and direction, is strongly originated from fully foreign-owned large firms. In the case of Hungary, these firms represent the fully-owned subsidiaries of the world's major international enterprises. However, Panel (a) of **Table 4.7** indicates that foreign JV firms also generate a significant positive externality. According to the estimation results of the nested variable model [2], this is mainly brought about by firms with the most distant proximity in terms of industrial classification (Enterprise Layer Ⅲ in **Figure 4.2**). In the service industry, as compared to manufacturing firms, the role of small and medium-sized foreign companies is very distinctive as the economic entities promoting the export activity of domestic firms. According to the estimation results of Model [8], the foreign firms belonging to the lower group in terms of the organizational size produce a significantly positive information spillover effect

Table 4.7 FDI heterogeneity and information spillover effect

(a) Investment mode

Industrial sector	Manufacturing		Services	
Model[a]	[1]	[2]	[3]	[4]
$SPILL2FUL_{it-1}$	0.6102**		0.0349	
	(0.239)		(0.280)	
$SPILL2FULN_{it-1}$		0.7182***		0.6676***
		(0.193)		(0.134)
$SPILL3FULN_{it-1}$		−0.1715**		0.0029
		(0.074)		(0.053)
$SPILL4FUL_{it-1}$		0.1348**		0.0362
		(0.069)		(0.054)
$SPILL2JV_{it-1}$	0.8337**		0.1206	
	(0.403)		(0.753)	
$SPILL2JVN_{it-1}$		0.8113***		1.0034***
		(0.256)		(0.261)
$SPILL3JVN_{it-1}$		0.1330		−0.6782***
		(0.154)		(0.188)
$SPILL4JV_{it-1}$		0.1120		0.1589
		(0.138)		(0.138)
N	12854	12854	26692	26692
Log likelihood	−4259.12	−4249.51	−7147.01	−7122.42
Wald test[b]	6196.68***	6185.31***	10668.98***	10622.53***

(b) Organizational size

Industrial sector	Manufacturing		Services	
Model[a]	[5]	[6]	[7]	[8]
$SPILL2BIG_{it-1}$	0.5523**		0.4618	
	(0.235)		(0.371)	
$SPILL2BIGN_{it-1}$		0.6472***		0.5621***
		(0.199)		(0.135)
$SPILL3BIGN_{it-1}$		−0.1928**		−0.2668***
		(0.076)		(0.073)
$SPILL4BIG_{it-1}$		0.1787**		−0.0100
		(0.071)		(0.057)
$SPILL2SME_{it-1}$	0.7689		0.7403*	
	(0.682)		(0.442)	
$SPILL2SMEN_{it-1}$		0.4302		0.5886***
		(0.366)		(0.207)
$SPILL3SMEN_{it-1}$		0.0060		0.1748*
		(0.118)		(0.091)
$SPILL4SME_{it-1}$		−0.0816		0.3151***
		(0.127)		(0.087)
N	12854	12854	26692	26692
Log likelihood	−4259.41	−4247.22	−7146.80	−7118.48
Wald test[b]	6196.45***	6180.82***	10668.32***	10626.65***

Notes : [a]All models are estimated using the random-effects probit estimator. The estimates of the constant term and other independent variables are not reported here. The robust standard errors are reported in parentheses. ***, **, and* denote statistical significance at the 1%, 5%, and 10% levels, respectively.
[b]Null hypothesis : All coefficients are zero.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 4.10.

in each and every enterprise layer comprising the 2-digit level industrial classification. This result demonstrates that, in the case of the service industry, it is much easier for domestic firms to understand and imitate the export operation of small and medium-sized foreign companies than that of larger ones. In sum, we found that the source and extent of the information spillover effect may vary greatly depending on the industrial sector, even in the same country.

4.6.2 Heterogeneity of Domestic Firms

Next, we look at the relationship of the heterogeneity of domestic firms to the information spillover effect. Here, we focus on the presence of a foreign investor(s) as a business partner, the firm size, and the human resource and organizational capacity. We expect that these factors will positively affect the export potential of domestic firms by improving their ability to collect external information and their adaptive capacity in the export business.

To validate this hypothesis, we estimated the interacted terms of the firm characteristics variables reflecting the above three factors and the FDI spillover variables. As with the baseline model, we use foreign ownership share (*FS*) and the annual average number of employees (*SIZE*) to represent the management participation of foreign investors and the firm size, respectively. On the other hand, it is difficult to express the human resource and organizational capacity of a domestic firm using any one of the firm characteristics variables. Thus, we perform the principal component analysis of the *TFP*, *K/L*, *LC*, and *R&D* variables and use its first component score (*ORG*) as a proxy of a firm's capacity for human resources and organization. As shown in **Table 4.8**, the *ORG* variable explains nearly 50% of the total variance of the four variables in both industries and adds original variables in a balanced manner.

The estimation results of the extension model, containing the interacted terms of *FS*, *SIZE*, and the newly introduced *ORG* variable and the FDI spillover variable(s) in its right-hand side, are listed in **Table 4.9**[10]. The results demonstrate that each factor, i.e., foreign own-

[10] To avoid multicollinearity, four firm characteristics variables are removed from the right-hand side of the regression model with the *ORG* variable.

Table 4.8 Principal component analysis of the human resource and organizational capacity of domestic firms

(a) Manufacturing (N=12854)

Eigenvalue of the correlation matrix				Eigenvectors and component loadings of the first component		
Component no.	Eigenvalue	Accounted for variance	Cumulative percentage of total variance	Variables	Eigenvector	Component loading
1	1.9589	48.97	48.97	*TFP*	0.2066	0.2892
2	1.0988	27.47	76.44	*K/L*	0.5008	0.5249
3	0.5599	14.00	90.44	*LC*	0.8018	0.6000
4	0.3825	9.56	100.00	*R&D*	0.8570	0.5300

(b) Services (N=22692)

Eigenvalue of the correlation matrix				Eigenvectors and component loadings of the first component		
Component no.	Eigenvalue	Accounted for variance	Cumulative percentage of total variance	Variables	Eigenvector	Component loading
1	1.8617	46.54	46.54	*TFP*	0.2660	0.3629
2	1.1044	27.61	74.15	*K/L*	0.4261	0.4478
3	0.6413	16.03	90.19	*LC*	0.7761	0.6215
4	0.3926	9.81	100.00	*R&D*	0.8468	0.5306

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 4.10.

ership, firm size, and human resource and organizational capacity, is effective in the absorption of know-how and technology diffusing from the export activity of MNEs. However, there is a significant difference in the extent among factors and industrial sectors. For instance, in Models [1] and [2] reported in Panel (a) of **Table 4.9**, the interacted terms of the *FS*, *SPILL2*, and *SPILL2N* variables produce statistically significant and positive coefficients. The information suggests that the participation of foreign investors in the management of a manufacturing firm is an effective means of enjoying FDI externality more efficiently. However, the same effect cannot be observed in the service industry. On the other hand, it is highly probable that human resource and organizational capacity are more critical for service firms than for manufacturing firms to absorb the information spillover effect and apply it to export business. Indeed, Panel (c) of **Table 4.8** shows that all interacted terms of *ORG* variable and FDI spillover variables in Models [11] and [12] dealing with the service industry are estimated with a positive sign, and the statistical significance of their estimates is substantially higher than that for manufacturing firms reported in Models [9] and [10].

As described above, although the heterogeneity of domestic firms is closely related to the information spillover from MNEs, there is a difference in its extent depending on the nature of the heterogeneity or the industrial sector.

4.7 Conclusions

In this chapter, we empirically examined the determinants of export market entry by domestic firms using large-scale panel data on Hungarian firms for the early 2000s. We found that direct transnational investment greatly stimulates the export activity of domestic firms in Hungary through two channels, that is, direct management participation by foreign investors and the information spillover originated from incoming MNEs. The nested variable model, which has a set of spillover variables reflecting the multi-layered structure of the NACE industrial classification in its right-hand side, can more precisely specify the source, extent, and direction of the FDI externality affecting the export decision of domestic firms than the conventional model, which expresses the export propensity of foreign firms with a

Table 4.9 Heterogeneity of domestic firms and information spillover effect

(a) Foreign ownership share

Industrial sector	Manufacturing		Services	
Model[a]	[1]	[2]	[3]	[4]
FS_{it-1}	−0.2993	0.0039	0.4876**	0.3424
	(0.314)	(0.351)	(0.241)	(0.262)
$SPILL2_{it-1}$	0.4769**		0.0201	
	(0.235)		(0.267)	
$SPILL2N_{it-1}$		0.6442***		0.6979***
		(0.193)		(0.133)
$SPILL3N_{it-1}$		−0.1512**		−0.0653
		(0.073)		(0.051)
$SPILL4_{it-1}$		0.1327*		0.0434
		(0.070)		(0.055)
$FS \times SPILL2_{it-1}$	1.4244***		0.0561	
	(0.500)		(0.406)	
$FS \times SPILL2N_{it-1}$		0.8027*		−0.1120
		(0.420)		(0.370)
$FS \times SPILL3N_{it-1}$		0.1124		0.2857
		(0.280)		(0.231)
$FS \times SPILL4_{it-1}$		0.0351		0.3094
		(0.335)		(0.270)
N	12854	12854	26692	26692
Log likelihood	−4255.33	−4249.87	−7147.01	−7129.57
Wald test[b]	6171.22***	6173.04***	10669.67***	10647.84***

(b) Organizational size

Industrial sector	Manufacturing		Services	
Model[a]	[5]	[6]	[7]	[8]
$SIZE_{it-1}$	0.2225***	0.1690***	0.0638*	0.0541
	(0.065)	(0.063)	(0.038)	(0.035)
$SPILL2_{it-1}$	−0.0114		−0.3198	
	(0.390)		(0.329)	
$SPILL2N_{it-1}$		0.3592		0.4522**
		(0.311)		(0.224)
$SPILL3N_{it-1}$		−0.1836		−0.1682
		(0.174)		(0.138)
$SPILL4_{it-1}$		−0.4308**		−0.1257
		(0.197)		(0.139)
$SIZE \times SPILL2_{it-1}$	0.1814*		0.1215*	
	(0.099)		(0.068)	
$SIZE \times SPILL2N_{it-1}$		0.1051		0.0817
		(0.078)		(0.064)
$SIZE \times SPILL3N_{it-1}$		0.0119		0.0468
		(0.049)		(0.047)
$SIZE \times SPILL4_{it-1}$		0.1769***		0.0647
		(0.058)		(0.046)
N	12854	12854	26692	26692
Log likelihood	−4257.77	−4245.63	−7145.43	−7127.98
Wald test[b]	6189.36***	6170.94***	10670.33***	10647.25***

(Continued)

Table 4.9 (continued)

(c) Human resource and organizational capacity

Industrial sector	Manufacturing		Services	
Model[a]	[9]	[10]	[11]	[12]
ORG_{it-1}	0.0549	0.0930*	0.0472	0.1069***
	(0.049)	(0.050)	(0.033)	(0.031)
$SPILL2_{it-1}$	0.5533**		−0.0048	
	(0.232)		(0.266)	
$SPILL2N_{it-1}$		0.7333***		0.6481***
		(0.191)		(0.130)
$SPILL3N_{it-1}$		−0.1396*		−0.1052**
		(0.072)		(0.051)
$SPILL4_{it-1}$		0.1359**		0.0972*
		(0.068)		(0.053)
$ORG \times SPILL2_{it-1}$	0.1450*		0.1683***	
	(0.075)		(0.057)	
$ORG \times SPILL2N_{it-1}$		0.0709		0.1484***
		(0.063)		(0.048)
$ORG \times SPILL3N_{it-1}$		0.0594		0.0198
		(0.039)		(0.032)
$ORG \times SPILL4_{it-1}$		−0.0350		0.1037***
		(0.046)		(0.035)
N	12854	12854	26692	26692
Log likelihood	−4294.10	−4284.57	−7213.15	−7191.27
Wald test[b]	6249.71***	6240.32***	10766.66***	10719.27***

Notes : [a]All models are estimated using the random-effects probit estimator. The estimates of the constant term and other independent variables are not reported here. The robust standard errors are reported in parentheses. ***, **, and *denote statistical significance at the 1%, 5%, and 10% levels, respectively.
[b]Null hypothesis : All coefficients are zero.
Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 4.10.

single variable.

The estimation results of the nested variable model reported in Section 4.5 strongly suggest that there is a close causality between the industrial-technological proximity of MNEs to domestic firms and the information spillover effect. In addition, the empirical analysis conducted in the previous section reveals that the investment mode and organizational size of foreign firms and the ownership structure and organizational size of domestic firms as well as the human resource and organizational capacity greatly affect the possibility and extent of the information spillover effect.

We also confirmed that the findings of previous studies on developed and developing economies are generally applicable to Hungary, a post-socialist transitional country. Specifically, the exporters in Hungary possess superior characteristics in terms of capital intensity,

Table 4.10 Definitions and descriptive statistics of the variables used in the empirical analysis

Variable name	Definition	Descriptive statistics			
		Manufacturing (N=12854)		Services (N=26692)	
		Mean	S. D.	Mean	S. D.
Firm category variable					
y	Exporter dummy variable	0.491	0.500	0.233	0.423
ALWAYS	Always exporter dummy variable ($y_{it}=1$; $y_{it+1}=1$)	0.434	0.496	0.192	0.394
STOP	Export stopper dummy variable ($y_{it}=1$; $y_{it+1}=0$)	0.057	0.232	0.041	0.199
START	Export starter dummy variable ($y_{it}=0$; $y_{it+1}=1$)	0.061	0.239	0.048	0.215
Trade environment variables					
TT	Terms of trade (export price index/import price index × 100)	99.434	0.490	99.435	0.491
EU15	Annual GDP real growth rate of 15 EU countries	1.567	0.519	1.566	0.518
FDI spillover variables					
SPILL2	Share of foreign firms in the export volume (NACE 2-digit level)	0.642	0.166	0.529	0.174
SPILL2N	Share of foreign firms in the export volume (NACE 2-digit level : nested variable)	0.638	0.207	0.532	0.178
SPILL3N	Share of foreign firms in the export volume (NACE 3-digit level : nested variable)	0.490	0.331	0.240	0.283
SPILL4	Share of foreign firms in the export volume (NACE 4-digit level)	0.557	0.281	0.436	0.292
Firm characteristics variables		0.064	0.209	0.036	0.157
FS	Foreign ownership share of the total equity capital				
TFP	Total factor productivity estimated using the Levinsohn-Petrin semi-parametric method	0.025	0.187	0.029	0.190
K/L	Assets per employee (natural logarithm)	8.544	0.952	8.870	1.051
LC	Labor costs per employee (natural logarithm)	7.269	0.465	7.291	0.526
R&D	Intangible assets per employee (natural logarithm)	2.010	1.372	2.256	1.423
SIZE	Annual average number of employees (natural logarithm)	3.293	1.105	2.739	0.897
CAPITAL	Dummy variable for firms located in the capital region	0.394	0.489	0.463	0.499
EAST	Dummy variable for firms located in the eastern region	0.332	0.471	0.278	0.448
ORG	Human resource and organizational capacity (first principal component of *TFP*, *K/L*, *LC* and *R&D* variables)	−0.140	1.333	−0.089	1.308

Source : *TT* and *EU15* are from the Hungarian Central Statistical Office's website (http://portal.ksh.hu/) and Statistical Office of the European Union's website (http://epp.eurostat.ec.europa.eu/), respectively. The other variables come from census data of Hungarian firms.

quality of human capital, research and development capacity, and firm size in comparison to nonexporters. In addition, we found that Hungarian domestic firms face substantial sunk costs incurred by new entries into export markets.

By subjecting not only the manufacturing industry, which has been addressed in the large majority of previous studies, but also the service industry to empirical analysis, this study gave great attention to the differences a distinction in the industrial sector brings to the structure of the export decision model. The empirical analysis in this chapter revealed that the mechanisms generating the information spillover effect and the effects of firm location are very different between the two industries. The cost-benefit performance of export promotion policies for domestic firms can be improved through modification of their institutional frameworks by taking this empirical evidence into account.

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Part Ⅲ

Industrial Restructuring and Organizational Innovation

Chapter 5

Emergence of a Service Economy: The Case of Knowledge-Intensive Business Services-Hungary vs. Slovakia

5.1 Historical Shift in Economic Structure and Growing Importance of the Services

5.1.1 Growing Role of the Service Sector

Since the last decades of the 20th Century, the growth of the service sector has been unprecedented, considerably outpacing manufacturing and agriculture. Some researchers refer to this change as a service sector revolution (Chesbrough and Shphrer, 2006). In a simplistic way, the wealth of nations can be attributed to agriculture two centuries ago, to manufacturing a century ago, and to the service sector now, producing 70-80% of GDP in developed economies. In contrast, the share of the service sector in the GDP in developing countries is 52% and that in the Central and Eastern European Post-Socialist countries ranges from 58.4% to 62.9%. Another noteworthy feature of these changes is the different developmental dynamics in the manufacturing and service sectors. For example, in the UK, between 1998 and 2004, the knowledge-intensive business service (KIBS) sector experienced 23.6% productivity growth, accompanying a 20.2% employment increase. On the other hand, 28.8% productivity growth and 22.8% employment decline were reported in the manufacturing

Table 5.1 Contributions of economic sectors in the GDP : Comparison of some CEE economies to various groups of EU countries, 1995 and 2007

	1995			2007		
	Agriculture	Industry	Service	Agriculture	Industry	Service
EU-27	8.4%	28.6%	63.0%	5.8%	24.9%	69.2%
EU-15	5.0%	27.5%	67.5%	3.4%	23.5%	73.1%
Czech Republic	6.4%	40.5%	53.1%	3.5%	38.1%	58.4%
Hungary	8.2%	33.1%	58.7%	4.7%	32.5%	62.8%
Poland	26.9%	29.7%	43.5%	n.a.	n.a.	n.a.
Slovakia	9.3%	37.1%	53.9%	3.6%	34.3%	62.1%

Source : EUROSTAT, European Union Labor Force Survey (http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/)

sector (Sako, 2006, p. 500).

Similarly to international trends, the economic performance of the service sector increased significantly in the last decade in Hungary and Slovakia. In 2007, as shown in **Table 5.1**, almost two-thirds of the GDP was generated by the service sector in both countries. These findings bolster a previous analysis of the importance of the service sector in both countries.

In addition, it is noteworthy that, in the case of Hungary, between 1992 and 2006, the productivity growth in the service sector (measured by the share of the gross value added/capital) was higher than that in manufacturing. In addition, the service sector played a crucial role in employment generation. Between 1995 and 2006, every second new job (46%) was created in the service sector, and, interestingly, more than every second new job (57%) was established in KIBS (ERM Report, 2008)[1].

With regard to the unbundling of corporate functions relative to support activities in a firm's infrastructure and administration, globalization of the service sector is a rather new phenomenon in comparison to manufacturing and is driven by the factors presented below :

(1) Globalization of the labor market or the Great Doubling in the international labor market. After 1989, rather than 1.48 billion people, 2.93 billion are competing and intensifying wage competi-

[1] The composition of the KIBS is presented in detail in Section 5.2.

tion globally (Freeman, 2006).

(2) General use (due to radical cost reduction) of the Information and Communication Technologies (ICT) in company practices speeded up the delocalization (outsourcing/off shoring) of not only the 'primary activities' (e.g., production) in the global value chain (GVC) but also the 'support activities' in administrative functions (Gospel and Sako, 2010) or services. In this relation it is worth noting that Austrian and German firms could radically reduce their labor costs (by 37-73%) by outsourcing research activities to Eastern European countries (Marin, 2010, p. 10).

(3) In the emerging markets, the social and economic actors (governments) are looking for new development strategies (a new path of the economic development) aimed to improve their position in GVC in supplying higher-value-added products and services. With the help of this new policy orientation, the CEE countries, including Hungary, intend to get rid of the situation of "locking (...) into economic activities with low-value-added/productivity growth and, thus, undermining future sustainable growth" (Kattel et al., 2009, p. 2).

(4) Fast development of 'modularization' or 'networking' via various types of organizational and managerial innovations in global corporations is continuing. This process is driven by both the cost-reduction and the transformation of the firms (e.g., focusing on the core competences in both the 'primary' and the 'support' activities)[2].

Radical changes in the nature of the global labor market are regarded as a key factor for the high speed of internationalization of services. As a result of the participation of China, India, and former Soviet-bloc countries in the global labor market, today, 2.93 billion people are in competition, while only 1.46 billion workers were active in the global labor market before these historical changes. Richard B. Freeman labeled this enormous shift in the global labor market as a 'great doubling' with a far reaching impact on labor in both the devel-

[2] According to Sako (2009b), in the 'modular corporation,' the labor process in practically every large corporate department can be delocalized by outsourcing or off shoring and can be driven both by cost- and knowledge efficiencies, using what she calls 'new locations with a talent pool' (p. 4).

oped and developing economies (Freeman, 2006). In the countries mentioned above, before the collapse of the state-socialist political-economic system and before the end of their economic isolations (e.g., India), the workforce rarely competed directly with those in the developed countries. One of the most important impacts of this historical change in the global labor market is increased wage competition, not only in the low-level blue-collar jobs in the manufacturing sector but also in the best- and worst-paid white-collar jobs. Contrary to widespread public belief, these developing (or emerging) economies are increasing their highly skilled labor force rather fast with the future aspiration to improve their present position in the GVC of both manufacturing and services. In this regard, the following is noteworthy : even before the 2008 global financial and economic crisis, China launched various initiatives to increase the share of high value-added products in total exports and made remarkable progress in R&D (e.g., more than 750 MNCs created R&D capacity in the nanotechnology industry). In addition, by 2010, the number of Chinese PhD students in engineering and natural sciences was expected to outstrip that of similar categories in the U. S. A. Finally, it is noteworthy that, besides China, Indonesia and Brazil doubled the number of university graduates between 1980 and 1990. In this relation, we are noting a new patterns of outsourcing has recently emerged as German firms started to outsource their core or head office activities to Eastern Europe. As a result of the delocalization, "Germany is losing high-paying jobs in R&D and IT not just the bad and low skilled jobs. (...) Siemens praised the high quality of skilled workers in Eastern Europe, (*which is*) a particularly attractive location for Siemens compared to India and China because of its proximity to Germany and because of the culture and time zone" (Marin, 2010, p. 17).

ICT and modularization (or networking) of business organizations are important drivers and/or enablers of delocalization (outsourcing/off shoring) of services. The dramatic decline in the telecommunication costs, decreasing importance of the physical distance ('death of distance'), and extensive use of ICT assist in the geographical redistribution of data storage and processing (e.g., outsourcing the data processing activities of accounting and wage departments, medical diagnosis, and logistical activities). Finally, ICT facilitates the standardization of services. This is the process of 'productizing services' in the

Table 5.2 Moving of the value chain of business services

IT Services →	BPO →	KPO
IT infrastructure, Software applications development, Hosting, Data entry and conversion	Call centers, Horizontal back-office processes (e.g., payroll administration, accounts payable), Vertical business process (e.g., claims handling in insurance)	Research and development, Engineering design, Data analysis and data mining, Advanced processes in legal, medical, biotechnical, and pharmaceutical sectors

Note : BPO and KPO denote business process outsourcing and knowledge process outsourcing, respectively.
Source : Sako (2009b, p. 17).

service sector. However, the infiltration of servicing is also evident in the manufacturing sector. For example, among such globally well-known manufacturers as the American IBM or the German Siemens, the fastest growing aspect of their turnover is generated from service activities. This process is often called 'servicing products.'

In spite of the fact that the service sector covers a greater variety of activities than the manufacturing one, only 10% of the service sector is involved in international trade, while it is more than 50% in the case of manufacturing (UNCTAD, 2004). The smaller share of the service sector in international trade may be explained by the special characteristics of its products. In the majority of cases, it is difficult to store a significant part of the service sector's product due to the fact that the production and consumption of services take place simultaneously. This feature of the service sector results in weak tradability; therefore, at the beginning of the 21st Century (2003), despite the heavy reliance on the use of ICT, services represented only 1.8 billion USD in the work trade, in contrast to the 7.4 billion USD share of the manufacturing sector (WTO, 2005). Despite these difficulties, the share of foreign direct investments (FDI) in the service activities increased in the last decades of the 20th Century. For example, in the 1970s, the sector represented only 25% of the total inward FDI; in 2002, this share increased to 60% (UNCTAD, 2004). The role of FDI is especially important in business services (e.g., in such sub-sectors as transportation, telecommunications, real estate, catering, and hotels).

Governments in the emerging markets are designing new development (modernization) strategies aimed at moving up on the GVC

and shifting from a 'low-skill' to a 'high-skill' equilibrium growth model in the CEE countries. **Table 5.2** illustrates the possible steps of moving up in the GVC in the field of business service activities.

It is quite probable that the radical changes in the global labor market and the impact of the global financial and economic crisis in spite of the temptation of 'economic nationalism' in some countries may result in only a temporary slowdown and stronger competition and not a reversal of the trend of delocalization of business services. In this context, the organizational innovations and the knowledge development practice in the KIBS firms are playing a key role in improving the competitiveness and moving up the GVC of business services.

5.1.2 Heterogeneous Character of Services and Innovation

Characterizing the service activities in general, Korczynski (2002) (cited by Flecker et al. (2008, p. 103)) identifies the following basic features of services :

(1) 'Intangibility' — the product of service work is not at all or only partially tangible;
(2) 'Perishability' — the product is 'ephemeral' and cannot be stored;
(3) 'Variability' — the recipients of services may vary according to their expectations and actions;
(4) 'Simultaneous production and consumption' — the service is produced and consumed in one and the same situation ('uno-actu' principle); and
(5) 'Inseparability' — the product is produced by both a service provider and a receiver (co-production).

According to Salther and Tether (2006), the fundamental characteristics of innovation activities in the knowledge-intensive and professional service firms are as follows : (1) the role of highly skilled labor in the creation and exploitation of new solutions; (2) the importance of new organizational practices, such as the use of knowledge management (KM) systems in supporting the realization of new innovative opportunities; (3) the 'generative dance' between clients and producers as new solutions are negotiated and co-produced between different actors; (4) the key role of social networks in generating and supporting knowledge creation and exchange through brokerage and closure; (5) the '*ad hoc*' or 'informal' organizational form of most

knowledge-intensive service firms (p. 17).

The characteristics of the innovation of the KIBS firms reported above reflect the features of an open innovation system in which reciprocal training is an essential part. In such a system, KIBS firms increase their knowledge base each time they work with new clients. Furthermore, client firms benefit from the expertise of the KIBS providers, which is established from their experience with other firms (Basset et al., 2011, p. 21).

The fast development of information and communication technologies, which has fundamentally transformed knowledge management in general (e.g., handling, storing, and transferring information) did not question the importance of the 'proximity paradox'. Toivonen reported the following : "The empirical studies made until now indicate that, even though there is growing potential for the electronic delivery of graphic, numerical, and text-based information, no part of the KIBS transactions can be carried out without local presence of face-to-face contacts" (Basset et al., 2011, p. 9).

5.2 A Brief Overview of the Diffusion of Learning/Innovative Organizations in Europe

Before reporting the outcome of the organizational innovation and knowledge development in the KIBS firms in Hungary and Slovakia, a brief overview of similar practices in Europe is presented.

The economy in Europe has a characteristic variety of forms of work organization, reflecting various capacities of learning and innovation. The findings of the 4th European Working Conditions Survey (EWCS-2005) in the EU-27 countries (Valeyre et al., 2009) indicate that almost two fifths (38%) of the European employees surveyed are working in a '*discretionary learning organization*' (innovative organization). In this class of work organization, the job structure is characterized by a high level of autonomy in work, a need to learn, and problem-solving, task complexity, and self-assessment of the quality of work. Such characteristics of work as monotony, repetitiveness, and pace constraints are under-represented[3]. The discretionary learning

[3] The discretionary learning form of work organization is comparable to the 'operating adhocracy' model of Minztberg (1979; 1983) and has many of the common

forms of work organization are highly developed in such sectors of the national economies as service, mainly in financial and insurance activities (63% of employees), business services (50%), community, recreational, cultural, and personal services (49%), and in the utility sector of gas, electricity, and water (56%). This type of organization is used less in manufacturing; however, there is a concern with the large share of employees in the mechanical engineering sector (44%), which is characterized by complex production processes and important research-development activities. A comparison of the diffusion of innovative or learning-oriented forms of work organization clearly indicates that these forms of work organization are more widespread in Northern Europe than in other parts.

Another type, referred to as '*lean organization*,' is typified by good learning and innovation potential[4]. This class of work organization, in which more than one fourth (26%) of the employees participate, is defined primarily by an overrepresentation of teamwork (autonomous or not) and job rotation (particularly multi-skilling), autonomy in quality supervision (self assessment of quality of work and quality norms), and various factors constraining the speed of work or pace. However, work autonomy is only slightly higher than the average and limited by the importance of pace constraints linked to the collective nature of the work and the requirement of respecting strict quantitative pro-

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features of the 'Social-Technical System Design' (STSD) model. Nielsen (2007) makes a distinction between the traditional social-technical approach of the Tavistock Institute and the Scandinavian STSD in which, in early socio-technical studies, attention was focused on the improvement of the quality of working life at the level of work groups within the organization. In the modern STSD, the attention shifts from the working group to the organization as a whole. As a result, a set of design rules for a division of labor is created, having a positive effect on the quality of working life as well as on the performance of the organization (Nielsen, 2007, p. 67).

[4] The 'lean wave' and the lean principle have been popular since the 1990s, and "the practical use of lean strategies includes issues of cost reductions, employee empowerment, value chain orientation, customer focus, and product innovation" (MEADOW Consortium, 2010, p. 26). In our use, a lean organization emphasizes the importance of the 'employee empowerment' from the various features of lean production. The original description of the lean principles or lean wave is related to the work of Womack and Jones (2003).

duction norms. Thus, this model of work organization has much in common with 'controlled autonomy,' which reflects the employers' contradictory concern for balancing the needs of exercising control over employees while encouraging creativity.

The lean production forms of work organization are most prevalent in the manufacturing industries (31%) and in the construction sector, but significant numbers of employees (20%) are in other service sectors. *Taylorist* forms of work organization (or the organization of work for mass production) occur most frequently in manufacturing (28%), especially in such mature industries as textiles, clothing, and leather (47%), but to a much lesser degree in the mechanical, electrical, and electronic engineering industries (17% and 19%). These forms are generally less present in the service sectors, except in hotels and restaurants (26%) and post and telecommunications (22%), with a higher level than the average (16.4%). Finally, the *traditional or simple structure of work organization* grouped in the fourth class is prevalent in the service sectors, mainly in transport (27%), wholesale and retail trade (25%), community, recreational, cultural, and personal services (22%), and hotels and restaurants (21%), but is also diffused, higher than the average rate (16.4%), in the food and beverage industries (19%). **Table 5.3** indicates the distribution of forms or models of work organization and is a comparison of the 'old' and 'new' member states in the European Union.

The positions of Hungary and Slovakia within the EU-27 countries are rather unbalanced. For example, on the one hand, among such new member state (NMS) countries as Hungary, Estonia, and Cyprus, the share of 'learning' or 'innovative' organization is among the highest. On the other hand, the Taylorist model of mass production is near or exceeds the EU average. The same pattern of distribution of forms of work organization is true for Slovakia. This country belongs to the country cluster in which a 'lean organization' has a higher rate than the EU average. At the same time in Slovakia, the share of Taylorist work organizations exceeds the EU average. Unfortunately, these aggregated country-level data do not provide information about the distribution of various forms of work organization ('learning,' 'lean,' 'Taylorist,' and 'simple' versions) by sectors within the countries surveyed. The core motif in designing and carrying out a comparative company survey in the Hungarian and Slovak

Table 5.3 Share of work organization models in the EU-27 countries : EWCS-2005

Models of work organization	NMS+2	EU-15
Discretionary learning organization (post-Fordism)	Hungary, Estonia, and Malta	Austria, Belgium, Germany, Sweden, Denmark, The Netherlands, France, Luxemburg, and Finland
Lean organization (Neo-Fordist work organization)	Estonia, Latvia, Lithuania, Czech Republic, Poland, Romania, Slovenia, Slovakia, and Cyprus	Belgium, Luxemburg, UK, Ireland, Spain, Denmark, Finland, Malta, Portugal, and Greece
Taylorist/Fordist work organization (mass production)	Bulgaria, Czech Republic, Hungary, Lithuania, Romania, Slovakia, and Cyprus	Greece, Spain, Italy, and Portugal
Traditional or non-coded work organization	Bulgaria, Czech Republic, Hungary, Lithuania, Slovakia, and Cyprus	Ireland, Greece, UK, Portugal, and Spain

Source : Makó et al. (2008, p. 1080).

KIBS sector was to overcome 'knowledge deficiency' in that field.

5.3 Share and Changes in the KIBS Sector Employment in Europe : Special Focus on Hungary and Slovakia

Following a brief presentation of the distribution of the forms of work organization in Europe, we intend to locate the various branches of the KIBS sector within the European employment structure (see **Table 5.4** for details) and the development of this sector in Hungary and Slovakia and compare them with the EU-27 average over the last decade (2000-2007).

In Hungary and other post-socialist countries, the share of KIBS in employment is below the EU-27 average (33%), and these economies are lagging considerably behind such countries as Sweden(48%), the UK(43%), and Finland(41%). Among the post-socialist economies of the NMS countries, in a comparison of the knowledge-intensive (business) services (KIS or KIBS), the highest level of employment was registered in Hungary (28.2%). When evaluating the employment shares in the sub-sectors of the KIBS (e.g., KIHTS and KIMS), visible

Table 5.4 Share of knowledge-intensive service sectors in employment in some EU countries, 2007

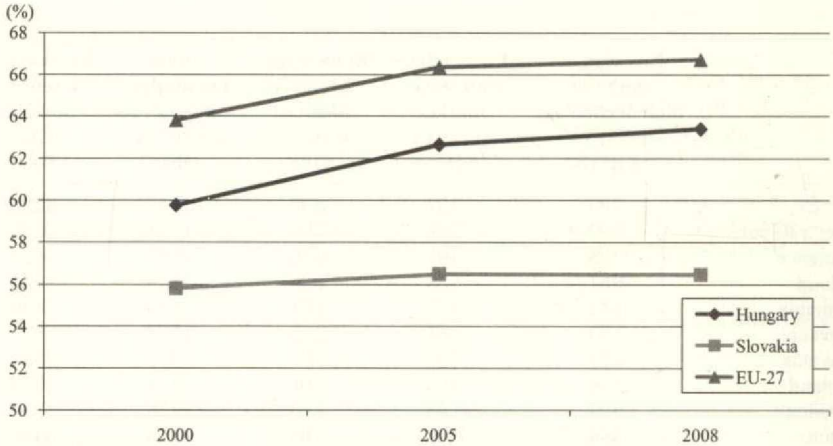
(%)

	Knowledge-intensive high-technology services (KIHTS)	Knowledge-intensive market services (KIMS)	Knowledge-intensive financial services (KIFS)	Other knowledge-intensive services (OKIS)	Knowledge-intensive services (KIS) (Total)
EU-27	3.29	8.27	2.97	18.43	32.96
Czech Republic	2.99	5.86	2.07	14.74	25.66
Hungary	3.28	5.91	2.16	16.85	28.20
Poland	2.57	5.38	2.38	14.49	24.81
Romania	1.52	2.70	1.04	9.15	14.40
Slovenia	2.80	5.64	2.45	15.38	26.27
Slovakia	2.89	4.95	2.02	14.87	24.74
Finland	4.56	9.92	2.01	24.24	40.73
Sweden	5.07	11.43	1.95	29.38	47.83
France	3.40	9.24	3.09	21.16	36.89
Germany	3.44	8.64	3.50	19.21	34.79
United Kingdom	4.36	10.02	4.35	24.12	42.85
Ireland	3.70	7.92	4.43	19.43	35.48
Spain	2.95	8.87	2.40	13.98	28.19
Italy	3.12	9.58	2.87	11.15	30.67

Source : Eurostat Data Explorer (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes).

variations were registered within this country group. In the case of the 'knowledge-intensive high-tech services' (KIHTS), the Hungarian employment share is the highest (3.28%) among the post-socialist countries, followed by the Czech Republic (3.99%), Slovakia (2.89%), and Slovenia (2.80%), and the lowest in Romania (1.52%). In the case of the 'knowledge-intensive market services' (KIMS), Estonia (7.03%) and Latvia (6.17%) occupy the first two positions, and Hungary is the third in rank (5.91%), followed by the Czech Republic (5.86%), Slovenia (5.64%), Poland (5.38%), and Slovakia (4.95%). Identifying the share of employment in the 'knowledge-intensive financial services' (KIFS), Slovenia has a leading position (2.45%), followed by Poland (2.38%), Hungary (2.16%), the Czech Republic (2.07%), and Slovakia (2.02%). Concerning the 'other knowledge-intensive services' (OKIS), Lithuania has the leading position (17.78%), and Hungary occupies the second position (16.85%), followed by Estonia (16.83%), Slovenia

Figure 5.1 Share of total service sector in employment in Hungary, Slovakia, and EU-27 countries, 2000-2008



Source : Authors' illustration based on Eurostat Data Explorer (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes).

(15.38%), and then Slovakia (14.86%). Romania has the weakest position among the post-socialist countries[5].

In a dynamic perspective (from 2000 to 2008), looking at the growth rates of employment in the total service sector and in both the 'knowledge-intensive' and 'less-knowledge-intensive' service sectors, the following patterns were identified. As shown in **Figure 5.1**, the share and the growth rates of the total service sector were the highest in the EU-27 countries, followed by Hungary, and Slovakia has a visibly weaker position.

Assessment of the aggregated data of the 'total service sector,' 'knowledge-intensive service' (KIS), and 'less-knowledge-intensive service' (LKIS) shows that Hungary is in a better position than Slovakia, both from a static and a dynamic perspective. In addition, it is of value to map the employment share and its growth by sub-sectors of the KIS. In other words, our focus is on country contrasts in employ-

[5] In relation to the 'less-knowledge-intensive services,' Hungary has a higher share of employment (34.67%) than Slovakia (31.78%). In addition, the Hungarian share of employment in this type of service (34.67%) was higher than the EU-27 average (33.7%) in 2007.

Table 5.5 Share of knowledge-intensive service sectors in employment in Hungary, Slovakia, and the EU, 2000-2008

(%)

Types of services	Hungary			Slovakia			EU-27 average [a]		
	2000	2005	2008	2000	2005	2008	2000	2005	2007
Knowledge-intensive high-technology services (KIHTS)	3.09	3.15	3.28	2.97	2.67	2.77	3.21	3.28	3.29
Knowledge-intensive market services (KIMS)	4.68	5.95	6.45	3.31	4.72	5.44	6.81	7.79	8.27
Knowledge-intensive financial services (KIFS) [b]	2.23	2.06	2.44	1.77	2.17	2.27	3.11	2.96	2.97
Other knowledge-intensive services (OKIS)	16.5	17.07	16.55	16.43	15.87	14.24	17.22	18.45	18.43
Knowledge-intensive services total	26.5	28.22	28.73	24.48	25.43	24.71	30.36	32.47	32.96
Less-knowledge-intensive services (LKIS)	33.27	34.44	34.67	31.35	31.08	31.78	33.45	33.89	33.77
Service sector total	59.77	62.66	63.40	55.83	56.51	56.49	63.81	66.36	66.73

Notes : [a] As there are no data on the EU average available for 2008, the data in the last column refer to 2007.
[b] Excluding financial intermediation and high-tech services.
Source : Eurostat Data Explorer (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes).

ment share and employment growth by such sub-sectors as KIHTS, KIMS, KIFS, and LKIS. **Tables 5.5** and **5.6** provide information about these differentials between the two post-socialist Central European countries in comparison to the EU-27.

The share of the service sector total (KIS + LKIS) in the two post-socialist countries was weaker than that of the EU-27 average in both 2000 and 2008 or 2007. However, there were differences. In the case of Hungary, the differences in the service sector employment share between 2000 and 2008 or 2007 decreased (from 4.04% in 2000 to 3.33% in 2008). In the case of Slovakia, the differences were more visible and increased more than the EU-27 average (from 7.98% in 2000 to 10.24% in 2008).

The picture is clearly different in a comparison of the growth

Table 5.6 Growth rate of overall and sub-sector service sector employment between 2000 and 2008 (2007) in Hungary, Slovakia, and the EU-27 average

Types of services	Hungary (2008/2000)	Slovakia (2008/2000)	EU-27 average (2007/2000)
KIHS	6.1%	−6.7%	2.5%
KIMS	37.8%	64.4%	21.4%
KIFS	9.4%	28.2%	−4.5%
OKIS	0.3%	−13.3%	7.0%
KIS total	6.4%	0.9%	8.6%
Service total	6.1%	1.4%	1.0%

Note: See Table 5.5 for definitions of type of service.
Source: Eurostat Data Explorer (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes).

potential of the service sector in general and, especially, in its sub-sectors (see **Table 5.5**).

Looking at the growth rates of the overall service employment, in both post-socialist countries, but particularly in Hungary (+6.1%) and, to a lesser extent, in Slovakia (+1.4%), the growth rate between 2000 and 2008 (2007) was stronger than the EU-27 average (+1%).

By evaluating the employment growth between 2000 and 2008 by sub-sectors of KIS (or KIBS) services, a more nuanced picture may be obtained. The growth rate of the overall KIS in Hungary (+8.4%) was close to the EU-27 average (+8.6%), but it was much weaker in Slovakia (+0.9%). The employment growth in the KIHS was higher in Hungary (+6.1%) than the EU-27 average (+2.5%) and declined in Slovakia (−6.7%). In the KIMS, the employment growth rates in Hungary (+37.8%) and, especially, in Slovakia (+64.4%) were higher than the EU-27 average (+21.4%). Similarly, the employment growth rates in the KIFS, in Hungary (+9.4%), and, again, especially, in Slovakia (+28.2%) were significant, while, in the EU-27 (−4.5%), there was a reduction in employment. In the case of the OKIS, the employment growth rate was stronger in the EU-27 countries (+7.0%) and very weak in Hungary (+0.3%), and a significant decline was observed in Slovakia (−13.3%).

The improvement of economic performance was rather unequal in the very heterogeneous service sector. For example, such firm level performance indicators as gross value-added per capita, turnover,

export, profitability, and employment growth were higher than the average in the KIBS (Hamar, 2005) in comparison to the traditional and system firms.

The next section focuses on the research design and methods of company surveys carried out in the Hungarian (2008) and Slovakian (2008-2009) KIBS sectors on the diffusion of organizational innovations and the knowledge-development practices. Detailed empirical data on the diffusion of organizational innovation and the knowledge development practices of the firms surveyed are presented in the next chapter.

5.4 Research Design, Sampling, and Research Method

5.4.1 Organizational Innovation : A Neglected Area of Research

In relation with the innovation performance of the economy, there is an abundance of information on technologically related product and process innovation, especially, in the manufacturing sector (Schienstock and Hämäläinen, 2001). Since the 1980s, renewed interest has been registered to better understand, from both the theoretical and empirical perspectives, the complex, dynamic, and multi-level relationship between organizational development and innovation, especially in the KIBS sector (Lam, 2005; Salter and Tether, 2006). In this context, it is necessary to call attention to the similarities and differences of the organizational innovation and patterns of knowledge use between the KIBS and manufacturing firms. The literature dealing with service sector innovation can be classified into two contrasting schools of thought. First, a theoretical approach stresses the particular character of innovation in the service sector (e.g., the key role of organizational development, extensive use of an external knowledge source, higher priority of training, collective practice of knowledge development, interactive working practices, client-specific specialization, and generalized use of cooperative work) in comparison with the manufacturing sector (Leiponen, 2001; Leiponen, 2004; Salter and Tether, 2006; Toivonen, 2006). The second approach emphasizes the similarity of innovation in the service and manufacturing sectors and refuses black-and-white views (Pavitt, 1984; Evangelista, 2000; Miozzo and

Soete, 2001; Evangelista and Savona, 2003) on the sector's character of innovation.

In the Hungarian academic community, there is a scarcity of systematic research on organizational innovation in general and, especially, with regard to the KIBS sector. To overcome this deficiency, the Research Group of Sociology of Organization and Work at the Institute of Sociology of the Hungarian Academy of Sciences (Budapest) recently initiated desk-top research on the diffusion of organizational innovation and gathered empirical materials learned from its participation in several EU-funded projects[6].

This chapter and the next are a presentation of the first analysis of systematically collected company-level data with the objective of better understanding the diffusion and drivers of organizational innovation and the practice of knowledge development by comparing the KIBS sectors in Hungary (2008) and Slovakia (2008-2009).

5.4.2 Sample of the Company Survey and Sampling Method

The cross-country company survey was designed to collect systematic information on the innovation and learning practices of business service firms operating in Hungary and Slovakia[7]. There is no generally accepted definition for 'business service;' this category includes heterogeneous economic activities. In our study, based on screening of the literature and with the intention to produce internationally comparable data, the knowledge-intensive professional services offered for other companies are defined as 'business services,' such as IT services (both software and hardware), administrative and

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[6] In this respect, our involvement in the following projects is noteworthy : EU-funded projects : 'Work Organization and Restructuring in the Knowledge Society' (WORKS, Integrating and Strengthening the European Research Area—CIT3/CT/2005-006193, 6th FP, 2005/2009, 'Measuring the Dynamics of Organization and Work' (MEADOW—Priority 7 : Citizens and Governance in a Knowledge-based Society—028336, 6th FP, 2007-2010).

[7] Regarding the service sector, the following classifications were often used (Salter and Tether, 2006) : (a) traditional service (e.g., personal service), (b) system service (e.g., airlines and banking), and (c) KIBS. The main focus of our research is on activities classified under the KIBS.

Table 5.7 Share of KIBS firms by types of activities (NACE codes) in Hungary and Slovakia

(%)

Activity	Hungary	Slovakia
Accounting, finance, and legal services (NACE codes : K 66.1, Activities auxiliary to financial services, except insurance and pension funding; K 66.2, Activities auxiliary to insurance and pension funding; K 64.9, Other financial service activities, except insurance and pension funding; M 69, Legal and accounting activities; M 70, Activities of head offices; management consultancy activities)	20.9	22.7
Human resources management (NACE codes : N 78, Employment activities; P 85.5, Other education)	19.4	20.7
Technical engineering, consultancy (NACE codes : M 71, Architectural and engineering activities; technical testing and analysis; M 72, Scientific research and development)	25.2	18.5
Information- and computer-related activities (NACE codes : J 62, Computer programming, consultancy, and related activities; J 63, Information service activities)	21.9	21.6
Advertising, marketing, customer service, other services (NACE codes : M 73, Advertising, market research; M 74.3, Translation and interpretation activities; N 77.3, Renting and leasing of other machinery, equipment, and tangible goods; N 81.1, Combined facilities support activities; N 81.2.2, Other building and industrial cleaning activities; N 82.2, Activities of call centers)	12.6	16.5
Total	100.0	100.0

Source : The joint company survey.

legal services, financial services, and R&D[8]. **Table 5.7** contains the activities selected for the purpose of company surveys in both Hungary and Slovakia.

In the first quarter of 2008, according to the National Register of Economic Organizations compiled by the Hungarian Central Statistical Office, 4,049 companies with 10 or more employees were registered in the field of business services, while 2,714 were registered in Slovakia[9]. To design a statistically representative sample of firms, 200 companies

[8] For more details, see Makó et al. (2008).

[9] Bajzikova et al. (2009, pp. 5–6).

and 100 companies were selected from Hungary and Slovakia, respectively, using a multi-stage stratified sampling method. The basic economic activity of the firms classified by the NACE code (the statistical classification of economic activities in the European Community) was used as the stratification variable. This sampling method ensured equal chances for all companies belonging to the population surveyed to be selected in the sample and reflected the heterogeneity of the organizational population as well. The sampling frame was restricted for companies employing at least 10 persons; micro-firms were excluded because, according to previous research experiences, these firms are hardly available for surveys and also because the division of labor within these firms is rather underdeveloped, making it difficult to find and compare the forms of organizational innovation with other size categories of firms (Valeyre et al., 2009).

5.4.3 Structure of the Questionnaire and Characteristics of Data Collection

In designing the questionnaire, we created a 'benchmarking exercise' to review the Hungarian and international surveys dealing with various features of organizational innovation. Among other things, we have learned extensively from such projects as the Danish Innovation System in Comparative Perspective Survey (DISKO) carried out five times between 1993 and 2006 by the Aalborg University Business School, the Community Innovation Surveys (CIS) carried out six times by Eurostat, the Continuous Vocational Training Survey (CVTS) carried out in 1999 and in 2005 by Eurostat, and several Europe-wide surveys organized by the European Foundation for the Improvement of Living and Working Conditions (Dublin). Finally, in designing our organizational survey methods, the members of the international research team relied substantially on 'The MEADOW Guidelines', which "set out guidelines for collecting and interpreting information on both organizational states and organizational change. The guidelines are concerned with collecting data at the workplace and employee level providing relevant definitions and indicators for capturing general characteristics of organizations, such as the nature of authority relations and the method of coordination and control"

(MEADOW Consortium, 2010)[10].

In addition, designing the research tools of the Hungarian and Slovak company surveys, in 2007, the Research Group of Sociology of Organization and Work (Institute of Sociology) of the Hungarian Academy of Sciences launched a national survey to test concepts and questions measuring the diffusion of new organizational values or institutional standards in more than 500 industrial firms (Makó et al., 2007).

The questionnaire used in the company survey in both countries in the KIBS sectors was finalized after the pilot study, which aimed to test the validity of the questionnaire within the cluster of firms (N= 36) belonging to the Hungarian Outsourcing Association (*Magyar Outsourcing Szövetség*) comprising 'leading-edge' firms in the KIBS sector. The finalized questionnaire, composed of 43 questions, has the following four thematic sections :

(1) *General characteristics of firms* : This section contains a description of the architecture of the organization (e.g., length of operation and size), ownership, market structure, types of activities, and type of technology employed.

(2) *Composition of Management and Institutional Transfer of Business Practices* : This section includes a subsection on firms in which foreign managers are employed and an examination of the share of foreign vs. local managers, the recruitment practice of foreign managers, and the generic business functions occupied by them. In addition, this section indicates the degree of autonomy in the local subsidiaries in developing their business practices.

(3) *Diffusion and Drivers of Organizational Innovation* : In addition to mapping the differences and/or similarities of forms of organizational innovation, this section contains an examination of the degree of embeddedness of the ICT in the business practices in the sectors surveyed. Regarding the forms of organizational innovation, the drivers of innovation are also identified.

(4) *Characteristics of Knowledge Development Practice in the Firm* : In this section, the dominant combination of the required skills or competencies is identified. In assessing the training practices of

[10] MEADOW is the Measuring the Dynamics of Organization and Work Project funded within the 6th Framework Program of the European Commission DG Research. More information is available at : http://www.meadow-project.eu/.

the firms surveyed, we tried to understand not only the roles of the formal training and education in the skill formation of employees but the importance of the so-called on-site (*in situ*) learning. In addition, particular attention was given to the role of the various external knowledge sources in skill development.

5.5 Organizational Demography and Networking Activity of the Firms

The empirical outcomes are based on data collected during 2008 and 2009 company surveys that involved firms employing more than 10 persons in the KIBS sector in both Hungary and Slovakia. This section presents a preliminary descriptive statistical analysis of the survey results using variables such as ownership, company size, year of establishment, market structure, and company group membership (networking). In contrast, in the next chapter, the focus is on the diffusion of organizational innovation and the practice of knowledge development.

One-fifth (21.1%) of the firms in the Hungarian KIBS sector were incorporated (established) in the last four years, and one-fourth (24.7%), from 2000 to 2003. Only a tiny minority of the firms (6.5%) were established in the period of state socialism (i.e., before 1990). The peak year of the company establishment in the KIBS sector was at the beginning of the new millennium, when the growth rates of the firms were as follows : 9.8% in 2004, 7.2% in 2003, and 7.9% in 2000. A similar pattern of company creation was identified in Slovakia as well. The overwhelming majority of business service companies in Slovakia were established after 1990, and, as in Hungary, only a tiny share of them (6.5%) existed during the period of state socialism.

With regard to the ownership structure of the surveyed firms, in both countries, the domestically owned firms dominate. However, the share of foreign-owned firms is almost three times higher in Slovakia than in Hungary. Similarly, the share of mixed ownership is visibly higher in the Slovakia than in Hungary. The composition of firm ownership is shown in **Table 5.8**.

The KIBS firms are very young and dominated by domestically owned firms. However, in Slovakia, the share of foreign or mixed ownership is significantly higher than it is in Hungarian business service

Table 5.8 Ownership compositions of firms in the KIBS sectors

Types of ownership	Hungary (N=196)	Slovakia (N=97)
Domestic or national ownership	77.5%	52.6%
Foreign ownership	9.5%	26.8%
Mixed ownership	13.0%	20.6%

Source : The joint company survey.

sector firms. In summary, the majority of the surveyed firms, especially in Hungary, belong to the *de novo* segment (Martin, 2008) of the economy in both countries. They were created following the collapse of the state-socialist economy and are domestically owned.

Membership in a company group or company networking plays an important role in developing learning and innovation capacity of business organizations due to access to an extended and varied knowledge pool and facilitated knowledge sharing and transfer. Firms belonging to a company group tend to be more innovative than single firms. In this field, we found visible differences in the two countries. Company groups or network firms represent the minority of the Hungarian business service firms (18.2%), while, in Slovakia, every second firm surveyed (50.5%) is in this category. In addition, looking at the headquarters ownership, again, the differences are striking. More than three-quarters of the Slovak business service firms belong to groups located in 10 countries, the USA being the most frequent location (28.6%); the remaining 30% of firms have headquarters in Germany, UK, and the Czech Republic. An important percentage of the business service firms' headquarters (14.3%) were located in such countries as Austria, Ireland, France, Netherlands, and Slovenia. In the case of the Hungarian KIBS sector, domestically (or Hungarian) based headquarters dominate. The foreign headquarters are dispersed in 10 countries, and Austria is the dominant location for the company headquarters.

In relation with the important innovation generating impacts of company networking, the following empirical example is illuminating. According to the Danish innovation surveys (DISKO), manufacturing firms operating as a member of company groups, especially foreign owned groups, have visibly higher innovation activity than single firms (see **Table 5.9** for details).

Table 5.9 Product or service innovation in 1993-95 and/or 1998-2000 ownership/company group membership

	P/S innovation 1993-95 and 1998-2000	P/S innovation 1993-95 or 1998-2000	Not P/S innovation	*N*
Danish group member	33.1%	39.6%	27.2%	169
Foreign group member	51.0%	27.5%	21.6%	102
Single firm	22.2%	32.9%	44.9%	216
All firms	32.0%	34.1%	33.9%	487

Note : P and S denote product innovation and service innovation, respectively.
Source : Nielsen (2006, p. 42).

Table 5.10 Size of the firms in the KIBS sector

Size of the firms	Hungary (*N*=196)	Slovakia (*N*=97)
Small firm (9-49 persons)	78.7%	56.7%
Medium firm (50-249 persons)	16.6%	26.8%
Large firm (250 and over)	4.6%	16.5%

Source : The joint company survey.

Nielsen (2006) emphasizes that "single firms have the largest group of the firms with no product innovation in the periods surveyed. Danish group firms have the largest share of one-time innovators and foreign group firms have the largest proportion of firms with innovation in both periods. This distribution may be an indication of the importance of economic resources or international influence, and not least of the importance of the international or global dimension, on the propensity to innovate among firms" (p. 42).

Table 5.10 shows the size distribution of the surveyed firms. In both the Hungarian and the Slovak business service sectors, the share of small firms is high : almost four-fifths of the Hungarian KIBS firms are in this category, and, in Slovakia, slightly more than half. It is also noteworthy that there are three times as many large firms in the Slovak KIBS sector than in the Hungarian one. In addition, there are more Slovak companies in the medium category than in Hungary. Indeed, the Slovak KIBS firms are more balanced than those in Hungary.

In addition to size, we examined the organizational architecture of the firm. There is a consensus among management specialists on the impact of organizational levels separating the highest and lowest job positions on the flexibility and learning capacity of the firms. In both countries, slightly more than half of the business service firms (Hungary : 56.8% and Slovakia : 56.6%) have only one or no separate hierarchical levels. Besides this similarity in organizational architecture, the share of Hungarian firms with 2 or 3 hierarchical levels is slightly higher than that in Slovakia (38.1% vs. 29.9%). However, firms having 4 or more hierarchical levels represent a slightly higher share in the Slovak than the Hungarian KIBS sector (10.5% vs. 13.4%), which can be explained by a significant share of larger firms in the Slovak KIBS sector (16.5%) than the Hungarian one (4.6%).

Regarding the types of business services, similar basic patterns were identified. In relation with the scale of services, 'customer-tailored' solutions are dominant in both countries. However, in Hungary, they represent a visibly higher share of the services than in Slovakia. The standard solutions score minimally and have a roughly similar share in both countries. Similarly, the high value-added content of services is dominant in both countries, although it has a slightly higher share in Slovakia. The low value-added services represent less than one-third of all services in both countries. In addition, it is noteworthy that almost one-third of the Hungarian and Slovak firms produce exclusively high value-added services. However, a significantly higher share of the Hungarian firms than of the Slovakian firms does not offer high value-added services (14.4% vs. 3.1%, respectively). The composition of services by degree of standardization and value-added content is illustrated in **Table 5.11**.

During the survey, managers/owners were asked to locate their market share in relation to their primary and secondary markets. **Table 5.12** shows the geographical location of the firms' primary and secondary markets.

Although to a significantly different degree, the domestic product market is playing a crucial role in both countries. However, the domestic market as the primary market is playing a more important role for Hungary (94.7%) than for Slovakia (55.4%). The market structure is more balanced in the Slovak KIBS sector, where the international market (both primary and secondary) is playing a more central role

Table 5.11 Types of business services by value-added content

Characteristics of services	Hungary (N=196)	Slovakia (N=97)
Customer-tailored	83.7%	66.3%
Standardized	32.4%	33.7%
High value-added	65.8%	70.8%
Low value-added	32.8%	29.2%

Source : The joint company survey.

Table 5.12 Market distribution : Primary and secondary markets

Types of markets	Hungary (N=196)		Slovakia (N=97)	
	Primary market	Secondary market	Primary market	Secondary market
National market	94.7%	3.4%	55.4%	39.9%
EU-15 countries	10.5%	4.8%	22.8%	38.6%
New Member States (NMS)	6.5%	8.0%	23.3%	46.7%
North America	2.4%	1.5%	25.6%	16.3%
Russia and Ukraine	1.5%	1.5%	12.8%	29.8%
Asia	1.9%	2.3%	11.6%	25.6%
Others	1.5%	—	16.7%	12.5%

Source : The joint company survey.

than in Hungary. A higher share of Slovak firms is focusing on both the North American (25.6%) and the EU-15 (22.8%) markets than in Hungary. In other words, the Slovak firms are more internationalized than the Hungarian ones.

Chapter 6

Organizational Innovation and the Company Practice of Knowledge Use : Hungarian vs. Slovak Knowledge-Intensive Business Service Sector

6.1 Developing Typology of Organizational Innovation : A Brief Theoretical Overview

Europe's weakness in competitiveness compared to the US and Southeast Asia does not lie in basic research and R&D but in the low capability to transform research results into market advantage or, as Coriat (1995) notes, "it is in the process from scientific discovery and invention to innovation, and from innovation to the market" (p. 12). The missing link seems to be represented by those organizational and managerial practices that, on the one hand, are preconditions of innovative activities and, on the other, help organizations adapt to the technological changes. These practices are usually referred as 'organizational innovation'. This syndrome is the so-called "European paradox, i.e., the discrepancy between European scientific output and commercially successful innovations, and the low number of high growth companies (compared to the number of SMEs). (...) The Innovation Union Scoreboard (2010) discloses an unsatisfactory level of return on R&D spending, especially for public spending. As a matter of fact, too little policy focus has been put on hidden and non-technological innovation, especially in low tech industries and services" (Basset et al., 2011, p. 31). Organizational and technological innovations are in interaction. Even before the Second World War, Joseph Schumpeter (1934)

recognized the interrelatedness of various forms of innovation and went beyond that to focus exclusively on the technical side of innovation. In his view, technological and organizational innovations were interrelated, and Lam (2005) wrote that Schumpeter "saw organizational changes, alongside new products and processes, as well as markets as factors of 'creative destruction'" (p. 115). Schumpeter made a distinction among the five following types of innovation. That is : (1) new product; (2) new production methods; (3) new markets; (4) new sources of supply; and (5) new forms of organization.

Other innovation researchers, following the Schumpeterian intellectual heritage, are looking at innovation as "a complex phenomenon including technical (e.g., new products and new production methods) and non-technical aspects (e.g., new markets and new forms of organization) as well as product innovation (e.g., new products or services) and process innovation (e.g., new production methods or new forms of organization)" (Armbruster et al., 2008, pp. 644-645).

In spite of the abundance of literature on organizational innovation, there is no consensus among innovation researchers regarding the definition of 'organizational innovation.' In this respect, Lam (2005, p. 116) categorized the literature as follows :

(1) Organizational design theories deal primarily with relationships between structural forms and the capacity of an organization to innovate (Mintzberg, 1979; Teece, 1998);
(2) The organizational change and adaptation (development) theory is used to understand the ability of an organization to overcome the forces of stability (inertia) and adaptation/change in the context of a radical shift in its environment and technological setting. Innovation represents the capacity to answer or respond to the challenges created by radical shifts in an organization's external environment (Hannan and Freeman, 1984; Child, 1997);
(3) The third theoretical stream focuses on the micro-process level of how an organization understands the characteristics of knowledge creation and learning within an organization. This cognitive approach explains the interplay between learning and organizational innovation (Argyris and Schön, 1978; Amiable, 1988; Senge, 1990; Nonaka and Takeuchi, 1995).

Another perspective on organizational innovation is represented by Schienstock (2004), whose innovation matrix intends to integrate

Table 6.1 Typology of organizational innovation

Relations between the core components of the organization	Core components of the organization	
	Not changing	Changing
Not changing	*Incremental innovation* (e.g. participation of employees in quality control)	*Modular innovation* (e.g. cross-functional or interdisciplinary project team)
Changing	*Architectural innovation* (e.g. lean organizations)	*Radical innovation* (e.g. lean organization, project-based firms, PBF)

Source : Schienstock (2004, p. 18).

the key dimensions of organizational innovations. In Schienstock's classification attempt, one dimension of classification relates to the 'core' components of an organization, and the other refers to the changes in the 'relations' of the core components. Using these two dimensions, the matrix shown in **Table 6.1** describes the possible types of organizational innovation from both a static and a dynamic perspective.

In this perspective, the cumulative or incremental type of organizational innovation does not produce changes in the core components and in their relations within an organization. For example, job rotation and job enrichment belong to this type of organizational innovation. A modular version of organizational innovation, such as cross-functional project teams, changes the content of the core component of an organization but does not modify the relations between them. Contrary to the incremental and modular types of organizational changes, architectural innovation, for instance, the decentralization of responsibilities and decision making within an organization, may result in a significant shift in the existing balance of interest and power relations. Similarly, such radical innovation as the creation of project-based firms (PBF) may modify both the core components and their relations within the firms. In translating these major forms of innovation into the language of organizational learning, the incremental or modular forms of innovations require a single-loop or a first-level mode of learning, and radical innovation represents a double-loop or a second-level (holistic) form of organizational learning.

Armbruster et al. (2008), implicitly adopting Schienstock's (2004)

theoretical classification of organizational innovation, have developed an item-oriented typology of organizational innovation. In their definition of 'organizational innovation as the use of new managerial and working concepts and practices' (Armbruster et al., 2008, p. 646), the item-oriented typology of organizational innovation makes a distinction between structural and procedural organizational innovations and their intra-organizational and inter-organizational dimensions (using Schienstock's categories, the incremental and modular innovations are classified into the category of process innovation, and the architectural and radical innovations belong to the category of structural organizational innovation).

The item-oriented typology of organizational innovation, developed by Armbruster et al.(2008), is convenient to empirically measure (monitor) organizational innovation using organizational surveys. The groups of an 'item-oriented typology of organizational innovation' are as follows :

(1) *Structural organizational innovation*, which may modify the divisional structure of organizational functions, hierarchical levels, and information flow or, in general, the organizational architecture of the firm. This type of innovation requires changes in the existing status quo (and the related interest) and power relations within the organization ;

(2) *Procedural organizational innovation*, which may change the process and operation routines within the firms, such as improving the flexibility of manpower and the use of knowledge through the implementation of teamwork, just-in-time production systems (*Kan-Ban* in Japanese), or quality circles ;

(3) *Intra-organizational innovation* that is taking place within an organization ;

(4) *Inter-organizational aspects of innovation*, which refer to new organizational forms and processes that exist beyond the organizational border of the firm.

In our empirical study, our objective was to identify structural and procedural forms of organizational innovations and not to deal with their inter-organizational or network-type versions.

6.2 Diffusion and Drivers of Organizational Innovation

The Hungarian and Slovak company survey conducted in 2008-09 was designed to focus exclusively on intra-organizational innovation without the goal of covering new inter-organizational forms (e.g., project-based firms), which are beyond the scope of the individual firm's organization. Regarding the various forms of intra-organizational innovation, the diffusion of both structural and procedural organizational innovation was our primary interest. The following forms of structural and procedural organizational innovation were assessed by managers/leaders of the firms surveyed :

Ⅰ. Structural organizational innovation :
- Project-based work;
- Lean or flat organization; and
- Inter-professional (functional) working groups.

Ⅱ. Procedural organizational innovation :
- Quality-assurance or continuous improvement process (e.g., ISO, TQM);
- Collecting suggestions from workers;
- Teamwork[1];
- Benchmarking;
- Job rotation; and
- Delegation of quality assurance to workers (decentralization).

Among the organizational or managerial practices listed above, 'structural organizational innovation' is less often used than its 'procedural' version. This is not by chance, because structural organizational innovation affects both the 'core' components and their relationships within the organization. These types of changes require significant modification in the existing interest and power relations and more intensive participation in the collective learning of various actors. Successful procedural innovation can be carried out without a radical shift

[1] Both teamwork and job rotation are key components of lean production and 'high-performance work systems,' and the use of teams, in particular, has been the subject of many studies concerned with the impact of new managerial practices on enterprise performance and the quality of work, including worker satisfaction (Kyzlinkov et al., 2007).

Table 6.2 Diffusion of leading edge managerial practices in the KIBS sector

Types of organizational innovation	Hungary (N=196)	Slovakia (N=97)
I. Structural organizational innovation :		
Project-based work	34.8%	69.1%
Flat or lean organization	10.7%	13.4%
Inter-professional (inter-disciplinary) working groups	13.4%	36.1%
II. Procedural organizational innovation :		
Quality assurance and auditing systems (e.g., ISO and TQM)	21.9%	33.0%
Collecting suggestions from employees	49.7%	41.2%
Teamwork	41.7%	89.6%
Benchmarking	37.3%	21.6%
Quality control carried out by rank-and-file employees	23.7%	14.4%
Job rotation	9.7%	28.9%

Notes : The classification of different types of organizational innovation is based on the approach developed by Armbruster et al. (2008, pp. 646-647). See Section 6.2 for more details.
Source : The joint company survey.

in the core components and their relationships within an organization and requires rather limited collective learning activity from the actors concerned.

It is clear from the empirical data collected from our joint company surveys that strong differences are characterizing the diffusion of organizational innovations in the Hungarian and Slovak knowledge-intensive business service (KIBS) sectors. For example, such forms of structural organizational innovation as project-based work, lean organization, and inter-professional working groups are more widely used in Slovak than Hungarian company practices.

In the case of the diffusion of procedural organizational innovations, the contrast between the two countries diminishes. Teamwork, quality management, and, particularly, job rotation are more often used in Slovak than Hungarian firms. However, in Hungarian firms, in comparison with the Slovak practice, the quality circles, benchmarking, and collecting suggestions of employees are more prevalent (**Table 6.2**).

In mapping the diffusion of organizational innovation, in addition to grouping nine forms of organizational innovation into 'structural' and 'procedural' categories, we used the four larger classes of organi-

zational innovation listed below :

(1) New methods of *organizing work* (i.e., employee suggestions, teamwork, job rotation, and lean organization);
(2) Creating *new methods to renew external relations* (networking)[2] with other firms and public institutions;
(3) Implementing *new business practices*[3] that have an impact on the organizational and labor process; and
(4) Introducing *new knowledge management methods* to improve the quality of information processing and facilitate knowledge sharing.

There are visible differences in the Hungarian and Slovak company practices in the KIBS sectors. In the case of Slovakia, the share of firms implementing new business practices and new methods of knowledge management is higher than that in Hungary. In this relation, it is noteworthy that a key challenge for the high-quality knowledge management (KM) in the KIBS firms is the codification and formalization of the working experiences of project-level learning into organizational knowledge.

In this context, several options are available. As Salter and Tether (2006) reported, "in order to help ameliorate some of these problems and to increase the effectiveness of their project performance and knowledge sharing between projects, professional service firms have invested considerable resources in knowledge management (KM). This approach to KM varies, with some organizations investing heavily in technology to capture knowledge through documentation and data, and others introducing cultural change initiatives to encourage knowledge sharing within organization. These KM systems include electronic networks of practice, expert yellow pages, communities of practice, project repositories, searchable internal records, images libraries, and mentoring. They are an important part of the infrastructure supporting innovation in professional service firms, allowing them to capture knowledge from past projects and use this knowledge in the future projects" (p. 16).

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[2] The content of external relations or networking was as follows : alliances, partnerships, and delocalization of business functions.

[3] The new business practices covered activities such as supply change management, reengineering business process, learning organization, renewal education, and training system.

Table 6.3 Diffusion of bundles of organizational innovation in the KIBS sector

Types of organizational innovation	Hungary (N=196)	Slovakia (N=97)
New business practices for organizing work or procedures (i.e., supply chain management, business re-engineering, lean production, quality management, education/training systems, etc.)	26.1%	44.3%
New methods of workplace organization for distributing responsibilities and decision making (i.e., first use of a new system of employee responsibilities, teamwork, decentralization, integration or de-integration of departments, etc.)	39.3%	40.3%
New methods of organizing external relations with other firms or public institutions (i.e., first use of alliances, partnerships, outsourcing or sub-contracting, etc.)	29.9%	29.9%

Note : Multiple answers.
Source : The joint company survey.

The rate of diffusion of new methods of organizing work and creating new methods to renew external relations of the firms are similar in both countries. **Table 6.3** provides more details of the survey results on this matter.

To compare organizational innovations from a wider or European perspective, it would be worthwhile to use some results from the Community Innovation Survey (CIS) 2008. There are differences in the two countries in terms of the diffusion of different types of organizational innovations with respect to all economic sectors. As the data presented in **Table 6.4** indicate, 20.1% of Slovak firms implemented some form of organizational innovation in 2008, while this share remained 14% for Hungarian firms. The ratio of implementation of new business practices and new methods of workplace organization is about 5% higher in Slovakia than in Hungary, while the use of new practices for organizing firms' external relations is prevalent to the same extent in both countries.

After identifying various forms of organizational innovation, the respondents were asked to assess the drivers of implementation of the new organizational concepts and practices. In both countries, the most important driver is the improvement of the efficiency of daily operations. This factor is followed by the motives to renew the existing knowledge base, adapting to environmental changes, strengthening cooperation within an organization, improving quality and customer

Table 6.4 Diffusion of different types of organizational innovations in Hungary and Slovakia

Types of organizational innovation	Hungary (N=196)	Slovakia (N=97)
Implementing some form of organizational innovations	14.6%	20.1%
In detail :		
New business practices for organizing work or procedures (i.e., supply chain management, business re-engineering, lean production, quality management, education/training systems, etc.)	9.5%	14.8%
New methods of workplace organization for distributing responsibilities and decision making (i.e., first use of a new system of employee responsibilities, teamwork, decentralization, integration or de-integration of departments, etc.)	9.7%	14.0%
New methods of organizing external relations with other firms or public institutions (i.e., first use of alliances, partnerships, outsourcing or sub-contracting, etc.)	7.0%	7.7%

Source : The joint company survey.

service, and increasing the size of the firms. Surprisingly, the outsourcing or delocalizing business services received the lowest assessment among the driver of organizational changes in both countries. It is noteworthy that such drivers of organizational changes as the renewal of product and services, the renewal of existing knowledge, the increasing size of the firm, and, especially, the outsourcing of business functions play weaker roles in Slovak company practices than in Hungarian ones (**Table 6.5**).

Finally, regarding the drivers of organizational innovation, the main reasons for the lack of organizational innovation are presented in **Table 6.6**. In the case of Hungary, an important percentage of the firms (43% and 12.4% in Slovakia) carried out organizational changes before the reference period (2005-2007) ; therefore, no further efforts were necessary to modernize the organizational practice. In addition, one-third of the Hungarian and only one-tenth of the Slovak firm representatives said that, even in the reference period (2005-2007), there was no need for organizational innovation.

In the literature dealing with technological and organizational changes, resistance of employees/managers and skill shortage are frequently reported as constraints for these changes. It is noteworthy that, in the present study, such factors were reported by a small frac-

Table 6.5 Driving forces behind important organizational changes in the KIBS sector

Drivers of organizational changes	Hungary (N=196)	Slovakia (N=97)
Improving daily work efficiency	73.9%	67.0%
Strengthening cooperation within the firm	61.5%	53.6%
Adapting to environmental changes	62.8%	62.9%
Renewal of product and services	54.3%	36.0%
Renewal of the existing knowledge base	63.5%	33.0%
Outsourcing business functions	36.8%	16.5%
Improving quality and customer service	65.9%	44.4%
Increasing the size of the firm	42.5%	37.2%

Note : Drivers of organizational changes were assessed by managers on a 5 point-scale, where 1 = the least important and 5 = the most important factor.
Source : The joint company survey.

Table 6.6 Reasons for the absence of organizational innovation in the KIBS sector

Factors responsible for the lack of organizational innovation	Hungary (N=196)	Slovakia (N=97)
No need for organizational innovation from 2005 to 2007	33.0%	10.3%
Implementation of organizational innovation before 2005-2007: since then, no need for further changes	43.0%	12.4%
Lack of financial resources	6.9%	6.2%
Skill shortage	6.9%	6.2%
Resistance of employees and managers to change	5.4%	7.3%

Note : Employers interviewed assessed these factors on a 5 point-scale, where 1 = least important and 5 = most important with regard to the absence of organizational innovation.
Source : The joint company survey.

tion of the respondents, and they attributed the problems to a shortage of financial resources.

Due to the fact that the KIBS service sector is characterized by one of the most important concentrations of the so-called 'knowledge workers,' particular attention was given in the company survey to the sector-level distribution of such forms of organizational and contractual innovations as 'part-time employment,' 'working time flexibility,' 'mobile work,' and 'home-based telework.' The data summarized in

Table 6.7 Tools to improve the flexibility of manpower and knowledge use in the KIBS sector

Forms of organizational and contractual innovation	Hungary (N=196)	Slovakia (N=97)
Part-time employment	36.1%	58.8%
Flexible working time arrangement	26.1%	76.3%
Mobile work	15.6%	39.2%
Home-based telework	15.4%	51.5%

Source : The joint company survey.

Table 6.7 indicate that these forms of organizational innovation are better integrated into Slovakian than Hungarian employment and working practices.

6.3 The Practice of Information and Communication Technology (ICT) Use in the Firm

It is a commonly shared view among scholars of organizational innovation that, since the last decades of the 20th century, the term 'knowledge economy' has become a catch phrase for identifying new trends of development. This shift was attributed in the pattern of economic development to the forces of globalization and the growing use of information and communication technology (ICT). According to Ramioul et al.(2006), in contrast to previous technological changes(e.g., automatization)and due to its integrative character, ICT represents an 'organizational technology' that offers to the actors concerned exceptional opportunities to shape the division of labor and the practices of knowledge use. Nielsen (2006) added that, during the so-called 'take-off' period of the ICT in the mid-1980s, "the more narrow rationalization phase dominated up to the end of eighties; than in the early nineties a more organic, pervasive and information-oriented approach to the use of ICT started to emerge. The importance of thinking new ICT into, as an integrative part of, new managerial and organization forms became more widely recognized. Even though rationalization was still an important function, information and communication came to be seen as more and more important functions" (pp. 15-16).

As did Nielsen (2006), we are calling attention to the use to varying degrees of ICT in the everyday working and management prac-

Table 6.8 Use of ICT by function and location in the business process in the KIBS sector

Function/location of business process	Hungary (N=192)	Slovakia (N=97)
Information processing and communication	68.7%	42.9%
Rationalization of labor process and reengineering company development	34.3%	29.3%
Development activities (e.g., development of knowledge base)	44.9%	27.8%

Source : The joint company survey.

tices of the firm. It is widely known that ICT is crucial in the everyday life of a firm, especially in the service sector[4]. ICT is implemented and used in a multitude of functions, such as information processing and communication, and in different fields of a firm's activity, such as routine production, research, and development within the business process. The goal of our survey was to identify the functions in which ICT is employed in KIBS firms in both countries. A crucial role of ICT in the organizational changes or, more precisely, in the diffusion of organizational innovation is widely supported by the results of a recent international study on the restructuring of the value chain in both the manufacturing and service sectors (Flecker et al., 2008). According to our experience, ICT is more extensively used in the KIBS than in the manufacturing sector. This could be explained by the fact that "ICT process innovation is often a necessary prerequisite for the service innovation in this industry" (Nielsen, 2006, p. 56).

Table 6.8 indicates that ICT is used more extensively in Hungarian than in Slovakian company practices. This is especially true in such basic functions as information processing and communication. In addition, in the development activities, which are emblematic fields for the deeper and more extensive use of ICT, Hungarian firms are again in a better position than Slovakian business service firms.

[4] For example, in the U. S. A., more than 70% of the ICT equipment is purchased by service companies. The selection, implementation, and integration of this technology are key factors in their business success (Chesborough and Shphrer, 2006).

6.4 Knowledge Use Practice in Comparison : Dominance of the Experience-Based Competence Development

In this section, we examine knowledge development practices of the firms investigated. In our interpretation, organizational learning indicates "the capacity (or process) within an organization to maintain or improve performance based on experience. This activity involves knowledge acquisition (the development or creation of skills, insights, relationships), knowledge sharing (the dissemination to others of what has been acquired by some), and knowledge utilization (integration of the learning so that it is assimilated, broadly available, and can also be generalized to new situations" (DiBella et al., 1996, p. 363). There is a strong interplay between innovation and the learning process within the organization, and, in this respect, it is noteworthy that the complementary character of the formal education and experience-based learning is as Nielsen (2006) summarized : "To make learning complete and sufficient, with the innovative mode in focus, it is necessary to combine experience-based and reflective learning with the new knowledge achieved from formal training and education. Only in this way does learning become both knowledge-based and experience-based, and may evolve dynamically in the context of the organization" (p. 117).

Skill development and formal training are important preconditions for innovation. However, what really matters is the ability of a person to mobilize his/her qualification in a real job situation. "While qualifications are individually adopted characteristics, built into and carried out by a person, competence as a concept has to do with specific job situations and assignments, and concerns the capacity of an employee to use his or her qualifications in the job situation. (…) In line with this definition, *competence development* as a concept in this context will be defined as continuous development of experiences, skills, influence, possibilities and responsibilities, related to the job situation, tasks and context of the employees" (Nielsen, 2006, p. 124).

Prior to describing the knowledge development practices of the firms surveyed, we identified the types of knowledge and skills required by the employers. The most important types of knowledge evaluated by the employers interviewed in both countries are as fol-

lows :

(1) Professional-technical skills (Hungary : 93.7% ; and Slovakia: 98.1%) ;
(2) Reliability in work (Hungary : 97.5% ; and Slovakia : 89.1%) ;
(3) Customer-centered attitude (Hungary : 90.3% ; and Slovakia : 86.5%).

Evaluating the importance of the various methods of knowledge development in the firm, the following classification was used :

(1) Participation in formal education;
(2) Competence development; and
(3) Improving social skills[5].

In both countries, such forms of experience-based ('on-site') knowledge or competence development as 'consulting with management/other employees' and 'on-the-job training (OJT)' play more important roles than participation in formal education (e.g., participation in courses/educational schemes and involvement in further training tailored for the needs of the firm)[6]. In spite of this common pattern, it is noteworthy that formal training (e.g., standard educational schemes and further training) plays a relatively more significant role in the Slovak business service firms than in the Hungarian ones.

The importance of training aimed to improve the social skills of employees (e.g., motivation of cooperation between various organizational units and teamwork) is between 'competence development' and 'participation in formal education.'

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[5] Besides the briefly presented classifications of knowledge preconditions for learning or innovative organization, another strand of the labor process school makes a distinction between 'learning as acquisition' and 'learning as participation.' According to Felstead et al. (2010), the former refers to a conceptualization, which views learning as a product with a visible, identifiable outcome, often accompanied by certification or proof of attendance. The latter perspective, on the other hand, views learning as a process in which learners improve their work performance by carrying out daily activities. This distinction is similar to the distinction between 'formal education' and 'competence development.'

[6] According to the experiences from a project conducted in 13 European countries on outsourcing software development in leading IT firms, only 10% of training activities were based on a training program, and the remaining 90% were based on OJT (Flecker et al., 2008, p. 57).

Table 6.9 Methods of knowledge development in the KIBS sector

Methods of knowledge development	Hungary (N=196)	Slovakia (N=97)
Ⅰ. Participation in formal education :		
Standard courses/educational schemes	45.5%	60.4%
Further training designed according to the needs of the firm	64.3%	69.6%
Ⅱ. Experience-based learning or competence development :		
Consulting with management/other employees	80.3%	75.5%
On-the-job training (OJT)	74.1%	70.3%
Attending professional fairs and expositions	67.5%	44.3%
Job rotation	31.1%	40.1%
Ⅲ. Improving social skills :		
Supporting cooperation between organizational units	62.6%	63.3%
Teamwork	57.1%	74.0%

Source : The joint company survey.

In both countries, 'consulting with managers and other employees' and 'on-the-job training' (or 'learning by participation') were more often used as tools of knowledge development than 'participation in formal training' (or 'learning by acquisition'). In addition to this common pattern of knowledge development, we identified slight differences as well. Such sources of experience-based learning as 'attending professional fairs and expositions' are playing more important role in Hungary than in Slovakia; however, 'job rotation' is organized more frequently in the Slovak business firms than in the Hungarian ones. In relation with the development of social skills, the cooperation between organizational units has a similarly important role in both countries, but teamwork as a widely recognized source of social skill development is more widely used in the Slovak business service firms than in the Hungarian ones. In **Table 6.9** the methods of knowledge development in company practices are illustrated.

6.5 Company Training Practice : More Training and Stronger Reliance on the External Knowledge Sources in Slovakia than Hungary

While the former section focused on the identification of various forms of knowledge development (i.e., participation in formal education, experience-based learning, and improvement of social skills), this sec-

tion focuses on the issue of company in-house training practices and the role of external knowledge sources.

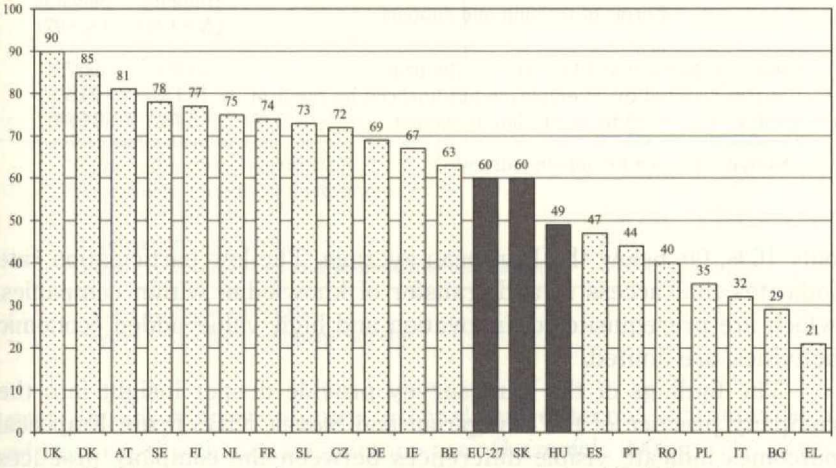
According to the data stemming from the European Continuing Vocational Survey 2005 (CVTS)[7], European countries vary remarkably in terms of their company training practices (**Figure 6.1**).

As **Figure 6.2** indicates, on the average, 60% of European companies provided formal and/or informal training courses to their employees in 2005. The UK, the Nordic countries (Norway, Denmark, Sweden, and Finland), and some continental countries (Austria and the Netherlands) have the largest share of training providers. Among the post-socialist countries, Slovenia, the Czech Republic, and Estonia are in a better position than the EU average. Romania, Latvia, Poland, Italy, Bulgaria, and Greece lag far behind the EU average. Slovakia performs around the average, while Hungary is in a weaker position (49%). These data, however, should be interpreted carefully, since there are large differences between the given national institutional contexts of education and training systems (e.g., in the UK, firm-specific company training plays an important role in the vocational training system, which is not the case in France or in most of the post-socialist countries).

If we broaden the scope and take not just the proportion of companies that provide training but also the percentage of the employees participating in training activities into consideration, the picture becomes more complex. Approximately every third employee participated in company training in Europe in 2005; there are, however, remarkable differences among the European countries. In the Czech Republic, almost 60% of all employees participated in training courses, and Slovenia, Ireland, Luxembourg, France, and Sweden also performed far above the EU average in this respect. Romania, Hungary, Bulgaria, Latvia, Lithuania, and Greece are in the worst position within the EU-27. In Slovakia, 38% of all employees took part in formal and/or informal company training, while this proportion in Hungary was

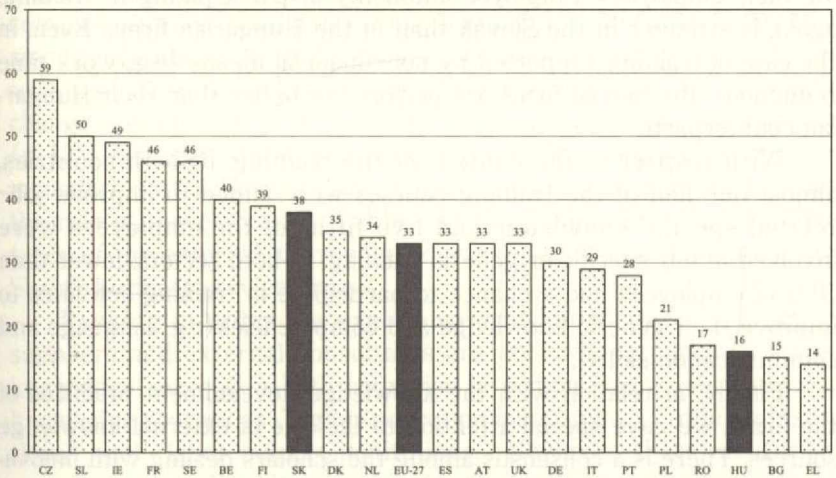
[7] The Continuing Vocational Training Survey is a European Union-wide representative employer survey on vocational training practice of the European enterprises and carried out by Eurostat. The survey data is available at : http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary : Continuing_vocational_training_survey_ (CVTS).

Figure 6.1 Distribution of enterprises providing training courses in % of the all enterprises by European countries, 2005



Notes : Training courses include both formal and informal trainings. EU-27 includes Norway.
Source : Authors' illustration based on the Continuing Vocational Training Survey 2005.

Figure 6.2 Percentage of employees participating in continuing vocational training (CVT) courses by European countries, 2005



Note : CVT courses include both formal and informal trainings.
Source : Authors' illustration based on the Continuing Vocational Training Survey 2005.

Table 6.10 The rates of company-supported training

Forms of training and support	Hungary (N=196)	Slovakia (N=97)
Courses organized and financed by the firm	31.2%	50.7%
Courses selected by an employee but financed by the firm	16.1%	24.5%
Courses supported by work time reduction	5.4%	10.8%

Source : The joint company survey.

only 16%, far below the European average. The low participation rate indicates that access to and transfer of knowledge within companies, which are prerequisites of innovation and high-value-added economic activities, are limited.

The findings of the joint survey provide deeper insight into the company practice of the Hungarian and Slovak KIBS firms. Empirical outcomes indicate visible differences between the company practices of the two countries. As shown in **Table 6.10**, in the Slovak business service firms, every second employee (50.7%) participated in a training course organized and financed by the firms (in 2007). In the Hungarian case, less than one third of the firms organized and financed training for their employees. Employee autonomy in participating in training, again, is stronger in the Slovak than in the Hungarian firms. Even, in the case of training supported by non-financial means (e.g., work time reduction), the Slovak firms are performing better than their Hungarian counterparts.

With respect to the content of the training, in both countries, almost one half of the training courses were aimed to improve job-related specific knowledge and two-fifths of the employees were involved in job-specific or general training. In both sectors, fewer than 10% of employees had a chance to participate in training activities to improve their generic knowledge and competencies (e.g., language and communication skills).

Finally, in relation with the knowledge development practices of the firms, we gave special attention to the role of external knowledge sources. There is a consensus among the scholars dealing with innovation that organizational differences in generating innovation are intimately related to the absorption or to the dynamic capabilities of companies. "The dynamic capabilities indicate the 'firms' ability to inte-

Table 6.11 External sources of knowledge development in the Hungarian and Slovak KIBS firms

External knowledge sources	Hungary (N=196)	Slovakia (N=97)
Customers	79.2%	61.9%
Suppliers and service providers	62.1%	59.8%
External consulting	54.2%	68.0%
Higher educational institutions	27.4%	55.7%
Educational (training) institutions	29.0%	66.0%
Research institutes	19.7%	28.9%
Development agencies	26.5%	23.7%
Labor market agencies and professional associations	25.9%	43.3%

Note : Multiple answers.
Source : The joint company survey.

grate, build, and reconfigure internal and external competences to address rapidly changing environments" (Lazonick, 2006, p. 33). In relation with the particular importance of external knowledge in the radical innovation generation processes within the KIBS sector, Salter and Tether (2006) stressed that "radical innovations in these industries will typically involve changes more than one of the triumvirate of the employees' division of labour, technologies, and organization, as their complex intertwining can create powerful barriers to innovation among incumbents. Outsiders and newcomers are therefore the main source of more radical innovation. When incumbents do initiate the change (...) this is typically through a new and separate organisation" (p. 13). Identifying the importance of the external knowledge sources, managers participating in the company surveys were asked to assess the role of these sources. **Table 6.11** is an illustration of the importance of the external knowledge sources used by the Hungarian and Slovak business service firms.

Ranking in order the experience and knowledge of customers, suppliers and external consultants are the most important external knowledge sources in both countries in comparison to such external knowledge sources as 'higher education institutions,' 'training institutions,' and 'labor market institutions.' However, these institutions, especially educational (training) institutions and labor market agencies, are still playing a more important role in Slovak than in Hungarian company practices. Other factors (e.g., R&D expenditure, access to a

highly educated and skilled population, and quality of institutions) need to be included to better understand the systematic prerequisites for the knowledge-based growth in the countries investigated (Veugelers, 2010). However, the relatively stronger reliance on the variety of external knowledge sources in the Slovak KIBS than in the Hungarian ones indicates the Slovak KIBS firms' better innovation and learning potential.

In the KIBS sector, the various forms of external knowledge sources are fulfilling a more important role than the aggregated national data. As Basset et al. (2011) emphasize, "15 out of 29 European countries, the most common form of cooperation reported is with suppliers. In addition, 20 percent of innovative enterprises cooperate with their clients or customers. This average rate hides great discrepancy between EU countries : in Spain only 4 percent of enterprises with innovative activities collaborate in these ways, while in Finland the figure is 41 percent. (…) Apart from Finland, most EU countries show very low percentages (less than 15 percent on average for cooperation with higher education and less than 10 percent for cooperation with government or public institutes). More enterprises cooperate with consultants, commercial labs or private R&D institutes (e.g. KIBS)" (pp. 21-22).

Part Ⅳ

Industry Cluster and Economic Development

Chapter 7

Emergence and Development of Industry Clusters: Searching for a 'Critical Mass' of Business via Cluster Mapping

7.1 Introduction

Industry clusters (ICs) have attracted much attention in the recent past. Besides the ever-growing academic interest, ICs have become primary targets of development policy. Various documents of the European Commission (EC) have expressed strong confidence in ICs as exceptionally suitable drivers of economic growth, innovation, and competitiveness (EC, 2003; EC, 2008a; EC, 2008b). National governments and EC-supported policies were designed to promote the process of clustering and the establishment of cluster organizations. Another important string of literature and policy practice is foreign direct investment (FDI) attraction and the development of local linkages (for example, supplier networks) of foreign investment enterprises (FIEs). Both structures, ICs and widespread supplier networks, have common features. Most importantly, both need a sufficient number of potential collaborators. Both can be developed most successfully in regions where economic activity is vivid and enterprising and cooperation have traditions. It is therefore of special interest to learn what should and could be the relationship between the two cooperation systems, what are their common features, and what are the differences?

Agglomeration of economic activity is a phenomenon that is as long as human history. Centers of active and vibrant economic devel-

opment and welfare have attracted various businesses for centuries. As early as the work of Alfred Marshall (1890), there has been an awareness of the importance of geographical proximity in determining the location of industrial activity. Marshall argued that clusters develop as a consequence of three factors: (a) the presence of a skilled local labor market; (b) key inputs from suppliers; and (c) rapid know-how transfer between firms, leading to technological spillover. Hence, regional concentration is not a new phenomenon. What is then new in clusters?

The industrial clustering work by Michael Porter (1990; 1998; 2003) is regarded as seminal. He emphasized that firm competitiveness was determined by multiple factors only partly endogenous to them. In his 'diamond model,' four sets of interrelated forces are introduced to explain industrial dynamics and competitiveness. These are associated with factor input conditions, sophisticated local demand conditions, related and supported industries, and firm structure, strategy, and rivalry. A core notion arose around his model, stressing that a collaborative, mutually supportive group of actors could enhance regional competitiveness in global markets and, thus, create growth and other benefits. In addition, the significance of face-to-face contacts and personal demonstration, exchange of experience, and role of geographical proximity for knowledge transfers and innovation has been explored and emphasized. Another string of related economic thought elaborated on knowledge creation and innovation as a social process engaging individuals that exchange tacit and explicit knowledge. Trust-based relationships and social capital may, thus, be important for enabling horizontal cooperation between individuals within and across firms and institutions (Saxenian, 1994; Pouder and St. John, 1996).

ICs are spatial concentrations of business and related institutions with activity specialization and active cooperation linkages among cluster members[1]. IC activity may be facilitated by cluster organiza-

[1] Michael Porter's original definition for clusters is as follows : "Clusters are geographic concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (Porter, 1990, p. 199). The main aim of this cooperation is enhancing the competitiveness of regions and actors in the

tions (cluster initiatives). Nevertheless, the latter are institutions rather than an economic phenomenon, and we make a clear distinction between them. The essence of ICs is member cooperation, and the main benefits that they obtain stem from joint actions. FIEs may also benefit from cooperation with ICs related to their core activity. Nevertheless, the linkage is more often the opposite. Local companies and, more importantly, governments promote joint actions sometimes organized as ICs in order to facilitate cooperation with FIEs. One of the main FDI-related policy aims is to promote their embeddedness into local economic environments and loosen their island-like appearance in the host economy. Developing local linkages, however, requires actions from both sides of the FIEs and the local firms. Governments usually have greater influence on local small and medium-sized firms and can better facilitate their efforts to become suppliers of FIEs. An interesting new tool in this effort is cluster promotion and their potential role in facilitating FIE local supplier networks[2].

For the study of cluster emergence and their further development, the Hungarian experience has potential to be taken as the best laboratory case in the context of transition economies. It is well-known that Hungary has been a leader among Central European states in terms of the total accumulated FDI inflows during the early 1990s. As argued in Chapter 1, this vast influx of foreign capital formed a mega economic sector of FIEs within the country. As discussed later, there is considerable room for the development of production networks between incoming multinational enterprises (MNEs) and local companies (Acs et al., 2007). Nevertheless, it is also true that the business activity of FIEs has taken greater root in local communities and their alliance with indigenous companies, especially in manufacturing and service industries, has achieved larger scale and depth through parts supply and outsourcing than before. This recent progress is empirically supported by our studies, which confirmed the positive and statistically significant FDI spillover effects on the productivity and export propensity of domestic firms for the early 2000s (see Chapter 3 and 4 in this book). As a result, newly emerged clusters of

region.

[2] For more details on supplier network promotion programs in Hungary, see Sass and Szanyi (2004), ICEG (2006), and Sass et al. (2009).

FDI-led businesses can now be observed in many regions, which gives us the opportunity to examine the determinants of cluster development and its possible impact on the national and regional economy in Hungary.

We can approach ICs on different levels. Since the co-location of business in close geographical proximity is an organic development, we can focus on a real economic clustering process, i.e., how spatial concentrations of certain activities evolve or show up at a given time of observation. This is important, since benefits of close cooperation among firms are expected to arise when cooperating agents exceed a certain number, the 'critical mass[3].' We can make observations using statistical analysis of activities on the local level. First, such an extensive 'cluster mapping' exercise was carried out in the US by Michael Porter's team at Harvard Business School (HBS). Since then, several similar calculations were made using Porter's original method. In this chapter, we review previous mapping exercises and report our own results for Hungary.

The remainder of this chapter is organized as follows : Section 7.2 briefly summarizes the existing literature on the relationship of supplier networks and cluster development in Hungary. Section 7.3 deals with measuring the regional density of economic activity using Michael Porter's measurement idea, the cluster mapping methodology. In this section, we introduce the results of previous mapping exercises as well as our own research results, which were based on a modified measurement method that expanded the number of measures and refined the database in geographic terms. Section 7.4 performs cluster mapping using the census-type data of Hungarian firms. Section 7.5 concludes.

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[3] One main precondition of a successful cluster operation is the presence of a fairly large and diverse pool of economic agents specializing in similar or supportive activities. The sufficiently large specialized local economic activity is crucial for knowledge generation and transfer, for the internal stability of cluster organizations, for the visibility of clusters, and for the self-sustaining development of cluster activities. For more general descriptions and various interpretations of the cluster concept, see Porter (1998), Sölvell et al. (2003), ICEG (2007), EC (2008b), Sölvell (2008), and Szanyi (2008b).

7.2 Supplier Networks and Cluster Development in Hungary

ICs are flexible production platforms with some kind of activity specialization. Cluster operation can be targeted directly to consumer markets but also to supplies of specific intermediate products. In some cases, ICs are organized as an alliance of equal parties (i.e., firms with similar size and importance). In other cases, an organization is more satellite-like, and there is one or a few large companies that determine cluster activities according to their input demands. In this latter case, cluster participants and activities are organized in order to enhance the competitiveness of the whole value chain, on top of which there usually are western large-scale MNEs. It is important to emphasize that FIE-centered ICs may work properly only on the basis of mutual benefits. Cluster cooperation, which is largely sponsored by the FIE, must bring benefits for suppliers in terms of technological up-grading, market access, and sometimes even financial support. The benefits of FIEs may range from access to less expensive and flexible local supplies to a better labor force pool and technology assistance.

The essence of ICs is the mutually beneficial co-operation of various economic actors. Hence, true ICs expand beyond the mere FIE supplier networks. They include non-business participants, and their activity goes beyond the technical organization of supplies. Most common is the technology and knowledge transfer to facilitate the technical and managerial capabilities of small suppliers. There is also financial support to undertake necessary investments. However, in this type of cooperation, there is relatively little emphasis on innovation and technological cooperation, at least for the time being.

FIEs may also be important players in the innovation process of ICs. They were always regarded as primary sources of technology to the host transition economy. Whenever their local involvement increases, interfaces of technological spillovers also widen. Hence, ICs may serve as good platforms of knowledge transfer between FIEs and local actors. The concept of dynamic clusters[4] emphasizes innovative

[4] Sölvell et al. (2003) ran the first major questionnaire-based empirical survey on cluster organizations worldwide. Using the survey results, they described a

cooperation among partners rather than one-way transfers of knowledge. It is not self-evident that FIE strategies exceed the technical minimum of knowledge transfer towards suppliers. Their links to local universities or research laboratories also depend on many factors that are independent from cluster policies (Sass and Szanyi, 2004b).

MNEs are desired participants of ICs (Sölvell et al., 2003). They may support cluster development in several ways. They are in direct contact with world markets and can potentially bring breaking news to the cluster first-hand. Through their widespread international linkages, these companies may support international activities of the cluster and smaller cluster members. They may even lobby for their partners' interests. Another potential support area is technology. MNEs usually have cutting-edge technology and are able to provide technology and knowledge transfer to strategic partners. In the case of stable supplier contacts, technology transfer and support to enable small firms to become suppliers are rather usual. The intensity of such linkage very much depends on the level of MNEs' inclination for supplier network development with nationality, global strategy as perhaps the strongest determinants of this inclination. Another technology-related area is R&D. One of the essential cluster functions, especially in the case of dynamic clusters, is knowledge generation and distribution within the ICs. Should there be intensive R&D linkages within the cluster members, including research institutions and universities, it is likely that also MNEs will participate in this collaboration. Related to knowledge generation is training and education. This is also based on cooperation of heterogeneous partners, also including MNEs.

We believe that, at least for the time being, emerging market economies do not offer strong conditions for knowledge-based dynamic clusters or innovation systems that could provide strategic

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typical or best-practice cluster type : the most common appearance of clusters. Because of the overrepresentation of clusters from developed market economies, this model, which they called a dynamic cluster, basically reflected those characteristics, cooperation forms, and structures that were found to be typical in more developed economies. Later research, including Ketels and Sölvell (2005) and Ketels et al. (2006), revealed the fact that, in emerging market economies or developing countries, clusters may substantially differ concerning their focus of activity and working models.

innovation inputs for MNEs, though many of them possess strong innovation communities that could potentially serve as a knowledge-generating network with international importance. Thus, it is highly likely that the interest of MNEs in developing deep cooperation networks with cluster participation is weaker in emerging market economies, including Hungary, than in developed countries. Nevertheless, similarly to conditions for developing supplier networks, cluster participation is plausible and desirable, although the likelihood and modes of participation may greatly vary. In the next section, we compare the conditions of supplier network development with those of cluster establishment from the angle of MNEs. This comparison will also highlight possible ways of organizing ICs based on existing supplier networks of MNEs.

In general, we expect that factors increasing the likelihood of supplier network development also increase the propensity for cluster involvement. However, the two phenomena are not identical, and, in some cases, interests may differ substantially. Therefore, it is necessary to consider these determinants from a cluster viewpoint. These are : spatial concentration, specialization, heterogeneity of actors, simultaneous competition and cooperation, critical mass, and typical cluster activities.

As far as the geographic concentration is concerned, we can immediately realize that, in Hungary, the main areas for FDI are identical with those of intensive cluster development. It is mainly the capital city and the Central and Western Transdanubia regions, where both clusters and FDIs accumulate[5]. In fact, investments started to settle in important agglomerations already in the 1990s, while cluster development (meaning formal cluster initiatives) started only after 2000. Causal relations are rather unclear, hence these regions used to be rather developed industrial centers prior to the transition period, and their production potentials significantly contributed to FDI attraction. Later, this attraction potential was further strengthened by the MNEs themselves. Leading original equipment manufacturers (OEMs) attracted their traditional suppliers to invest in the same region in order to ensure easy and smooth cooperation. This FDI pattern itself

[5] For maps of NUTS-2 and NUTS-3 administrative geographical units, see **Figure 7.2** at the end of the chapter.

contributed to a large extent to the creation of sufficient pools of specialized firms within close vicinity. OEMs also exercised a strong pulling effect on local suppliers. While many of them had their premises in these historic industrial districts, new firms also settled in them. This process was strengthened by some policy measures as well. For over a decade or so, special industrial zones enjoyed privileges in the form of tax and customs relief provided that they exported their output in its entirety. Tax-free zones became hubs for greenfield investments that also incorporated many Hungarian suppliers (Antalóczy and Sass, 2001; Sass, 2003).

Much of the export-oriented greenfield investment was carried out in the tax-free zones; however, it is also worth noting that some 100 such zones were created in Hungary, since regulations for the establishment were rather easy to meet. Therefore, the likely pattern of spatial concentration was one OEM and its traditional first tire suppliers, completed by local second and third tire supplier companies. Only on rare occasions did OEMs with similar final product settle in the same hub. They separated themselves from their competitors and seemed to prefer separating their supplier network as well (Szalavetz, 2001).

Consequently, significant concentrations of specialized firms were created in Hungary's more developed areas. These networks consisted of technologically dependent suppliers of the value chain of single OEMs. The types of cooperation also contributed to the smooth functioning of the chain. Technology and knowledge transfer were provided by the OEMs and other major firms to Hungarian smaller suppliers in the areas to the extent it was necessary to improve their supply capabilities. This knowledge transfer and, generally speaking, all cooperation links were vertical : the OEM was in the center, and other firms depended on them as satellites. Not only did OEMs avoid contacting other OEMs of their branch, but the horizontal linkages of suppliers were also curtailed (or at least not promoted), i.e., both contacts to other MNEs and linkages among suppliers (for example, in the case of Electrolux)[6]. There is some evidence that MNEs liked sporadic suppliers also because they could bargain for lower prices when han-

[6] For more details, see ICEG (2006).

dling with separated, individual companies (Szanyi, 2008a). Summing up, FDI created hot spots for potential cluster development, but MNEs were not really interested in creating cooperation and communication platforms among supplier firms, which would be an essential cluster function.

We must emphasize the role of the tax-free zones in the spatial development of industrial districts in the first phase of the transition period. The advantageous regulation was, however, lifted while Hungary was joining the European Union (EU), since it was not regarded as compatible with competition rules. In addition, in this period, there was another pattern of FDI in Hungary, which was more connected with the privatization process and was regarded as more likely leading to the development of supplier networks. From the point of view of the development of horizontal linkages, and the possibility of becoming suppliers of several firms, (various OEMs) there is anecdotal evidence proving that cooperation linkages were more frequent in this second FDI pattern. However, MNEs were in many of the privatization cases not more interested in the further development of horizontal linkages among suppliers. Nevertheless, traditional cooperation among some of the local based suppliers might remain intact. Hence, the development of local cooperation linkages around these OEMs can be more likely than in the case of greenfield investments.

Another aspect of cluster development is the heterogeneity of members. It is rather clear that supplier networks around MNEs serve primarily the business interests of the integrating company. Anything beyond this interest must be initiated by other parties. The day-to-day interest of MNEs is simple : they must run their production facilities smoothly and efficiently since many of them are efficiency seeking. They need reliable business partners in the value chain. However, basically, and especially in the early years of their investments, they do not care much about the broader background. Many MNEs regard investment projects as one-off deals that last until favorable conditions prevail, but they do not intend to get involved in supporting the longer-term provision of the conditions. Therefore, institutions of the broader production background (education, infrastructure, and local development) remain outside of their attention. As a result of this, the early-phase local production networks usually lack diversity, which would be an important feature of ICs.

This situation is changing with the age and development of investment projects. There is much empirical evidence that shows how even greenfield investments changed their nature and behavior (Hunya, 2001; Szanyi, 2003; Szalavetz, 2005). This is because it is in their own efficiency-seeking interest to tap cheap opportunities throughout the whole value chain. Therefore, they expand their activity from the final assembly of imported parts to increasing the local component supply to increasing local participation in corporate functions (from accounting through logistics and even to R&D). This expansion of affiliate activity in global corporate networks is in line with the current wave of concentrating on core competences and outsourcing/off shoring much of the activities (Sass, 2008). The higher the number of activities that are carried out locally, the more likely business and cooperation links are developed in various directions, exceeding the simple technological cooperation of suppliers. Whenever there is more room for contacts among heterogeneous market actors, the potential also increases for organizing these contacts and actors in some formal ways. The clustering process may also get started from the bottom.

Recent experiences with labor shortage in some industrial bases in Hungary opened up new frontiers of cooperation with MNEs. National Instruments in Debrecen, Siemens in Budapest, Nokia in Szeged, and Audi in Győr are just a few examples of MNEs participating in shaping and also financing education programs of universities. Of course, they do this because they need high quality labor supply also in the future. Another welcome development pattern is the increasing participation of MNEs in financing and participation in R&D projects in Hungary. Some of the leading investors in Hungary established R&D laboratories in the country. This also substantially increased the clustering potentials of some cities in which sufficient educational and innovation background was present. We do not believe that dynamic clusters will soon play an important role in Hungary's economic development. It will be good if MNEs at least realize that they may also benefit from cluster cooperation in Hungary and become active members of ICs. Nevertheless, the mere fact that universities, R&D facilities, maybe also other actors raised their interest in cooperation also supports the cluster idea and increases chances for proper cluster actions.

Concerning the coexistence of cooperation and competition, Hungarian ICs may play a positive role. MNE supplier networks always supported intensive competition among local firms. The degree of cooperation was insufficient; however, it was clearly demonstrated that local firms benefitted when they improved their abilities in joint actions rather than individually. ICs may play an important role in organizing various programs for the development of participating SMEs. This is also in the interest of the MNEs heading the value chain. Other forms of cooperation, most importantly, technology and knowledge transfer, possibly even generation, are also plausible in supplier-based ICs, especially if cluster members can change their way of thinking regarding vertical flows but recognize that there is also room for joint horizontal actions. The empirical evidence indicates that this is the most difficult task for cluster managers since many of the potential cluster members are competitors and compete for contracts of the top OEMs or first tire foreign suppliers. Promoting MNE interest in cluster cooperation is sometimes not any more difficult than building trust among competing local suppliers.

As far as the critical mass of ICs is concerned, there is very little information on this issue in Hungary. Empirical surveys have indicated that formal cluster organizations do not set such targets (Szanyi, 2008a). Many are in their early stage of development; thus, the question is not yet relevant for them. Nevertheless, we can draw some general conclusions using guidelines available in the literature (ECOTEC, 2003; Sölvell et al., 2003; CLOE, 2006). Achieving a critical mass is important for three reasons. One is stability, which protecting against potential dropouts of large, dominating firms; the second is a financially self-sustaining cluster and new entry attraction; and the third is achieving a critical mass of information flow and activity, which is a kind of density of cluster actions that provides the desired synergies. MNE supplier networks alone have little opportunity to achieve these goals. The membership of competing OEMs is not likely. However, there may be ICs that are not initiated and dominated by OEMs but are established by other parties, building on suppliers to MNEs. In this case, the initial favorable condition of the supplier network is utilized; namely, there is a pool of potential cluster members. Drawing on this pool, a cluster can be organized with or without the participation of the MNE itself. The case of the oldest and largest Hungarian cluster,

the Pannon Automotive Cluster (PANAC), is a good example of this. However, even this cluster could not develop activities away from a simple supplier network support for many years. It took time and a setback in the cluster activity until cluster management realized that proper cluster functioning cannot be solely based on supplier network development programs (Grosz, 2006a). Representing the cluster's own interests as a separate organization is crucial and cannot be subordinated to one company's business interests. In addition, professional cluster management needs to be employed as well so that regular cluster functions are developed.

As reported above, there is little information available on the actual concentration of economic activity or the achievement of critical mass in Hungary. In the remaining part of this chapter, we try to fill the information gap concerning existing critical mass of firms and economic activity in Hungary using large-scale firm-level data. Before doing this, we briefly review the results of some other cluster-mapping studies for comparison.

7.3 Cluster-Mapping Practices

While the origins of clustering included mostly bottom-up organizations, increased interest in cluster development as a policy tool resulted in large numbers of ICs that did not have traditional or organic spatial development roots. Many times, it was governments that boosted the organization of cluster initiatives. If countries wish to launch a thoroughly designed program, information has to be gathered and evaluated first. For the purpose of the promotion of the clustering process or the foundation of cluster organizations, it is necessary to check if conditions for clustering are given or not. Two characteristics are crucial. The first is spatial concentration, and the second is specialization on some core competence. It is obvious that, in the case of a top-down initiative, these characteristics can be controlled in advance. It is surprising that cluster mapping has not become a general practice by governments other than that of the USA, where a nationwide effort was made in the late 1990s. Some countries also calculated spatial concentration measures, but not even these efforts were always given the right attention by policy makers. For example, in Hungary, there was such an effort in 2003, but it was conducted when the clus-

ter promotion program had already been opened for application (Ravn and Petersen, 2005). An *ex-post* survey compared the identified ICs with the list of existing cluster initiatives. Only 10 of the then 22 Hungarian cluster initiatives matched the hot-spot map that identified 24 examples of above-average spatial concentration of industries (Gecse, 2004).

The above-mentioned weak result of match by actual cluster initiatives and statistically registered spatial concentrations raises the question of how to explain this failure. The question is whether it was the inappropriate analytical framework that created distortions in the mapping procedure or rather, it was due to a high number of 'virtual cluster initiatives'? However, most likely, both explanations are accurate.

A brief overview of methodological problems is presented in the following section. The cluster-mapping procedure tries to identify spatial locations where the representation of certain industries or economic activities is higher than average, i.e., where they seem to concentrate. The logic is simple. In these places, there must be some kind of competitive advantage that is perceived by economic actors, and they tend to co-locate. There are three types of industries that have different reasons to co-locate. A large number of manufacturing branches as well as service providers, typically personal services, are located right at their markets. The dispersion of such industries is roughly even in all regions. Per capita measures, for example, are very close to each other in the various geographic regions of a country. Natural resource-based industries, on the other hand, tend to concentrate mainly at the location of the valuable asset. These industries may serve the global market, but they do not have much locational choice. The third group of activities is the most important one. These are industries that concentrate at locations; hence, they choose among many potential sites. These industries are regarded as cluster industries. In the case of the US economy, their proportional share in employment was close to one third, but they recorded higher than average wages, productivity, and innovation (Ketels and Sölvell, 2005).

Ketels and Sölvell (2005) ran a comprehensive statistical survey of cluster mapping in the 10 new member states of the EU, including Hungary (EU-10). Their methodology was based on the methods of a survey that was conducted at the Institute for Strategy and Competi-

tiveness at HBS led by Michael Porter[7]. The European survey used the amended American industrial classification method when identifying those business activities that belonged to cluster industries. Spatial concentration was calculated for the European NUTS-2-level regions. Only employment data was readily available at this level of both sectoral and geographic disaggregation (38 businesses) and for two comparatively recent years (2000 and 2004). Thus, concentration was measured with this single data set. However, the authors calculated three different measures in order to limit some of the distortions stemming from the special features of employment data. They wanted to obtain a balanced picture of regions reaching sufficient specialized critical mass to develop the type of spillovers and linkages that create positive economic effects that can serve as a base for cluster initiatives.

The first measure expressed the size, whether employment reached a sufficient absolute level that has the potential to trigger strong economic effects of ICs. This level was set for each NUTS-2 region and every of the 38 branch with 15,000 employees at a location. The second measure expressed specialization, meaning that a region is more specialized in a specific cluster category than the overall economy across all regions, and therefore it may provide enough strength for the regional cluster to attract related economic activity from other regions. This notion was operationalized by regarding as fit those concentrations that reached a specialization quotient of more than 1.75, i.e., those which had at least 75% more employment within the given cluster than the average of all regions would suggest given their size. The third measure expressed dominance, whether branches employ a high share of the given region's overall labor. The measure was set at the level of 7% of overall regional employment. The level of all three measures was set to separate the highest 10 percentile of all regional ICs.

As expressed by the authors, the measurement method had several shortcomings. The first is the exclusive use of employment figures, which created a bias towards labor-intensive sectors. Another problem is the level of disaggregation in both dimensions. The 38 activity groups or businesses contain many that are rather heteroge-

[7] See the website of the cluster mapping project of the Institute for Strategy and Competitiveness (http://data.isc.hbs.edu/isc/index.jsp).

neous. A deeper level of disaggregation was not possible, since the original grouping pattern, which was based on more detailed surveys of the US economy, could be transformed from the American SIC classification structure to European NACE only at this level.

With regard to the NUTS-2 regions, they are also too big in at least some countries and for some activities. In Hungary, for example, NUTS-2 regions were artificially created as requested by the EU, but they consist of usually 3 former *comitats* that, historically, used to be the integrating geographic and administrative unit. The new NUTS-2 regions are so young that their economies could hardly amalgamate. On the other hand, there is no convincing evidence on ICs spreading according to administrative borders either. Thus, some ICs may have escaped mapping because they spread over two or even more NUTS-2 regions.

A further problem comes from the inheritance of previous industrial structures. In most socialist countries, production was heavily concentrated in large state-owned companies. In some cases, these huge *combinates* were located in places of arbitrary choice; in other cases, firms were created by the governments of these countries in their strive for self-supply in practically all commodities even if production inputs were not readily available. In many cases, these giants or their remnants survived the turmoil of the transition process. In other cases the least mobile production factor labor remained in places where it had accumulated during the years of socialist industrialization. All this experience seriously distorted spatial concentration patterns from the hypothetical optimum, and the old patterns still exercise influence on spatial differences in the supply of production factors. Thus, we may have strong reservations as far as the applicability of the results of current cluster mapping is concerned.

Ketels and Sölvell's (2005) survey found, nevertheless, interesting results : First, 367 regional ICs met at least one of the three hurdle rates for absolute size, specialization, and dominance. They represented 5,86 mn employees, which is about 58% of total employment in the cluster sector of the 10 new member states. Second, the capital regions of the largest countries led the ranking of regions by cluster portfolio strength : Budapest first, Warsaw second, and Prague fourth. Third, the largest seven cluster categories were food processing, heavy construction services, transportation and logistics, financial ser-

vices, hospitality and tourism, metal forming, and building fixtures, equipment and services, all of which accounted for 50% of all cluster sector employment across the EU-10. As is evident, these are mainly labor intensive branches with a relatively lower level of productivity which provides a clear indication for sample bias. For example, automotive and information and communication technology (ICT) sectors employed far fewer individuals, however they used to be considered as leading sectors for many ICs.

The research confirmed existing hypotheses concerning the development gap between developed countries and transition member states in the EU. The 10 EU economies had a specialization profile distinct from the more advanced economies. Specialization was found to have a far stronger natural resource-driven sector (20% share in employment) than developed countries. Within the cluster sector (32% share in employment), there was a stronger bias towards labor-intensive and manufacturing-driven cluster categories, while these countries had relatively few ICs in advanced services and knowledge-intensive cluster categories. Exceptions were the strongest clustering centers around capital cities. In addition, in the case of the Hungarian ICs, the bias reported above was less pronounced, and specialization towards high-value-added services and industries was stronger (see **Table 7.1**).

There may be several factors affecting the results of the above table that seems to underestimate IC potential in the region. For example, no Slovenian cluster qualified for all three dimensions. Ketels and Sölvell (2005) found convincing evidence on the correlation of spatial concentration and economic performance using the data of developed countries. However, the spatial concentration had different historic reasons in practically all of the 10 new EU countries, and these traditions seem to have a much weaker causal link to economic growth and performance today. For example, in the case of the strong position of the Kosice region in the Slovak Republic, we must not forget that this is one of the poorest regions of the EU 25 economies. The Kosice steel mill and very few other industrial facilities are the single most important employer of a region where unemployment rates are extraordinarily high. Thus, we may observe cases in which spatial concentration of business is the result of an overall meltdown of business activity in some regions and not the beneficial outcome of a deliberate

Table 7.1 Strong regional clusters and their specialization in six Central and Eastern European Countries, 2004

Region	Field of specialization
Czech Republic	
Liberec	Automotive
Liberec	Textiles
Ostrava	Metal manufacturing
Praha city	Education and knowledge generation
Praha city	Entertainment
Praha city	Financial services
Praha region	Automotive
Hungary	
Győr	Automotive
Szeged	Food processing
Székesfehérvár	Information technology
Lithuania	Apparel
Latvia	Entertainment
Poland	
Gdansk	Transportation and logistics
Katowice	Automotive
Lodz	Apparel
Warszawa	Financial services
Wroclaw	Automotive
Slovakia	
Bratislava	Financial services
Kosice	Apparel
Kosice	Metal manufacturing

Note : This table lists ICs qualifying for the top 10% in all three measures.
Source : Ketels and Sölvell (2005, pp. 62-65).

co-location decision of independent cluster actors.

It is perhaps more useful to look at the overall clustering performance of regional centers. **Table 7.2** contains a list of regional centers that attracted the largest cluster portfolio, i.e., businesses that qualified in one or more aspects of cluster measures.

There are large differences within the EU-10 across regions and cluster categories regarding their level of specialization and spatial concentration. These countries show much lower specialization on specific regional ICs within regions and much lower spatial concentration

Table 7.2 Regional clusters with strongest portfolio in EU-10, 2004

Region	Total number of qualifications	Average qualification per regional cluster	Share of qualified clusters in total regional cluster employment (%)
Budapest (Hungary)	23	1.53	77
Warsawa (Poland)	22	1.38	77
Katowice (Poland)	21	1.4	81
Praha city (Czech)	19	1.9	78
Lithuania	19	1.58	70
Krakow (Poland)	18	1.29	68
Liberec (Czech)	17	1.55	62
Lodz (Poland)	16	1.6	71
Wroclaw (Poland)	16	1.45	60
Poznan (Poland)	15	1.15	72
Nitra (Slovakia)	14	1.4	60
Bydgoszcz (Poland)	14	1.27	58
Slovenia	14	1.27	56
Olomouc (Czech)	14	1.4	45
Latvia	13	1.44	62
Gdansk (Poland)	13	1.44	59
Praha region (Czech)	13	1.63	43
Bratislava (Slovakia)	12	1.5	65
Brno (Czech)	12	1.2	56
Miskolc (Hungary)	12	1.09	51
Kosice (Slovakia)	12	1.71	45

Source : Ketels and Sölvell (2005, p. 26).

on specific regions within cluster categories than the original benchmark US economy. If, as is suggested by the authors, higher levels of specialization and concentration enable higher productivity and innovation, this is a serious concern. The same concern arises with regard to the EU-15 countries in comparison with the US, which is fully consistent with the performance gap relative to the United States.

The EU implemented Porter's idea as extended by Sölvell and addressed dynamic clusters, or 'innovative clusters,' as they are referred to by the EC, which serves as a cornerstone of the more concrete and operative implementation plan targeted by Lisbon in the mid-2000s. The emphasis on cluster development in Europe provides new impetus for cluster research. Based on previous work at the

Stockholm School of Economics, new research institutions were created. The European Cluster Observatory started to work in 2005. One main research output of this institution is its cluster mapping database[8]. The database contains employment data broken down according to Porter's original categorization of traded clusters for the European NUTS-2-level regions. Similar measures as those used by Ketels and Sölvell (2005) were calculated. Thus, the problem of using only one indicator (employment), as well as the broad and rather rigid separation of regions remains in this database. Nevertheless, the availability of methodologically comparable data for the whole territory of the EU is an important new feature in cluster research. In addition, the database contains some basic evaluation of the registered cluster exports and innovative activities that helps readers identify the true innovative clusters.

As far as the actual results are concerned, data of the observed Hungarian ICs are summarized in **Table 7.3**. As is seen, none of the spatial concentrations in Hungary qualified in all three measurement aspects in 2007 (in 2004, there were three). The number of two-star ICs also declined. Some of the 2004 two-star ICs lost one star, but, in two cases, i.e., building fixtures and business services in Central Hungary, the 2004 clusters were not reported in the 2007 table. On the other hand, 6 'new' two-star ICs appear in the 2007 table. They are certainly not new in the sense that these spatial concentrations have been known since they used to have a solid and traditional background and qualified for a one-to-two-star level.

Looking at the 2007 list of Hungarian ICs, the still strong positions of traditional sectors are evident. This is despite the less favorable development tendencies in the 1990s and 2000s. Strong path dependency is observed here. Despite the massive foreign investments in some global industries, such as automotive, electronics, and communication technology, important features of the Hungarian economy prevailed in the food industry, construction, and light industry, which retained important positions despite heavy contractions in the last 20 years.

Another important piece of information to be gleaned from the

[8] See the European Cluster Observatory special website (http://www.clusterobservatory.eu).

Table 7.3 Evaluation of Hungarian clusters, 2007

All regional clusters in Hungary
1- and 2-star regional clusters

Region	Cluster category	Employees	Size	Spec.	Focus	Stars	Innovation	Exports
Kozep-Magyarorszag	**Transportation**	50163	0.81%	1.23	4.00%	**	High	Weak
Kozep-Magyarorszag	Education	44476	1.00%	1.89	3.00%	**	High	N/A
Del-Alfold	**Food**	34101	0.68%	2.89	7.00%	**	Low	Weak
Kozep-Magyarorszag	**IT**	30735	1.00%	2.26	2.00%	**	High	Strong
Kozep-Dunantul	Automotive	17091	0.66%	2.85	4.00%	**	Low	Strong
Nyugat-Dunantul	**Automotive**	16741	0.64%	2.98	4.00%	**	Low	Strong
Kozep-Magyarorszag	Biopharma	14197	1.00%	2.61	1.00%	**	High	Weak
Kozep-Dunantul	**IT**	12535	0.61%	2.64	2.00%	**	Low	Strong
Kozep-Dunantul	**Building Fixtures**	11702	0.50%	2.17	2.00%	**	Low	Strong
Nyugat-Dunantul	**IT**	10995	0.54%	2.47	2.00%	**	Low	Strong
Nyugat-Dunantul	Lighting	6888	1.00%	6.17	1.00%	**	Low	Very strong
Kozep-Magyarorszag	Lighting	6832	1.00%	2.00	0.56%	**	High	Very strong
Del-Dunantul	Leather	3086	1.00%	10.32	0.95%	**	Low	Weak
Kozep-Magyarorszag	**Finance**	43439	0.61%	0.92	3.00%	*	High	Weak
Kozep-Magyarorszag	**Entertainment**	28559	1.00%	1.96	2.00%	*	High	Very strong
Eszak-Alfold	**Food**	22460	0.45%	1.73	4.00%	*	Low	Weak
Eszak-Alfold	**Construction**	18230	0.28%	1.07	3.00%	*	Low	N/A
Kozep-Dunantul	**Metal**	17403	0.44%	1.92	4.00%	*	Low	Weak
Kozep-Magyarorszag	**Publishing**	16886	1.00%	1.55	1.00%	*	High	Weak
Eszak-Magyarorszag	Food	16116	0.32%	1.51	4.00%	*	Low	Weak
Kozep-Dunantul	Construction	16020	0.24%	1.06	3.00%	*	Low	N/A
Eszak-Magyarorszag	Construction	15650	0.24%	1.11	3.00%	*	Low	N/A
Kozep-Dunantul	**Food**	15246	0.31%	1.32	3.00%	*	Low	Weak
Nyugat-Dunantul	Food	14718	0.29%	1.36	3.00%	*	Low	Weak
Del-Dunantul	Food	14374	0.29%	1.63	4.00%	*	Low	Weak
Del-Alfold	Construction	13783	0.21%	0.89	3.00%	*	Low	N/A
Eszak-Magyarorszag	**Metal**	13190	0.34%	1.57	3.00%	*	Low	Weak
Nyugat-Dunantul	Construction	12918	0.20%	0.91	3.00%	*	Low	N/A
Kozep-Dunantul	Transportation	12078	0.20%	0.85	2.00%	*	Low	Weak
Nyugat-Dunantul	Hospitality	11702	0.32%	1.47	2.00%	*	Low	Strong
Del-Dunantul	Construction	11151	0.17%	0.96	3.00%	*	Low	N/A
Del-Dunantul	Finance	9012	0.13%	0.72	2.00%	*	Low	Weak
Eszak-Magyarorszag	Chemical	6130	0.64%	2.97	1.00%	*	Low	Weak
Eszak-Magyarorszag	Communications	5910	0.74%	3.47	1.00%	*	Low	Very strong
Kozep-Dunantul	Communications	5890	0.74%	3.21	1.00%	*	Low	Very strong
Nyugat-Dunantul	Heavy Machinery	5341	0.64%	2.97	1.00%	*	Low	Weak
Eszak-Alfold	Heavy Machinery	4362	0.52%	2.02	0.92%	*	Low	Weak
Del-Dunantul	Communications	4333	0.54%	3.09	1.00%	*	Low	Very strong
Del-Alfold	Constr. Materials	3863	0.64%	2.72	0.89%	*	Low	Weak
Nyugat-Dunantul	Communications	3475	0.44%	2.01	0.87%	*	Low	Very strong
Kozep-Magyarorszag	Jewelry	3445	1.00%	1.75	0.28%	*	High	Weak
Eszak-Magyarorszag	Lighting	3357	0.65%	3.04	0.85%	*	Low	Very strong
Eszak-Alfold	Lighting	3084	0.60%	2.30	0.65%	*	Low	Very strong
Eszak-Alfold	Footwear	3066	0.70%	2.71	0.64%	*	Low	Weak
Del-Alfold	Oil and Gas	2372	0.67%	2.84	0.55%	*	Low	Weak
Del-Dunantul	Fishing	1369	0.38%	2.16	0.42%	*	Low	Weak
Eszak-Alfold	Leather	1167	0.69%	2.65	0.24%	*	Low	Weak
Nyugat-Dunantul	Leather	1041	0.61%	2.83	0.26%	*	Low	Weak

Notes: A brief description of the calculation method is provided in the text. In the case of the size, one star was given to clusters that belonged to the top 10% of all clusters in the EU concerning this feature. The % figure in this table shows the actual share of the given Hungarian cluster in Europe's total (total employment in the given sector in all European clusters). In the case of specialization, values over 2 earned one star. For the notion of focus, those clusters which belonged to those 10% of clusters that contributed the most to the total local cluster employment earned one star. The % figure in the table shows the actual share of the cluster in the employment of the region. Those clusters that also appeared in Ketels and Sölvell's (2005) table are shown in bold.
Source: European Cluster Observatory special website (http://www.clusterobservatory.eu).

table is that innovation was found to be the strongest mainly in sectors that did not export much and did not belong to traditional high-technology activities. The loose relationship of high technology, innovation, and exports calls for caution when designing cluster-promotion tools aiming at export-oriented innovative clusters, which are at the heart of the current Hungarian and, to some extent, the European innovation policy[9]. Porter stressed the importance of innovation in cluster activity, but he never reported that ICs were reserved for high-technology activities or for export-oriented industries. The heart of his concept is joint action for increasing regional competitiveness in general. One tool of this effort is the support of innovative cooperation in a wide range of industries and activities. Equally important in the cluster concept is its foundation on traditional regional sources and areas of competitiveness. These should be promoted by cluster cooperation. ICs should not be regarded as a means of capitalist industrialization.

As a conclusion, we can suggest further research in mapping spatial concentrations of business activity in the 'traded cluster' sectors. It seems to be necessary to use alternative indicators, such as sales turnover, investments, or paid salaries, rather than the number of employees. In addition, the strict administrative boundaries of NUTS-2 regions should be made more flexibly to allow for the observation of 'cross-border' clusters, or tighter spatial concentrations that "disappear" from calculations when comparing them with aggregated figures of larger areas. Such refinements in methodology will enhance a more reliable comparison of functioning cluster organizations and their background. This, in turn, would also contribute to a better formulation of cluster policies.

7.4 A New Hungarian Cluster Mapping

In this section, we perform a new cluster mapping exercise based on annual census-type data of Hungarian firms. The data were compiled from financial statements associated with tax reporting submitted to the National Tax Authority in Hungary by legal entities per-

[9] For example, see EC (2008a; 2008b) and European Cluster Observatory (2007).

forming accounting and tax procedures by double-entry bookkeeping. The data contain basic information for each sample firm, including its geographical location, the NACE 4-digit codes, annual average number of employees, total turnovers, and other financial indices[10]. First, we describe our empirical methodology followed by the results.

7.4.1 Methodology

We employ the 1998 and 2005 datasets to conduct mapping of ICs in Hungary using Porter's measurement method, which was described in the previous section. When transforming the industry categories of the database to the one that was defined in the HBS cluster mapping project, we could separate 37 out of the original 38 traded cluster activities[11]. Out of the three measures that were used by Ketels and Sölvell (2005), we used only one, namely, the specialization quotient. The design of the locational quotient is similar to Bela Balassa's RCA (revealed comparative advantage) measure. It expresses the relative weight of one single sector in a region to the total weight of the region compared to either the national economy or a larger geographical area. The calculation is conducted using the following formula (7.1):

$$LQ_{ij} = \frac{e_{ij}/E_i}{e_j/E} = \frac{S_{ij}}{x_j}, \tag{7.1}$$

where e_{ij} is the number of employees in area j in branch i, e_j is the total number of employees in area j, E_i is the number of employees in branch i in the whole country (spatial unit of comparison), and E the is total number of employees in the whole country (spatial unit of comparison). Hence, s_{ij} denotes the share of area j in total employment of branch i, and x_j denotes the share of area j in total employment.

We found that the statistical content of the other two measures was quite similar. We also found the other two measures to be strongly biased by the absolute differences between firms, branches, and spatial units. Relative concentration is at the heart of the cluster-

[10] See Section 2.4 in Chapter 2 for more details of the dataset.

[11] For a thorough description of the traded cluster category, see the website of the cluster-mapping project at : http://data.isc.hbs.edu/isc/index.jsp.

ing process, and this requires relative measures. Comparisons that are based on the use of absolute values are, therefore, less applicable, since they reflect size biases.

Our calculations are new and more precise in two aspects. We could disaggregate our database in spatial terms from NUTS-2 level (regions) to NUTS-3 level (comitats)[12]. This is important because, on a regional level, important concentrations can be neglected due to differences in terms of varying significance levels of the different economic activities. However, a finer spatial focus also allows for the observation of activity concentrations that do not follow the artificial boundaries of the regions. The other novelty of our calculation method was the usage of various measures of economic activity, not just employment data. We used employment (number of employed persons), number of enterprises, value added, and cumulated investment data (investments of the 1998-2005 period). Thus, the final product of the calculations was four measures for each traded cluster branch in each NUTS-3-level spatial unit for the year 2005 and three for the year 1998, since, for the starting year, no cumulated investment figure was available.

7.4.2 Results

The total number of calculation results was 740 (20 spatial units, 37 branches) for each of the four measures. For an easier overview and better analysis, we followed the evaluation method found in Ketels and Sölvell (2005). We gave one point for all branch-comitat pairs that belonged, in terms of the given measure, to the upper 15% of the calculation values. Thus, every branch-comitat pair could receive a maximum of 4 points (3 points in 1998)[13]. We considered those pairs in which at least two measures proved to be significant (they belonged to the highest 15% and, therefore, received two points). We also calculated the Gini coefficients. This measure helps us determine whether activity concentration is caused by one or a few large companies or a number of medium-sized or several small firms. This is a very important aspect, since we want to measure the pool of potential co-opera-

[12] The database allowed even deeper NUTS-4-level calculations.

[13] We also evaluated the branch-comitat pairs at a lower 30% level.

tors, and, therefore, the actual size structure is highly relevant for us. The Gini coefficient was calculated from employment figures. Values over 0.9 reflect a very uneven structure. If the number of firms (observations) is high (100 or more), then values as high as 0.7–0.8 already indicate that a number of medium-sized firms should also be present. Thus, cooperative structures, such as clusters or supplier networks, would have a sufficiently broad pool to serve as a base.

We could spot significant concentration in 22 of the 37 traded cluster branches for the year 2005. In the remaining 15 traded cluster branches, no branch-comitat pairs received at least two points. The results are summarized in **Table 7.4**. It is noteworthy that no services-centered cluster was captured by our calculations, although there is much anecdotal evidence on the existence of even formal cluster organizations based on various service activities (financial services, education, and entertainment). Of course, it is possible that this failure is related to the shortcomings of the measurement method. However, the absolute lack of indication in the whole country may also mean that either these ICs operate in an inappropriate environment (too few related companies) or may be very young organizations that are not yet measurable statistically. In case of the capital city, Budapest, a further option is also likely. This city is simply too big and has business activity that is too heterogeneous and does not allow statistically outstanding concentrations. The overall size limits the relative importance of sectors that would produce sufficiently large size in many aspects but whose large denominator permits them to go unnoticed. Due to this measurement problem, Budapest and Pest County did not show significant concentrations at all. Since, however, we could also provide the total number of firms in the given branch, high values of this data may still deliver the necessary information on spatial concentration.

As is seen in **Table 7.4** and also on the amended maps shown as **Figure 7.1**, in many cases, we included several comitats together to form a potential cluster. This idea stems from the logic that the spatial dispersion of clusters should not necessarily follow administrative boundaries. The lower spatial observation level (i.e., NUTS-3) allows us to better localize the potential spread of ICs in neighboring comitats. We treated the comitat-branch pair, which showed a significant concentration on the 15% level as gravity centers, and added the neighboring comitats, which showed concentration on a level of at

Table 7.4 Results of cluster mapping in Hungary using the 2005 census data

Sector	Counties	Number of firms	Gini coefficient	Qualification	Note
Automotive	Győr. Komárom	29: 17	0.81: 0.77	yes	one center
Leather Products	Vas. Baranya. Szolnok. Szabolcs	6: 17: 6: 3	0.66: 0.65: 0.58: 0.66	?	two centers, spatially disperse
Footware	Vas. Baranya. Tolna. Bács-Kiskun. Szolnok. Szabolcs	10: 15: 15: 19: 14: 27	0.64: 0.70: 0.56: 0.54: 0.73: 0.67	?	two centers, few firms
Processed Food	Bács-Kiskun. Csongrád. Békés. Szabolcs	262: 135: 141: 201	0.78: 0.85: 0.79: 0.79	yes	two centers
Building Fixtures. Equipment and Services	Veszprém. Komárom. Nógrád	238: 319: 119	0.82: 0.76: 0.68	yes	one center
Furniture	Zala. Vas. Győr. Békés	170: 124: 186: 117	0.71: 0.78: 0.81: 0.73	yes	two centers
Metal Manufacturing	Fejér. Nógrád	179: 49	0.91: 0.75	yes	two centers
Motor Driven Products	Zala. Szolnok	62: 63	0.80: 0.86	yes	two centers
Biopharmaceuticals	Hajdu	6	0.82	?	one center, few firms
Communications Equipment	Nógrád. Heves. Szolnok	18: 30: 36	0.79: 0.89: 0.89	yes	one center
Aerospace	Heves	3	0.57	?	one center, few firms
Agricultural Products	Veszprém. Baranya. Bács-Kiskun. Borsod	61: 59: 141: 93	0.81: 0.73: 0.65: 0.76	?	three centers, dispersed activities
Plastics	Bács-Kiskun. Borsod	106: 74	0.78: 0.87	yes	two centers
Analytical Instruments	Pest	87	0.77	yes	one center
Medical Devices	Hajdu	57	0.83	yes	one center
Publishing and Printing	Komárom	16	0.73	?	one center, dispersed activities
Apparel	Vas. Békés. Hajdu	40: 54: 115	0.76: 0.68: 0.89	yes	two centers
Sporting. Recreational and Children's Goods	Baranya. Nógrád	17: 6	0.61: 0.75	?	one center, few firms
Information Technology	Veszprém. Komárom. Baranya. Pest	13: 25: 23: 127	0.77: 0.91: 0.94: 0.92	?	quickly changing spatial location
Construction Materials	Veszprém. Békés	12: 10	0.84: 0.63	no	one center, dispersed location
Chemical Products	Vas. Borsod	5: 18	0.70: 0.70	no	one center, dispersed location
Lighting and Electrical Equipment	Tolna	6	0.62	no	dispersed location, few firms

Source : Authors' estimation.

least 33%. In some branches, we could identify 2 and, in some cases, even 3 centers, the nucleus of potential cluster formations[14]. Such examples are presented on the amended cluster maps. The last two columns of the table provide an evaluation of the branch–comitat pairs concerning the likelihood that they may become real ICs. Our objections were placed in the last column, and they included wide spatial dispersion and a shortage of companies.

Fifteen concentrations are found to be strong enough to form ICs. In many cases, cluster organizations already work in these centers. In 14 other cases, we inserted a question mark, indicating that either a strong concentration was not supported by a sufficiently high number of potential cooperating firms or the relatively strong comitats were not in each other's immediate neighborhood. That would have limited the frequent personal contacts of cluster members, which would also be an important aspect of successful cluster operations. In a few cases, we found that the original traded cluster categorization is not perfectly suitable for the Hungarian economy. For example, in the case of the branch agricultural products, Porter's original category included all types of farm products, such as crops and animal products. It also included equipment repair and other services. This is highly relevant for large and complex American farms, but it does not really apply to much smaller, more specialized Hungarian producers. In this case, another category could have reflected more precisely those activities along which Hungarian agricultural producers could potentially cooperate.

7.5 Conclusions

From a summary of the lessons of our cluster–mapping exercise for Hungary, we draw some important conclusions. It is necessary to show that most spatial concentrations (potential clusters) are located in areas where similar industrial activity had been carried out before

[14] It is noteworthy that spatial concentration is just one important condition of cluster formation. Hence, even if we call the observed concentrations clusters or potential clusters, it does by no means mean that there is an actual cluster organization present. HBS documents, as well as the European Cluster Observatory, also use the term 'cluster' for spatial activity concentrations.

the transition. This means that, despite the tremendous structural changes of the two decades of transition, some basic characteristics of spatial and activity structure of the Hungarian economy remained in place. This is important evidence that supports an important aspect of the IC-related literature, namely, that there is strong path-dependency in economic development. Path dependency also means, however, that cluster policies can and should not be treated as a means of a new capitalist industrialization. The main aim of clustering is to further develop traditional regional strength in order to gain regional competitiveness. We do not want to deny the possibility of creating new structures in the long run. Indeed, in the case of the automotive industry and ICT production, development in Hungary by far exceeded previous levels. In these cases, the existing capacities and expertise played a relatively small role. However, such examples seem to be more the exception than the rule.

Another noteworthy result of the survey follows from the previous argument. We found ample evidence of the existence of activity concentrations in branches and regions that have strong FIE influence, such as the automotive and ICT sectors. There is much empirical evidence that shows the impact of important supplier networks[15]. Strengthening the clustering process in such vertically integrated networks would require the support for horizontal linkages among cluster members. However, we also found branches in which FIE involvement was much weaker. We can conclude, therefore, that cluster development in such regions and branches in which there is no FIE dominance is also possible. However, the structure and functions of these clusters may be very different. They have stronger horizontal and less vertical cooperation. In addition, the power relations are different in them[16]. In this second type of clusters, the main activity is rather small-business and regional development. This variation of cluster types calls for more refined and not uniform solutions in cluster development policy.

In the next chapter, we will examine the impact of cluster development on regional economic growth using the cluster-mapping

[15] For the car industry and the role of PANAC, the Hungarian automotive cluster, see Grosz (2006a).

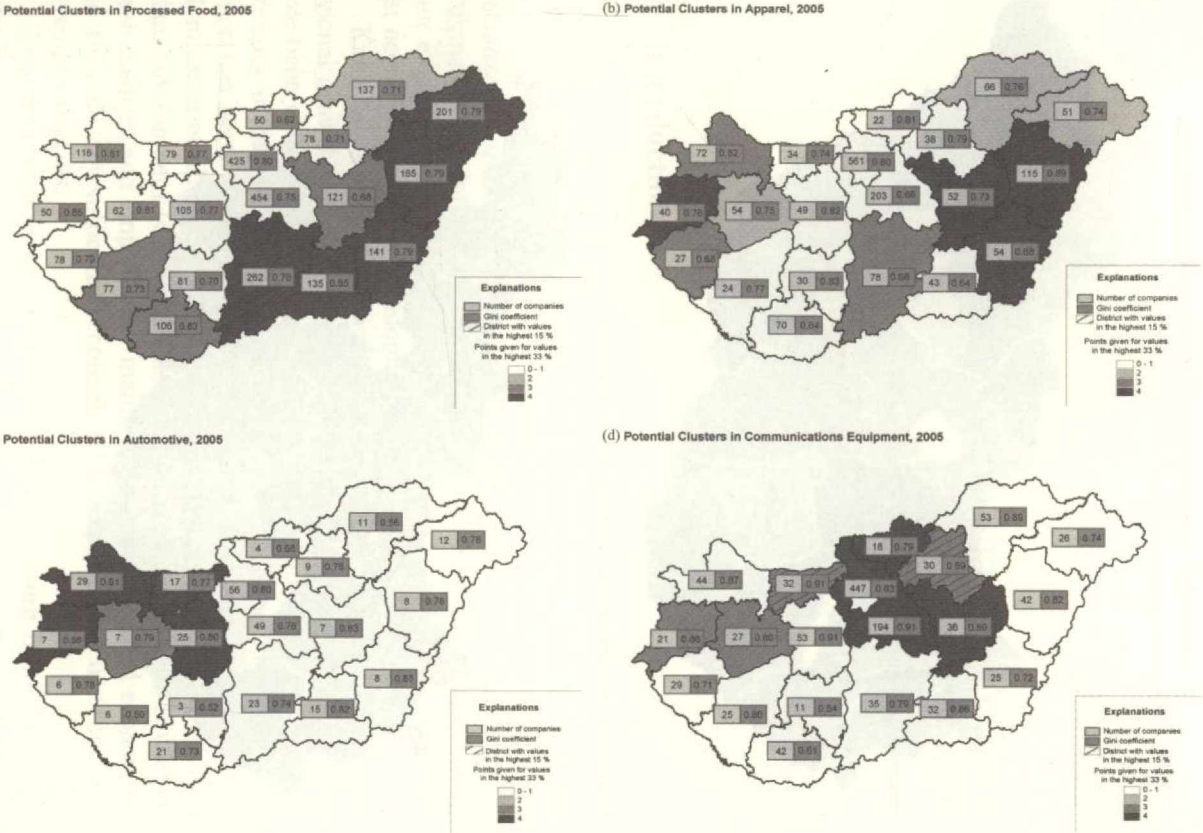
[16] For evidence and case studies, see Szanyi (2008a; 2008b).

results in this chapter.

Acknowledgment

This chapter is an extended version of Szanyi et al. (2010). The authors appreciate the permission of Palgrave Macmillan to reproduce the paper in this book.

Figure 7.1 Potential clusters in the processed food, apparel, automotive, and communications equipment industries in Hungary, 2005



Source : Authors' illustration.

Figure 7.2 Regional administration units of Hungary

(a) Regional administration units of Hungary: Comitats (NUTS-3)

(b) Regional administration units of Hungary: Regions (NUTS-2)

Chapter 8

Industry Cluster and Regional Economic Growth

8.1 Introduction

The geographic concentration of economic activities has attracted attention from economists for centuries. Research has been carried out on the topic with varying intensity since von Thünen's early model of specialization until the latest works of the Nobel Prize winner Paul Krugman. Some important schools of economic thought have recently been examining the topic, such as new growth theories, transaction cost economics, and new economic geography.

Knowledge externalities appeared as a key concept in the first regional growth theories developed by Alfred Marshall (1890), which have been elaborated upon during the 20th Century with an evolving intensity in the last decade and at the turn of the millennium. Evidence has been revealed proving the effect of regional specialization (Henderson et al., 1995), local competition (Porter, 1990), and diverse urban environment (Glaeser et al., 1992) on regional growth. However, these theories and empirics are mainly based on developed economies, and they do not sufficiently consider the experiences in other less developed regions.

Transition economies are particularly interesting from this viewpoint because most of them underwent at least 4-5 decades of economic development earmarked by socialist industrialization. This pro-

cess meant a forced economic restructuring that also largely altered previous spatial patterns of economic activity. In this period, bureaucratic coordination of the central government dominated, and the market mechanism was put aside. Under the planned economy, production was concentrated in large state-owned enterprises in selected locations. After the change of the political regime, greenfield investments by large multinational enterprises (MNEs) were carried out in the tradable and service sectors. Foreign direct investment (FDI) usually started operation with simpler activities that were mainly based on cheap unskilled labor as the local production input. However, MNEs continued investments using more value-producing resources, including skilled labor, local engineering, and research and development (R&D) capacities. Domestic companies played only a marginal role in the supplier networks of these companies; there was an enormous gap between MNEs that were connected directly to the global markets and a big number of less mature small and medium-sized enterprises (SMEs). As a result, newly emerged industry clusters produced a significantly different geographical allocation of workforce and firms from that in the socialist period.

Using annual census-type data of Hungarian firms, we empirically examine the relationship between industry clustering and regional economic growth in the transition period. More specifically, the aim of this chapter is to show how geographical concentration of industry and market affects employment and production growth in regions of Hungary. Our empirical results confirm that both organizational and market concentrations have a statistically significant and positive impact on production growth, while employment concentration is negatively related to production growth. These findings broadly support the Marshall-Arrow-Romer (MAR) model of local knowledge externalities, suggesting that investment-driven regional development prevails in Hungary.

The remainder of this chapter is organized as follows : Section 8.2 gives an account of regional development patterns in Hungary during the transition period. Section 8.3 develops a hypothesis based on the theories of agglomeration economies and local knowledge externalities. Section 8.4 describes the data utilized for this study and empirical methodology. Section 8.5 contains estimation results, and Section 8.6 summarizes the major findings and concludes.

8.2 Economic Transition, Regional Development, and Industrial Restructuring in Hungary

The determining role of FDI and the remaining presence of some state-controlled services and stagnating domestic companies are the main features of transition economies that distinguish their current development model (Szanyi, 2003). In the first period of transition, MNEs carried out large investment projects in the tradable and services sectors of Hungary. Automotive and information and communication technology (ICT) industries present good examples. The activity of the new facilities developed over time. Simple, cheap unskilled labor-based activities were developed by additional investments. New, more value-adding activities were launched, which utilized local skilled labor and engineering talent, as well as, in some cases, R&D capacities. Indeed, some of these foreign companies started to locate their R&D functions to their Hungarian sites (Lengyel and Cadil, 2009). From 1995-2003, the growth rate of business R&D spending by foreign affiliates was among the highest in Hungary (UNCTAD, 2005). As a result, the total share of foreign affiliates reached approximately 80% in 2003 (EC, 2005). This process suggests that foreign affiliates emerged as pools of potential knowledge spillovers, and, thus, they could serve as the main drivers of regional growth.

In Chapter 7, we described a structural process of shifting activity of MNEs that was complemented by increasing local sourcing. This process contributed to the emergence of some new concentrations of production activity. Foreign-owned companies played a crucial role in spatial industrial dynamics through their supplier networks with indigenous firms. However, decisions about their regional networks were usually determined by the parent company headquarter abroad, and domestic suppliers played only a marginal role (Sass and Szanyi, 2004a; Grosz, 2006b). In many cases, suppliers of these MNEs are *de-novo* foreign firms that had followed their main customers' advance into Hungary. In the previous chapter, we also demonstrated the possibility of establishing a cooperating network among local supplier companies, but their development needs more time and effort. However, it is more plausible that a dual structure of economy has evolved in the transition, in which domestic companies only have a trivial role

(Farkas, 2000).

The special development of Central European transition economies might have prevailed in their regional development as well, which can be captured mainly by regional industrial dynamics. In this regard, Lengyel and Leydesdorff (2011) showed that, in Hungary, besides industrial dynamics, foreign-owned firms in high-tech and medium-tech industries have restructured regional economic systems. On the other hand, universities play a larger role in shaping the local organization of high-tech knowledge-intensive services (R&D and communication services).

The regional concentration of industries has also evolved accordingly. For example, North-Western Hungary, where most foreign firms had located, stands out as a leading area in automotive industry concentration (Grosz, 2006b), while the ICT industry is spread on a larger scale over the country (Szanyi, 2008a) although it is concentrated in Budapest and its neighboring regions (Lengyel, 2010). Szanyi and Lengyel (2010) conducted an empirical analysis of the determinants of cluster emergence and confirmed that, despite the industrial differences in regional dynamics, the change in geographic labor concentration negatively correlated with the initial degree of labor concentration in all the industries. This result suggests that the more the region was specialized in a certain industry, the more slowly the concentration occurred in terms of employment.

The above arguments indicate that, in Hungary, regional economic growth in the transition period was closely associated with the spatial concentration of industry and market. Therefore, we make an attempt to empirically examine this relationship in the following sections.

8.3 Spatial Concentration and Regional Economic Growth : Hypothesis Development

The spatial concentration and specialization of economic activities have been recognized and analyzed for over a hundred years. Alfred Marshall (1890) studied the determinants of industrial agglomerations and found three decisive factors, i.e., (a) access to developed labor market, (b) deep supplier background, and (c) the possibility of quick knowledge and information transfer among firms. Recent publications

also have similar arguments (Krugman, 1991; Venables, 2001), and Marshall's argument on agglomeration economies is further developed, particularly by the new growth theories (Romer, 1986; Rebelo, 1991), which try to explain continuous differences in growth rates and lack of convergence (which contradict the neoclassical paradigm) with the notion of increasing returns on investments in knowledge and technology. Returns are increasing in the economy as a whole due to spillover effects, while individual economic agents may have production functions with decreasing returns.

This is the basis of the MAR model of local externalities. In this view, the regional concentration of specialized industries produces positive externalities because specialized labor and knowledge flow needs a similar technological and cultural background. On the other hand, Jane Jacobs (1969) showed that urban agglomerations provide the possibility for inter-industrial knowledge spillover through the dense social networks and diverse economy present in large cities.

The rationale of spatial concentration consists of achieving agglomeration economies and knowledge spillovers among firms at a given location, which are basically distinguished by the type of spatial knowledge transfer occurring. The MAR type of agglomeration economies relates to firms engaged in similar or inter-linked activities because these firms can learn from each other. For instance, Antonelli (1994) documented that Italian industrial districts provide the base for flexible production systems that can serve volatile markets. Similar association was reported in the Silicon Valley and Route 128(Saxenian, 1994) and in the UK (Oxford and Cambridge in particular) (Miller et al., 2001).

On the other hand, the Jacobsian type of agglomeration economies is rooted much more in the diversity of economic activity and labor division in spatial concentrations, such as metropolitan areas (Florida, 2002). This type of externalities of regional and urban concentration concerns all co-located firms and variety of industries in a single location because firms might learn from each other in a complex way and industry borders might be of secondary importance. In this regard, Frenken et al. (2007) suggested that knowledge spillover may emerge only among firms operating in technologically related industries that are capable to learn effectively from each other.

Nevertheless, the two types of knowledge spillover are not mutu-

ally exclusive, and they may occur simultaneously in the same area. Moreover, agglomeration economies are rooted in functioning processes where linkages among firms, institutions, and infrastructure of a given location give rise to economies of scale and scope. The development of general labor markets and pools of specialized skills, dense interactions between local suppliers and customers, shared infrastructure, and other localized externalities are typical examples. Agglomeration economies arise when such linkages lower the costs and increase the returns of the firms taking part in the local exchange. Presence in agglomerations improves firm performance by reducing transaction costs for both tangible and intangible assets.

Another powerful model that tries to explain existence of spatial concentrations of specialized activities (i.e., industry clusters) is bound to Michael Porter's seminal work (Porter, 1990; Porter, 2003). In his 'diamond model,' four sets of interrelated forces are brought forward to explain industrial dynamics and competitiveness. These are associated with (a) factor input conditions, (b) sophisticated local demand conditions, (c) related and supported industries, and (d) firm structure, strategy, and rivalry. A core notion arose around his model, stressing that a collaborative, mutually supportive group of actors could enhance regional competitiveness in global markets and thus create growth and other benefits. The scale and scope economies of agglomerations may also be enjoyed by cluster members, but they are completed by synergies of cooperation. In this view, regional development comes from the innovation pressure of local companies, which is helped by a competitive environment constituted by a large number of SMEs more than by a monopolistic or oligopolistic market environment with a small number of large-scale companies, including MNEs. On the other hand, papers using the concepts of localization economies and MAR-type externalities argue that a local monopoly is better for regional growth because firms can internalize and exploit innovative ideas more easily.

Porter (2003) also emphasizes that regional development goes through phases that differ slightly from each other : input-driven, investment-driven, and innovation-driven phases mainly depend on the maturity of the economy in the region. In his view, while innovation is the key mechanism in developed regions, cost efficiency is the leading force in less-developed regions by attracting economic activi-

ties. Consequently, the explaining power of knowledge externalities might vary across regions. Investments coming from outside the region and accumulated capital might determine regional growth in less-developed regions, where knowledge externalities are much less likely to be realized. Accordingly, measuring the impact of knowledge spillovers on regional growth is particularly difficult, since positive externalities that boost growth in economic concentrations may stem from other sources as well and the spillovers' impact on growth may change over time.

A significant amount of research has been published on regional growth of employment and regional concentration. The current literature basically goes back to Glaeser et al. (1992), who compared the three competing hypotheses on the knowledge spillovers mentioned above. Their results supported the Jacobsian idea of employment growth due to emerging spillovers in less specialized but diversified and competitive environments, such as metropolitan areas in the United States of America. On the other hand, Henderson et al. (1995) showed that, in some cases, the regional concentration of previous years also explained employment growth in subsequent years. They argued that growth patterns varied among different industrial sectors : the evolution of new high-tech industries is more bound to a diverse environment, while mature capital goods industries tend to enjoy MAR-type externalities. These authors found a significant positive effect of a static value of regional concentration on employment growth, which was repeatedly confirmed by many scholars[1]. These findings are also consistent with the notion that new industries prosper in large, diverse metropolitan areas but, with maturity, production decentralizes to smaller and more specialized cities. Moreover, empirical analyses with additional dynamic variables conducted by van Oort et al. (2005) and Weterings (2005) showed that a static regional concentration does not always have a promoting effect on the future growth of employment.

To sum up, three distinct features are discussed in the literature that may influence the emergence of knowledge spillovers and, hence, economic growth in agglomerations. The first is activity concentration,

[1] See McCann and van Oort (2009) for a historical overview.

the second is market concentration (monopoly versus competitive market), and the third is the direction of potential spillovers (intra- or inter-industry directions)[2]. Therefore, the three hypotheses of the agglomeration economies' effect on regional growth, namely, the MAR hypothesis, the Porter hypothesis, and the Jacobs hypothesis, are focused on.

According to the MAR hypothesis, regional growth is strongly affected by the co-location of similar or related firms because localization externalities and concentration enable knowledge spillovers to prevail across firms in the same industry (Marshall, 1890). In an empirical test, a statistically significant and positive effect of both industrial and market concentrations on regional economic growth supports the MAR hypothesis. The Porter hypothesis expects local competition among spatially concentrated firms in the same branch that forces firms to innovate in order to survive (Porter, 1990). Here, a combination of a positive coefficient of industrial concentration and a negative coefficient of market concentration supports this hypothesis.

Knowledge might also flow from one industry to the other in locations with high population density, and agglomeration externalities follow from the diversity of economic activities (Jacobs, 1969). Empirically, the negative impact of both market concentration and economic diversity on regional growth supports the Jacobs hypothesis. However, it is unlikely that both economic diversification and the SME network had attained a sufficient degree of maturity by the late 1990s and that Jacobsian-type local externality in Hungarian regions except for the capital Budapest had been realized. Thus, although the empirical analysis in this chapter treats economic diversification as a potential factor affecting regional growth, we focus on the verification of the MAR and Porter hypotheses.

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[2] The impact of knowledge spillovers on economic growth and, most importantly, on productivity growth has been examined by many scholars. Greenaway and Görg (2001; 2004) produced an excellent survey of empirical literature on this subject. They conclude that, due to various reasons (among them, methodological imperfections), very little convincing evidence was found on increasing growth or productivity due to spillover effects. Most papers in this review, however, did not investigate regional differences or the role of agglomerations.

8.4 Data and Methodology

The information used for the empirical analysis in this chapter was collected from the annual census-type data of Hungarian firms, which were compiled from financial statements associated with tax reporting submitted to the National Tax Authority in Hungary by legal entities using double-entry bookkeeping. The observation period covers 1998 and 2005. The data includes all industries and contains basic information for each sample firm, including the NACE 4-digit industrial classification codes, the annual average number of employees, total turnover, production costs, and other major financial indices. The locations of the sample firms are identifiable. Information about the ownership structure includes the total amount of equity capital at the end of the term and the proportional share held by domestic private investors and foreign investors. Tax incentives provided to firms are also present in the data[3].

To empirically examine the MAR and Porter hypotheses, we aggregate the above firm-level data by industry and by region. We use the industrial classification following the cluster study by Ketels and Sölvell (2005). To deal with the whole national economy in our study, however, we complement their list of industries with few additional sectors[4]. The final list consists of 41 sectors. Regional aggregation is conducted by Hungarian sub-region (so-called 'LAU1'). LAU1 accounts for 168 local administrative units in total. We eliminate samples containing missing values and, hence, posing an impediment to our empirical analysis. We also exclude observations if the total annual employment includes fewer than 10 persons. As a result, a total of 2,781 observations remain in our dataset.

Several methods are proposed to measure industrial concentration (Ratanawaraha and Polenske, 2007). Among them, we use the location quotient (LQ) indicator of relative concentration of industry. The LQ indicator is designed to express the relative weight of one

[3] See Section 2.4 in Chapter 2 for more details of the dataset.

[4] Newly added industries consist of (a) public services, (b) real estate services, (c) healthcare services, (d) other manufacturing, and (e) other consumer services.

single sector in a region to the total weight of the region compared to either the national economy or a larger geographical area. It is similar to Bela Balassa's RCA (revealed comparative advantage) measure[5].

The indicator for employment concentration (LQ_E) is given by :

$$LQ_{Eij} = \frac{e_{ij}/E_i}{e_j/E}, \tag{8.1}$$

where e_{ij} is the number of employees in the i th industry of the j th region, e_j is the number of employees in all industries of the j th region, E_i is the number of employees in the i th industry in the country, and E is the number of employees in all industries in the country.

In this chapter, the value of the LQ_E indicator reflects the relationship between the share of an industry in a sub-region and the share of the industry in the whole Hungarian national economy in terms of workforce distribution. If the LQ_E indicator is higher than 1, it implies that the employment share of the concerned industry is higher in the sub-region than the country average. Using the same formula, we also calculate the LQ indicator for the concentration of firms (LQ_F).

The above LQ_E and LQ_F indicators complement each other because they report on different aspects of industry clusters. LQ_E describes employment shares without considering firm density of the industry in the given region. It has the same value when the labor force is employed only by one firm or each employee belongs to separate firms. Meanwhile, LQ_F reflects the organizational structure of an industry in the given region compared to the country average : the higher the LQ_F value is, the more the industry is centered in the region. In the empirical analysis, we use the value of LQ_E and LQ_F indicators as variables of the regional employment concentration and regional organizational concentration, respectively.

Further, Nakamura and Morrison Paul (2009) suggest comparing the LQ_E and LQ_F indicators to capture the market environment aspect of industry clusters. They argue that, when LQ_E is higher than LQ_F, it denotes that the region contains relatively large firms. On the contrary, when LQ_E is lower than LQ_F, the region has a large number of

[5] See Section 7.4 in Chapter 7 and Szanyi et al. (2009) for more details on the LQ indicator.

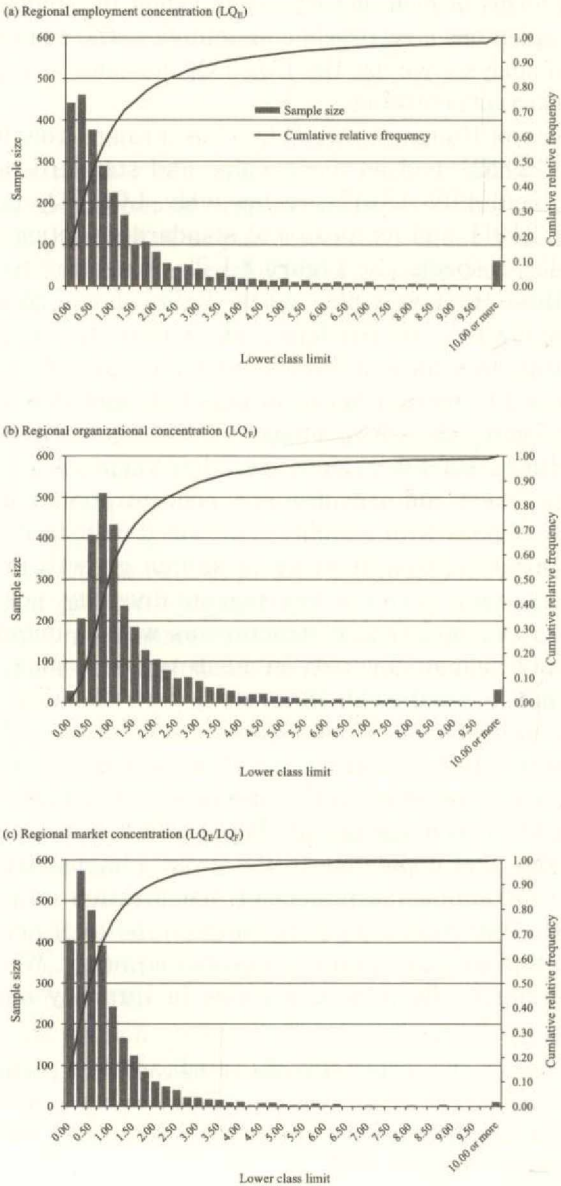
relatively small firms. Consequently, when the value of LQ_E divided by LQ_F is higher than 1, the region has a relatively concentrated market structure in terms of firm density, while, when the indicator is lower than 1, the region has a relatively competitive market environment. In the empirical analysis, we use the LQ_E/LQ_F indicator as a proxy of the regional market concentration.

In the case of Hungary, LQ_E (LQ_F) has a range from 0.019 (0.071) to 114.911 (122.852), and its mean value and standard deviation are 1.818 (1.811) and 4.158 (3.617), respectively. LQ_E/LQ_F takes a value from 0.023 to 24.911, and its mean and standard deviation are equal to 1.066 and 1.438, respectively. **Figure 8.1** illustrates the frequency distribution of these three variables. As the figure shows, all the variables tend to skew towards the left-hand side with a very long tail on the right-hand side. In a total of 2,781 observations, the share of samples with a value of 1 or more in terms of LQ_E, LQ_F, and LQ_E/LQ_F, reaches 43.7%, 58.6%, and 33.6%, respectively. These figures indicate that, in 1998, most Hungarian sub-regions were homogeneous from the viewpoint of employment and organizational concentration and there were very few sub-regions with a highly centralized industrial sector(s).

As potential factors affecting economic growth in Hungarian regions, we also pay attention to economic diversity, population density, state support, and capital structure as well as initial conditions. The degree of economic diversity in a sub-region is measured by the cross-sectoral Gini coefficient. In general, diversification of economic activities has the potential to encourage regional growth. We, however, expect a positive but statistically weak impact of this factor on the basis of the reason reported in the previous section and the very limited variance of the Gini coefficient[6]. Population density is calculated as the ratio of the total population to the gross administrative area of a sub-region to examine the impact of urbanization on regional economic growth. With regard to state support, the total tax incentive is employed to test its impact on the regional economy. We expect that the investment-friendly economic policy in Hungary had a positive

[6] In fact, the mean and standard deviation of the coefficient are 0.040 and 0.011, respectively, and almost all sub-regions take a value between 0.030 and 0.050. This suggests that the deviation of economic diversification was very limited among Hungarian regions in 1998.

Figure 8.1 Distribution of the location quotient indicator of regional employment and organizational concentration and the indicator of regional market concentration



Note : Total number of observations (N) is 2,781.
Source : Authors' illustration based on the annual census-type data of Hungarian firms in 1998.

effect on regional economic growth. To examine the relationship between capital structure and regional economic growth, we use the change in registered total domestic private capital and registered total foreign capital. As we argued in Chapter 1, previous studies repeatedly verified that private capital investment, FDI in particular, significantly improved the regional economies in Hungary. Moreover, in Chapter 3 and 4, using the same data in this study, we empirically verified technology and knowledge spillovers from MNEs to domestic firms. Hence, we predict that an increase in domestic private capital and foreign capital is positively related to regional economic growth.

As initial conditions of regional economic development, we control total domestic private capital and total foreign capital in 1998 as well as the initial level of the dependent variable. We also control the regional fixed effects taking the initial productivity gap among different counties into consideration.

The goal of our empirical analysis is to regress growth in total employment and total value-added of firms operating in the i th industry of the j th region (Δy_{ij}) into the above explanatory (independent) variables in the form :

$$\Delta y_{ij} = \alpha + \beta \cdot \mathrm{LQ}_{\mathrm{E}ij} + \gamma \cdot \mathrm{LQ}_{\mathrm{F}ij} + \delta \cdot \frac{\mathrm{LQ}_{\mathrm{E}ij}}{\mathrm{LQ}_{\mathrm{F}ij}} + \sum_{k=1}^{n} \theta_k \cdot x_k + \phi_l + \varepsilon_{ij}, \quad (8.2)$$

where α is a constant term, β, γ, δ, and θ are parameters of explanatory variables, x_k is the k th control variable, ϕ_l is the fixed effects of the l th county, to which the j th sub-region belongs, and ε is a error term[7]. We estimate the above regression equation using a Huber-White heteroskedasticity-consistent estimator for all specifications. Standard errors are adjusted for sectors by the clustering method.

As explained (dependent) variables, we use two kinds of indicators : growth rate and growth speed. The former expresses the relative scale of incremental growth from the base level ($(y_t - y_{t-1})/y_{t-1}$)), and the latter is measured by the natural logarithm of the realized outcome level divided by that in the base year ($ln\ (y_t/y_{t-1})$[8]). We use

[7] Total value-added is computed by total net turnover − (total material costs + total amortization).

[8] If y_t/y_{t-1} takes a negative value, the growth speed indicator is computed using the following formula : $sign\ (y_t/y_{t-1}) \cdot ln\ (|y_t/y_{t-1}|)$.

both of them to examine the impact of spatial concentration of industry and market on regional economy from different angles.

The detailed definition and descriptive statistics of variables used in the empirical analysis are reported in **Table 8.1**. As **Table 8.2** shows, we confirm that the Pearson correlation coefficients for the explanatory variables are well below a threshold of 0.700 for possible multicollinearity in all combinations. We also confirm that variance inflation factors (VIF) for the explanatory variables do not exceed the level of possible collinearity with the constant[9].

In **Table 8.3**, we classify samples into eight groups according to the industry cluster-related indicators (LQ_E, LQ_F, and LQ_E/LQ_F) reported above and compare these sample groups on the basis of the four growth performance variables. Panel (a) of the table indicates that both the industrial and market concentration are negatively associated with employment growth, and this relationship is statistically significant according to the results of the ANOVA and Kruskal-Wallis test. On the other hand, Panel (b) shows that the industrial and market concentration are positively related to regional production growth measured by total value-added, but the relationship between the two elements is ambiguous in comparison to that in Panel (a)[10].

The aim of the multivariate regression analysis is to confirm whether or not the relationship indicated in **Table 8.3** can be replicated while simultaneously controlling the potential determinants, including the control variables.

8.5 Estimation Results

In this section, we report the estimation results of the employment and production growth models formulated in the previous section. Estimation is performed by observation type (all observations versus observations with positive growth), by the type of growth indicator (growth rate versus growth speed), and by the set of explanatory variables (with and without initial conditions) for robustness

[9] In fact, VIF for each explanatory variable never exceeds a threshold of 5.00.

[10] We also performed a similar multiple comparison using the Gini coefficient of economic diversification, but no statistically significant association was found with each growth performance variable.

Table 8.1 Definition and descriptive statistics of the variables used in empirical analysis

Variable name	Definition	Descriptive statistics		
		Mean	Median	S. D.
Employment growth rate[a]	Growth rate of total employment by sub-region and industry, 1998-2005	1.307	0.341	3.621
Employment growth speed[b]	Natural logarithm of the change in total employment by sub-region and industry, 1998-2005	0.200	0.174	0.355
Production growth rate[a]	Real growth rate of total value-added by sub-region and industry, 1998-2005	166.187	1.873	4143.014
Production growth speed[b]	Natural logarithm of the real change in total value-added by sub-region and industry, 1998-2005	1.254	1.190	2.138
Regional employment concentration (LQ_E)	Location quotient indicator of relative concentration of employment, 1998	1.818	0.829	4.158
Regional organizational concentration (LQ_F)	Location quotient indicator of relative concentration of firm, 1998	1.811	1.120	3.617
Regional market concentration (LQ_E/LQ_F)	The value of LQ_E divided by LQ_F	1.065	0.716	1.438
Economic diversity	Cross-sectoral Gini coefficient by sub-region, 1998	0.040	0.040	0.011
Population density	Natural logarithm of population density by sub-region, 2001	0.030	−0.170	0.785
Tax incentive	Natural logarithm of total tax incentive given to firms by sub-region and industry, 1998	4.220	3.466	2.805
Domestic capital increase	Natural logarithm of the change in total registered domestic private capital by sub-region and industry, 1998-2005	5.994	10.316	9.412
Foreign capital increase	Natural logarithm of the change in total registered foreign capital by region and industry, 1998-2005	1.361	0.000	8.802
Initial domestic private capital	Natural logarithm of total registered domestic private capital by sub-region and industry, 1998	10.467	10.593	2.820
Initial foreign capital	Natural logarithm of total registered foreign capital by sub-region and industry, 1998	6.213	7.170	5.378
Initial total employment	Natural logarithm of total employment by sub-region and industry, 1998	4.947	4.852	1.521
Initial total value-added	Natural logarithm of total value-added by sub-region and industry, 1998	11.483	11.443	2.293

Notes : [a]Given by : $(y_{2005}-y_{1998})/y_{1998}$, where y_{1998} and y_{2005} are the realized levels in 1998 and 2005, respectively.
[b]Given by : $\ln(y_{2005}/y_{1998})$. If y_{2005}/y_{1998} takes a negative value, the growth speed variable is computed using the formula : sign $(y_{2005}/y_{1998}) \cdot \ln(|y_{2005}/y_{1998}|)$.

Source : Authors' calculation based on the annual census-type data of Hungarian firms in 1998 and 2005.

Table 8.2 Correlation matrix of explanatory variables

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
(A) Regional employment concentration (LQ_E)	—										
(B) Regional organizational concentration (LQ_F)	0.428	—									
(C) Regional market concentration (LQ_E/LQ_F)	0.508	−0.022	—								
(D) Economic diversity	0.022	0.046	−0.036	—							
(E) Population density	−0.075	−0.113	0.008	−0.268	—						
(F) Tax incentive	0.132	0.014	0.155	−0.073	0.278	—					
(G) Domestic capital increase	−0.129	−0.077	−0.082	0.002	0.082	−0.033	—				
(H) Foreign capital increase	−0.047	−0.038	−0.047	0.018	0.000	−0.057	0.036	—			
(I) Initial domestic private capital	0.043	0.010	0.036	−0.091	0.274	0.451	−0.199	0.003	—		
(J) Initial foreign capital	0.101	0.021	0.123	−0.092	0.319	0.537	−0.017	−0.192	0.368	—	
(K) Initial total employment	0.250	0.040	0.330	−0.114	0.326	0.668	−0.112	−0.030	0.588	0.569	—
(L) Initial total value-added	−0.085	−0.092	−0.069	−0.096	0.295	0.431	0.051	0.038	0.550	0.384	0.541

Source : Authors' calculation. For definitions and descriptive statistics of the variables, see Table 8.1.

check.

Table 8.4 contains estimation results of the employment growth model. As the table shows, neither of the hypotheses stated in Section Ⅲ is supported by our results concerning regional employment growth. In other words, neither the MAR nor the Porter hypothesis provides a sufficient explanation about the determinants of employment growth in the Hungarian sub-regions. As a matter of fact, statistically significant coefficients of the industrial concentration variables (both LQ_E and LQ_F) and the regional market competition variable (LQ_E/LQ_F) take a negative value except for the regional employment concentration variable (LQ_E) in Model [2]. Furthermore, in contrast to the weak impact of regional employment concentration, regional organizational concentration (LQ_F) has a significant and negative estimate in Models [1], [2], [5], and [6], which take the employment growth rate as an explained variable. The regional market concentration variable produces a strong and negative estimate in Models [1], [3], and [5]. However, its statistical power is significantly decreased when controlling initial conditions.

The above results are considered to be negative since, based on these findings, agglomeration economies cannot be expected to prevail in Hungary. However, regional development in transition economies

Table 8.3 Univariate comparison of growth performance among sample groups clustered in terms of the regional employment, organizational, and market concentration

(a) Employment growth

Growth performance variable	Employment growth rate			Employment growth speed		
Reference variable for sample grouping	Regional employment concentration (LQ_E)	Regional organizational concentration (LQ_F)	Regional market concentration (LQ_E/LQ_F)	Regional employment concentration (LQ_E)	Regional organizational concentration (LQ_F)	Regional market concentration (LQ_E/LQ_F)
Sample group : range of reference variables						
G1 : 0.00–0.25	3.815	3.526	3.163	3.481	2.949	2.830
G2 : 0.25–0.50	1.914	2.703	2.043	2.826	2.311	2.483
G3 : 0.50–0.75	1.111	2.099	1.163	2.377	2.522	1.678
G4 : 0.75–1.00	0.912	1.583	0.894	2.116	2.789	1.978
G5 : 1.00–1.25	0.798	1.167	0.453	1.999	1.890	1.385
G6 : 1.25–1.50	0.526	1.079	0.472	1.423	1.623	0.279
G7 : 1.50–2.00	0.479	0.865	0.443	0.011	0.538	−0.957
G8 : 2.00 or more	0.036	0.449	−0.007	−2.080	−0.941	−1.788
Multiple comparison of the 8 sample groups						
ANOVA (F)	52.950***	15.730***	32.670***	95.970***	42.970***	48.130***
Bartlett test (χ^2)	1600.000***	370.819***	1800.000***	277.095***	42.123***	201.719***
Kruskal-Wallis test (χ^2)	711.243***	297.236***	420.977***	402.989***	277.064***	208.779***

(b) Production growth

Growth performance variable	Production growth rate			Production growth speed		
Reference variable for sample grouping	Regional employment concentration (LQ_E)	Regional organizational concentration (LQ_F)	Regional market concentration (LQ_E/LQ_F)	Regional employment concentration (LQ_E)	Regional organizational concentration (LQ_F)	Regional market concentration (LQ_E/LQ_F)
Sample group : range of reference variables						
G1 : 0.00–0.25	17.289	62.738	22.479	3.811	5.959	4.249
G2 : 0.25–0.50	22.097	48.383	314.523	4.102	4.068	4.110
G3 : 0.50–0.75	15.042	48.546	16.039	4.275	4.600	3.387
G4 : 0.75–1.00	60.770	119.278	16.276	4.299	4.771	4.634
G5 : 1.00–1.25	38.525	38.692	16.568	5.207	4.947	3.465
G6 : 1.25–1.50	29.596	610.394	98.155	5.045	4.266	3.629
G7 : 1.50–2.00	22.727	30.540	703.089	5.063	5.723	4.837
G8 : 2.00 or more	658.097	306.599	289.441	5.388	3.935	8.964
Multiple comparison of the 8 sample groups						
ANOVA (F)	1.590	0.680	0.930	1.010	0.900	7.640***
Bartlett test (χ^2)	1300.000***	670.000***	1100.000***	3.922	5.945	30.525***
Kruskal-Wallis test (χ^2)	36.273***	2.475	104.576***	46.102***	18.826***	109.239***

Note : *** : Significant at the 1% level.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 8.1.

Table 8.4 Estimation of the employment growth model

Observation type	All observations				Observations with positive growth			
Growth indicator	Growth rate		Growth speed		Growth rate		Growth speed	
Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Regional employment concentration (LQ_E)	0.009	0.036*	−0.085*	−0.060	0.037	0.047	−0.024	−0.025
	(0.01)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)
Regional organizational concentration (LQ_F)	−0.058*	−0.049**	−0.054	−0.049	−0.060**	−0.049**	−0.009	−0.020**
	(0.03)	(0.02)	(0.06)	(0.05)	(0.03)	(0.02)	(0.01)	(0.01)
Regional market concentration (LQ_E/LQ_F)	−0.314***	−0.064	−0.498***	−0.248*	−0.559***	−0.163	0.078	−0.045
	(0.06)	(0.04)	(0.12)	(0.13)	(0.13)	(0.10)	(0.05)	(0.05)
Economic diversification	−1.281	−3.063	−3.382	−5.669	0.498	−2.775	−0.772	0.676
	(3.95)	(3.84)	(7.93)	(7.50)	(5.29)	(5.15)	(2.55)	(2.08)
Population density	0.330*	0.696***	0.504**	0.690*	0.477*	0.894***	0.551***	0.253**
	(0.18)	(0.23)	(0.22)	(0.35)	(0.26)	(0.33)	(0.10)	(0.11)
Tax incentive	−0.208***	0.039	−0.155	0.001	−0.326***	0.021	0.204***	−0.007
	(0.05)	(0.03)	(0.11)	(0.06)	(0.07)	(0.06)	(0.04)	(0.02)
Domestic capital increase	0.057***	0.048***	0.182***	0.180***	0.040***	0.048***	0.040***	0.042***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Foreign capital increase	0.053***	0.065***	0.112***	0.129***	0.060***	0.078***	0.038***	0.038***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Initial domestic private capital		0.084		0.179*		0.038		0.057***
		(0.05)		(0.09)		(0.08)		(0.02)
Initial foreign capital		0.077**		0.132***		0.100**		0.042***
		(0.03)		(0.03)		(0.05)		(0.01)
Initial level of dependent variable		−1.163***		−1.154***		−1.360***		0.410***
		(0.18)		(0.30)		(0.25)		(0.07)
Const.	2.016***	5.148***	1.438***	3.454*	3.140***	6.608***	3.203***	1.299***
	(0.37)	(0.85)	(0.46)	(1.74)	(0.50)	(1.10)	(0.23)	(0.34)
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2781	2781	2781	2781	1798	1798	1798	1798
Adjusted R^2	0.12	0.20	0.31	0.36	0.10	0.17	0.32	0.44
F-test	29.42***	30.18***	113.53***	119.55***	31.43***	24.61***	43.50***	141.66***

Notes : All models are estimated using Huber-White heteroskedasticity-consistent estimator. Standard errors are adjusted for 41 sectors and reported in parentheses beneath regression coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. F-test tests the null hypothesis that all coefficients are zero.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 8.1.

may differ from developed ones. We argue that the lower maturity of the regional economy predominates over the relevance of agglomeration economies in most of the sectors. In Hungary, the major industrial sectors are dominated by MNEs, and these foreign firms are highly motivated to invest, taking market potentials into account. Consequently, regional spread is much more likely to occur than regional agglomeration, which we found in most of the industries in previous research (Szanyi and Lengyel, 2010).

As we predicted, economic diversification does not have a significant coefficient, suggesting that the Jacobs model of local externalities does not excise the driving force in promoting regional employment in the case of Hungary. The variable of population density has a positive sign with statistical significance at the 10% or less level in all models. Hence, we conjecture that employment is more likely to occur in an urban environment than in less populated regions. Tax incentives show a significant coefficient in Models [1], [5], and [7], but the inclusion of initial condition variables into the right-hand side of the regression equation remarkably reduces its explanatory power. Capital investment has a strong positive impact on employment growth in all models, and the impact does not depend on the financial source.

The estimation results of the production growth model are reported in **Table 8.5**. Glaeser et al. (1992) stressed the importance of using output indicators to measure the effects of industrial concentration and agglomeration economies on the regional economy. As the table shows, contrary to employment growth, the MAR-type local externalities seem to visibly prevail in the growth of regional production. This statement is underlined by significant and positive estimates of the regional organizational concentration and regional market concentration variables in most models. At the same time, the estimation results in **Table 8.5** also reveal that regional employment concentration is negatively related to the production growth rate.

Two aspects of industrial concentration measured by firm and workforce density have a counter-effect on regional production growth; namely, a relatively high employment concentration does not increase production in industry clusters. On the contrary, clusters with a relatively high number of firms tend to create appropriate environments for local knowledge externalities leading in production growth. Meanwhile, estimates of the regional market concentration variable

Table 8.5 Estimation of the production growth model

Observation type	All observations				Observations with positive growth			
Growth indicator	Growth rate		Growth speed		Growth rate		Growth speed	
Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Regional employment concentration (LQ_E)	−169.418***	−173.588***	0.048	−0.030	−176.435***	−179.961***	0.010	0.010
	(26.20)	(25.96)	(0.07)	(0.05)	(32.57)	(31.03)	(0.01)	(0.01)
Regional organizational concentration (LQ_F)	665.135***	655.171***	0.088	−0.075	712.932***	693.844***	0.026***	0.022***
	(177.61)	(173.70)	(0.07)	(0.05)	(152.32)	(147.11)	(0.01)	(0.01)
Regional market concentration (LQ_E/LQ_F)	398.674***	363.881***	0.964***	0.313	420.210***	371.027***	0.115***	0.121***
	(97.22)	(87.86)	(0.27)	(0.22)	(111.72)	(97.50)	(0.03)	(0.03)
Economic diversification	1827.434	495.594	40.429*	18.133	1886.985	1911.865	−0.559	−1.616
	(1994.39)	(1867.71)	(23.06)	(19.59)	(3474.90)	(3808.40)	(2.55)	(2.24)
Population density	509.739***	539.930***	0.950	1.858**	541.082***	667.872**	0.757***	0.519***
	(171.80)	(189.12)	(0.93)	(0.84)	(194.56)	(290.56)	(0.10)	(0.12)
Tax incentive	−71.533**	−46.052	−0.094	0.482***	−78.166**	−35.212	0.256***	0.158***
	(29.22)	(41.66)	(0.37)	(0.15)	(35.06)	(51.82)	(0.02)	(0.02)
Domestic capital increase	20.759**	28.225**	0.096	0.171***	29.464***	46.717***	0.024***	0.027***
	(8.19)	(12.50)	(0.07)	(0.04)	(10.64)	(19.59)	(0.01)	(0.00)
Foreign capital increase	0.017	3.232	0.052	0.132***	−1.684	5.981	0.037***	0.042***
	(5.00)	(5.38)	(0.04)	(0.03)	(7.89)	(7.43)	(0.01)	(0.01)
Initial domestic private capital		91.737		0.710***		138.472		0.075*
		(72.19)		(0.21)		(104.53)		(0.04)
Initial foreign capital		12.012		0.374***		24.037		0.063***
		(22.52)		(0.07)		(31.14)		(0.01)
Initial level of dependent variable		−221.426*		−3.643***		−431.319		0.066**
		(131.53)		(0.33)		(260.78)		(0.03)
Const.	−1002.023***	443.624	1.144	31.959***	−1102.680***	1714.367	11.226***	9.683***
	(273.77)	(911.53)	(1.56)	(3.92)	(283.97)	(1672.70)	(0.20)	(0.55)
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2781	2781	2781	2781	1900	1900	1900	1900
Adjusted R^2	0.27	0.28	0.14	0.34	0.29	0.31	0.41	0.46
F-test	166.14***	91.21***	14.96***	39.51***	187.95***	94.22***	93.29**	151.68***

Notes : All models are estimated using Huber–White heteroskedasticity-consistent estimator. Standard errors are adjusted for 41 sectors and reported in parentheses beneath regression coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. F-test tests the null hypothesis that all coefficients are zero.

Source : Authors' estimation. For definitions and descriptive statistics of the variables, see Table 8.1.

suggest that successful clusters have a strong tendency to be constituted of relatively large companies that enjoy a large market share in their specialized segments. In other words, the combination of monopolistic market competition and the presence of large-scale companies are more likely to increase output than a group of small firms under competitive market environments. This finding corresponds with the evidence reported in previous literature on the significant impact of FDI and monopolistic market structure on economic recovery in transition economies (Szanyi, 2003; Lengyel and Leydesdorff, 2011). However, it is clear that industries may vary concerning the characteristics of their spatial organizational structure.

Among control variables, population density and domestic capital increase produce a significant and positive estimate, in line with our expectations. Tax incentives and foreign capital increase are also positively related to production growth speed even after controlling initial conditions. Economic diversification has a positive coefficient in all models, but it is statistically insignificant except in Model [3].

As reported above, the estimation results of the employment growth model and the production growth model are inconsistent at first sight. However, we stress that the two explained variables reflect on different aspects of agglomeration economies. Employment growth can either be the result of firm growth in a given location or the entrance of new firms into the region. Hence, the effect of agglomerations on regional economic performance is unpredictable. On the other hand, production growth reflects agglomeration economies much more easily. Co-located firms are able to enhance their output for several reasons. Economies of space, knowledge spillovers, and local (on-site) learning are the most powerful assumptions that encourage production growth. The positive coefficient of the regional organizational concentration variable suggests that co-located firms learn intensively from each other and enjoy intra-industrial knowledge externalities, making the most of geographical proximity advantage.

8.6 Conclusions

In this chapter, using census-type data of Hungarian firms in 1998 and 2005, we empirically examined hypothesis of local knowledge externalities focusing on the impact of industrial and market concen-

tration on regional economic growth. The results from univariate and multivariate regression analyses conducted in the previous sections confirm that both organizational and market concentrations are positively related to production growth in Hungarian sub-regions, while employment concentration has a negative impact. These findings broadly support the MAR hypothesis of local knowledge externalities that stresses the role of large firms in a specialized location. Furthermore, our empirical evidence strongly indicates the possible synergy of monopolistic market structure and the presence of big companies for regional production growth. On the contrary, we could not obtain any supporting evidence that industrial and market concentrations promote job creation at the sub-region level in the case of Hungary.

The Porter hypothesis is not supported by our empirical results perhaps due to the dual structure of the Hungarian industry, where foreign companies and their investments are decisive in regional employment and production growth. It is likely that regional economic development, in terms of the Porter hypothesis, is mostly investment-driven, and the motivation to innovate does not significantly influence economic growth in Hungarian regions. This argument offers policy implications for other transition economies as well because similar trends were observed in these countries during transition from the planned system to a market economy. However, in this chapter, we do not discriminate between the effect of foreign-owned and domestic firms in the empirical analysis. This is a topic reserved for future research.

Moreover, we confirmed that the Jacobsian-type local externality is very hard to identify in small economies, such as Hungary. The coefficient of the economic diversity variable is insignificant in both the employment and production growth models. In Hungary, most sub-regions are lightly populated and have a low firm density; the only metropolitan area is Budapest. These circumstances may not permit the empirical detection of the Jacobsian-type local externality using a sub-region level dataset. Reconsideration of empirical strategy is another issue for further work.

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Conclusions and Future Research

This book explores important aspects of an FDI-driven development model in Central Europe focusing on Hungary. The main emphasis is on a variety of positive externalities, more specifically, spillovers that emerged due to the activity of foreign affiliates in an emerging market economy. Impacts on domestic firms in close cooperation or technologically more remote positions, and the role of ownership change in structural and performance up-grading were explored, as well as macro structural aspects such as active development in the services sector, and the benefits of organizational innovations. Finally, the spatial aspects of FDI-led growth were examined. The main conclusion of the book is that foreign investments contributed to the fundamental restructuring and change of development path in economies of Central Europe. This process led to a new kind of integration of this region into the globalized world economic system. We emphasized that this reorientation had probably no better alternative, and countries and societies (illustrated mainly with the example of Hungary) benefited in a variety of ways.

We examined the development process from all aspects, which, of course, includes the negatively perceived tendencies. For example, the fundamental restructuring process was coupled with extensive downsizing of activities and employment in branches that were not in the main stream of the new development model. It was rather difficult, however, to separate the impacts of the overall globalization process and the restructuring process due to the systemic change. While this problem may seem to have lost importance 22 years after the initial political turnover, the results, the imprint of the period, and the current status of the transition economies cannot be evaluated without due regard to the transition process. In addition, the transition may be more or less finished on a micro level but not on a mezzo and macro level. Macroeconomic institutions continuously evolve, altering the working conditions of business. For example, changes in the social security systems may have a rather strong influence on the whole economy. Global changes and the impacts of the transition process are mixed in this regard as well, providing an exciting field of further research into the variety of economic systems and development.

While the broader background of the FDI-led development model and, mainly, its impact on business is an interesting research topic, the topics of this volume also deserve further elaboration. Although we dealt with the positive and negative externalities due to FDI, further attention should be given to the networks of multinational corporations, the benefits that these firms enjoy, and those enjoyed by home country investors. The model itself can be maintained only if the mutual interests of business and societies are maintained. There should be a balance in exploring and sharing the benefits of international cooperation. Research should figure out this balance of mutual interests. Another important aspect of this issue is the role of pan-European (maybe also global) business networks in strengthening the integration process of Europe. The current monetary and fiscal crisis of the European Union suggests that this type of mutually beneficial international cooperation has experienced serious bottlenecks in the past.

The European aspects lead us back to the problem of the long-term mutual interests of donor and host economies. In the case of host (transition) economies, further research is required to determine the long-term development impacts of the FDI-based development model. This is because current research focuses on the current status and puts little emphasis on the future impact. Structural changes, for example, might have led to very important structural up-grading and an astonishing increase in productivity. Not much is known, however, about other aspects of the new structures, such as income generating and sharing. It seems that some of the most rapidly evolving industries contribute to local value added only marginally. In addition, the strict specialization on a few and, in some cases, unskilled labor-intensive handling activities does not provide job opportunities for skilled labor. Thus, these activities do not represent demand for skill development and education, or for constructive engineering tasks. If this situation prevails on the long run, it may negatively impact the host country's labor reproduction systems. Further examples of long-term contradictions behind short-term benefits should also be analyzed, and policy suggestions for their solution should be provided. The same applies for donor countries. In other words, new tendencies of international labor division in the globalization process have not been thoroughly analyzed. Much of the research from developed countries

seems to be based on politically motivated opinions.

Researchers habitually look for new research topics and problems to explore. Sometimes, they have some preoccupation or hypotheses that they want to prove (rather than to reject). Researchers are differentiated from the public opinion by the ways and tools through which they establish and change their perceptions. These approaches and toolkits were established and refined over the course of centuries. The scientific approach to problems, therefore, leaves less room for sentiment, which can be strongly influenced by interest-driven opinion. In pure science, researchers may also change opinion and reject hypotheses. They are even expected to do so whenever neutral research produces new contradictory information. Therefore, we cannot stop at this stage, but continue to research the longer-term impacts of global cooperation networks on both host and donor economies.

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Biography

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