TECHNOLOGY SPILLOVERS THROUGH FOREIGN DIRECT INVESTMENT IN TURKISH MANUFACTURING INDUSTRY

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ABSTRACT

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This study investigates whether there are technology spillovers through foreign direct investment (FDI) in Turkish manufacturing industry. Before the econometric estimation, theoretical and empirical literature on FDI and technology spillovers especially by transnational corporations (TNCs) is analyzed in detail. Also, historical perspective of FDI and review of the related literature for Turkey constitutes an important part of the study. To test the spillover effects of FDI, the dataset including sectoral level determinants of 89 different sectors, according to ISIC (International Standard of Industrial Classification) 4-digit industrial classification, in Turkish manufacturing industry is used. The dataset is obtained from Turkish Statistical Institute (TurkStat) for the period 1983-2001. Sectoral market shares of foreign firms are used as spillover variables; and horizontal spillovers are tested. Although some specifications of variables produce negative and insignificant results, the significant regression results show that there are positive spillover effects from foreign firms to domestic firms through horizontal spillovers. In this estimation, six different proxies of capital stock are used to test the robustness of the results; and also, spillovers are tested in terms of low-technology-using (Low-Tech) sectors and high-technology-using (High-Tech) sectors.

Keywords: Foreign Direct Investment, Technology Spillovers, Turkey.

ÖZ

DOĞRUDAN YABANCI YATIRIMLARIN TÜRKİYE İMALAT SANAYİİ'NE TEKNOLOJİK GETİRİLERİ

OMUZLU AKSOY, Yeliz

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Bu çalışma, doğrudan yabancı yatırımların (DYY) Türkiye imalat sanayiine teknolojik getirilerini araştırmaktadır. Ekonometrik tahmin yapılmadan önce, DYY ve özellikle uluslararası firmalar aracılığıyla gelen teknolojik getiriler hakkındaki teorik ve deneysel yazın detaylı olarak incelenmiştir. Ayrıca, Türkiye'deki DYY'nin tarihsel gelişimi ve ilgili yazının taranması, çalışmanın önemli bir kısmını oluşturmaktadır. DYY aracılığıyla gelen teknolojik getirilerin test edilmesi amacıyla, Türkiye imalat sanayii için ISIC (Uluslararası Standart Sanayi Sınıflandırması) 4. düzey sanayi sınıflandırmasına göre seçilen 89 farklı sektöre ait sektörel düzeydeki belirleyicileri içeren veri seti kullanılmıştır. Türkiye İstatistik Kurumu'ndan alınan bu veri seti, 1983-2001 dönemini kapsamaktadır. Yabancı firmaların sektörel pazar payları getiri değişkeni olarak kullanılmakta ve yatay getiriler test edilmektedir. Değişkenlerin bazı tanımlamaları negatif ve anlamsız sonuçlar üretmesine rağmen, anlamlı regresyon sonuçlarına göre yabancı firmalardan yerli firmalara doğru yatay getiri yoluyla, pozitif teknolojik getiri etkisi vardır. Yapılan modellemede, altı farklı sermaye stoğu verisi kullanılarak sonuçların dayanıklılığı test edilmiş ve ayrıca getiriler yüksek teknoloji ve düşük teknoloji kullanan sektörler açısından da incelenmiştir.

Anahtar Kelimeler: Doğrudan Yabancı Yatırımlar, Teknoloji Getirileri (Teknolojik sızıntılar), Türkiye.

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CHAPTER 1

INTRODUCTION

Foreign Direct Investment (FDI) is a major policy issue of governments especially in developing countries in the context of development literature. Since FDI is seen as a means of economic growth, the role of FDI in enhancing growth has been analyzed extensively in the literature. Many researchers analyzed the effects of FDI in developing countries either theoretically or empirically. Another important aspect of the issue for policy makers is transnational corporations (TNCs) as foreign investors in developing countries. For this reason, the behaviours of TNCs as decision-makers of FDI in developing countries and their impact on the host country economy is an interesting area for researchers.

FDI goes to developing countries in four ways; cross border mergers and acquisitions (M&A), greenfield investments, earnings reinvested in foreign owned companies and cross-border loans & trade credits between related enterprises. Resource-seeking, market-seeking, efficiency-seeking and strategic asset-seeking are the four main motives of this kind of investment. In fact, there are many different options for TNCs to extend operations abroad such as exporting, licensing, or entering into a joint venture or strategic alliance. But they prefer investing abroad due to some advantages; such as ownership, location and internalization advantages (OLI-framework).

TNCs choose any region or country to invest, aiming some gain from this investment. Although FDI is generated by the motivation of TNCs, policy makers in developing countries try to attract foreign investment due to the impact of FDI on

economic growth by the way of embodied (import of machinery/equipment) or disembodied (know-how, knowledge and licences) technology transfer.
This technology transfer occurs either intentionally, by help of TNCs' policy to provide new technologies to host country, or unintentionally, as a positive externality effect on the host country. The unintentional transfer of technology is called technology spillover in the literature. There are three types of technology spillovers; horizontal, vertical and labour spillovers, arising by means of five main channels; demonstration/ imitation, labour mobility, exports, competition and linkages.

According to growth theories, it is believed that FDI promotes growth in the host country. However, there is no consensus on the benefits of FDI, that is, the existence of positive spillover effects, among the empirical studies analyzing investments on the manufacturing industries. While many studies found evidence in favour of positive horizontal and/or vertical spillovers there are still many others finding no support for positive spillovers or even support for negative productivity spillovers in developing countries.

As Yılmaz and Özler (2004) mentioned, the substantial variation in the results of econometric studies is perhaps due to the differences in the institutional framework, the state of development of the local manufacturing industry, and the characteristics of the foreign direct investment in each of the countries for which the studies are conducted.

Different conclusions could also be reached due to the limitations of the data sets in measuring intra- and inter-industry linkages through which productivity spillovers may be realized. One of the shortcomings of the empirical analysis of productivity spillovers is the measurement of spillovers. While the availability of plant level panel data has provided a significant improvement over the sector-level data, intra- and inter-industry linkages are still identified through the use of sector-level input-output matrices.

The objective of this study is to survey the theoretical and empirical literature on technology spillovers through FDI and analyze the Turkish manufacturing industry

in terms of spillover effects. The empirical investigation draws on a sector-level panel data over the 1983-2001 period consisting of 89 sectors in Turkish manufacturing industry in four-digit level. The data set used in this study is provided by Turkish Statistical Institute (TurkStat).

The remainder of the study is structured as follows. Section 2 provides a review of the literature on FDI and technology spillovers. In this section, globalization and trend in FDI, drivers and determinants of FDI are mentioned together with FDI-related spillovers and empirical studies on spillovers. Section 3 presents a brief history of FDI flows to Turkey and mentions the empirical studies of spillovers on Turkish manufacturing industry. The empirical estimation on Turkish manufacturing industry is discussed in detail in terms of data, methodology and results in Section 3. Section 4 concludes the study.

CHAPTER 2

FOREIGN DIRECT INVESTMENT AND SPILLOVERS

2.1. Globalization and Trends in FDI

As stated by Penalver (2002), globalization is a combination of four major trends, consisting of the expansion of international trade, financial flows (with FDI as the most important component of these flows), global communications (including transport) and movements of people (immigration). These four factors were main drivers in the so-called “first wave of globalization” of 1870-1914, and they have been present in the post World War II period through the 1970s and in the most recent wave, starting in the 1980s and consolidating in the decade of the 1990s.

Although four major trends are common in the three globalization waves, these three waves differ in terms of their causes, characteristics and effects. The first wave of global integration was triggered by a combination of falling transport costs and reductions in tariff barriers. New technologies such as railways created huge opportunities for land-intensive commodity exports. Trade pattern was land-intensive primary commodities against manufactures. In this period, exports and growth increased sharply, globalizing countries converged to each other due to mass migration equalizing incomes. The impact of globalization on inequality within countries depended on the ownership of land.

The second wave of globalization began after the period of retreat of nationalism during 1914 and 1945. United Nations persuaded governments to cooperate to reduce the trade barriers. The lifting of barriers between them greatly expanded the exchange of manufactures. International specialization within manufacturing became important and this helped to drive up the incomes of the rich countries relative to the

rest. Due to the rapid growth and greater equity on industrial world, this period is referred as golden age.

In the third wave of globalization, while a large group of developing countries broke into global markets; other developing countries suffered declining incomes and rising poverty. International migration and capital movements, which were negligible during second wave globalization, have again become substantial (World Bank, 2002). These three waves of globalization period and changes in the major factors can be shown in Figure 2.1.

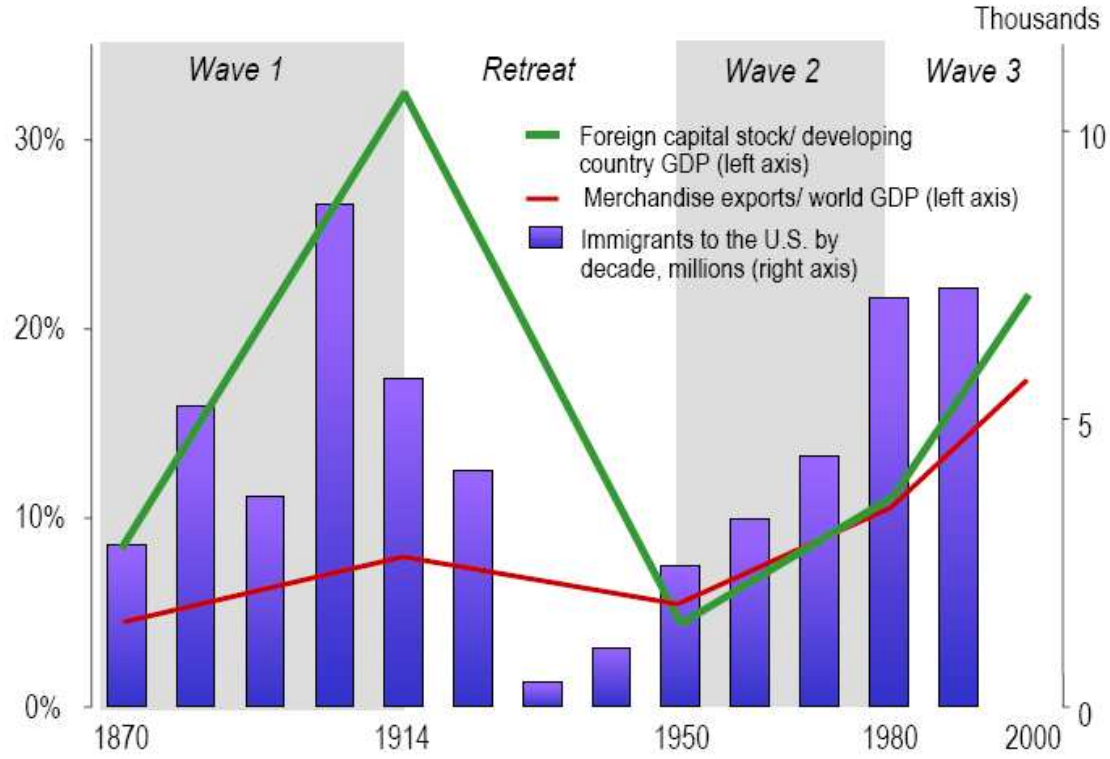

Figure 2.1: Three Waves of Globalization.
Source: World Bank (2002).

The new globalization wave has brought a significant policy change in developing countries, leading them to switch from inward-looking import substitution to

outward-looking, market-determined strategies. This resulted in greater openness to FDI as one of the key features of liberalization. This policy change is important in terms of FDI policies due to the finding of Bhagwati (1978) that FDI was shown to be more growth-enhancing in countries that pursue export promotion than in those promoting import substitutions.

With the recent globalization wave after 1980s, there has been a sharp increase in foreign capital flows for both developing and developed countries. Figure 2.2 provides information on the pattern of FDI globally, as well as for specific regions. Global FDI inflows rose by 29% to $916 billion in 2005, compared to a 27% increase in 2004.

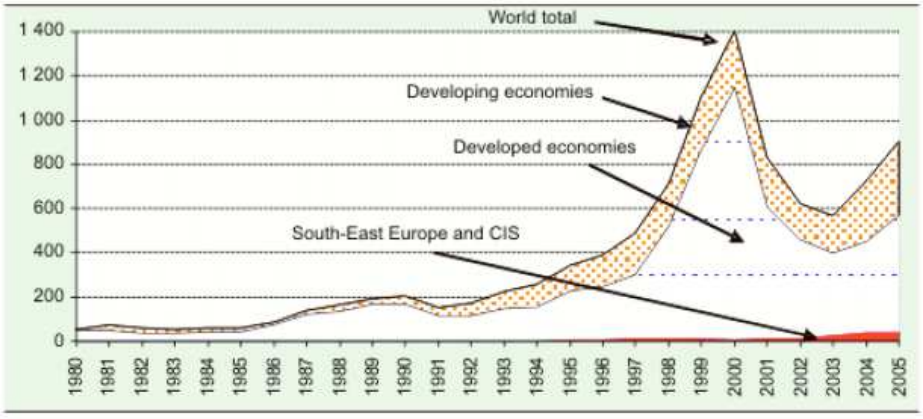

Figure 2.2: FDI Inflows, global and by group of economies, 1980-2005 (billions of dollars).
Source: UNCTAD (2006).

Increasing volume of inflows during this new globalization wave has been an important issue about FDI. The most important factors explaining the surge of FDI inflows into the developing countries in recent years have been the foreign acquisition of domestic firms in the process of privatization, the globalization of production, and increased economic and financial integration. Besides the increasing

volume of FDI globally, another important issue has been the composition of FDI. In terms of composition of FDI, investing in a recipient country is in two ways: cross-border mergers and acquisitions (M&As) -entering a foreign market by buying an existing enterprise- and greenfield investment -entering a foreign market by building a new enterprise. Earnings reinvested in foreign owned companies; and cross-border loans and trade credits between related enterprises are the other two ways of FDI. Although reinvested earnings sometimes make up a significant part of the FDI flows between mature economies, when FDI is analyzed in development context, greenfield investments and M&As are the main concern.

M&As are the result of a legal joining of two firms under a single ownership and include different types of transactions, such as acquisition of private domestic companies by foreign investors, or privatization of state-owned enterprises, when the buyers are foreign investors. M&As are the main channel of FDI inflows to developing countries. But according to Table 2.1, between 2003 and 2005 about 83% of all cross-border M&As took place in the developed countries. In monetary terms, cross border M&As accounted for $297 billion in 2003 to $716 billion in 2005 for the global economy.

Table 2.1: Cross Border M&As, by region/economy of seller/purchaser, 2003-2005 (Number of deals).

Region/economy	Sales (in the country of target firm)			Purchases (in the home country of the acquiring firm)		
	2003	2004	2005	2003	2004	2005
World	4.562	5.113	6.134	4.562	5.113	6.134
Developed Countries	3.328	3.741	4.52	3.778	4.255	5.062
Developing Countries	1.045	1.251	1.376	710	817	994
Turkey	11	18	23	3	4	8
South-East Europe and CIS	189	121	238	74	41	78

Source: UNCTAD (2006).

Greenfield investments involve the construction of new production facilities, rather than the purchase of existing facilities. According to UNCTAD (2006), between 2003 and 2005 about 42% of greenfield investments went to developed countries while greenfield FDI projects decreased from 47% in 2003 to 45% in 2005 for developing countries as sources of greenfield investment (Table 2.2). As destinations, approximately 84% of greenfield investments are made by developed countries.

Table 2.2: Greenfield FDI Projects, by investor/destination region, 2003-2005 (Number).

Partner region/economy	World as destination			World as source		
	2003	2004	2005	2003	2004	2005
	By source			By destination		
World	9.348	9.927	9.488	9.348	9.927	9.488
Developed Countries	7.735	8.443	8.057	3.867	4.144	3.981
Developing Countries	1.44	1.294	1.243	4.467	4.806	4.296
Turkey	105	62	57	69	66	62
South-East Europe and CIS	173	190	188	1.014	977	1.211

Source: (UNCTAD) 2006.

2.2. Drivers and Determinants of FDI Flows

2.2.1. Drivers of FDI

The composition of FDI, between greenfield FDI and M&As, has changed considerably towards M&As. Between 1980 and 1999, the value of M&A increased each year, by an average of 42% and reached a level of $3.400 billion in 2000. For all developing countries, the share of M&As in foreign investment increased from 18% in 1995 to 36% in 1999. Trends in the mode of entry of firms investing in developing countries differ considerably from those of developed countries, where

greenfield investment continues to dominate. However, in developing countries M&As have become an increasingly important mode of entry driven by privatization in recent years.

Besides the different modes of FDI inflows, the motives for investing abroad also differ among investors who want to invest abroad. According to Narula and Dunning (2000), four main motives for investors especially in developed countries are to seek natural resources, to seek new markets, to restructure existing foreign production in terms of lower costs and efficiency, and to seek new strategic assets. First three motives of FDI is asset-exploiting motives which aim to generate economic rent by using existing foreign production and the last motive is asset-augmenting motive to acquire new assets that protect or enhance existing assets.

Resource-seeking FDI: The availability of abundant or cheap production factors in a developing country is a motivation for transnational corporation (TNC) presence in that country. Natural resources are a type of production factors that traditionally has attracted greatest interest among foreign investors. Especially, in the first wave of globalization, colonial powers invested in their colonies to extract natural resources and they subsequently used them in their home countries.

Natural resource-seeking is still the main FDI motive for TNCs operating in sectors such as mining, mineral extraction and operating in large-scale agricultural business. Countries with an abundance of the relevant natural resources, especially, least developed countries are potential investment regions for investors seeking natural resources in TNCs. TNCs may seek natural resources for three reasons: to meet the needs of its own downstream refining or manufacturing activities, to sell the minerals directly in host, home or international markets, or to secure the strategic requirements of energy or other minerals for its home country (as formulated by the country's government) (OECD, 2002; UNCTAD, 2007).

Human resource-seeking motive for FDI arouse due to the potential of obtaining cheap labour. Human resource-seeking FDI depends on the relative pricing of labour with a given level of qualifications. Besides natural resource seeking, the availability

of skilled inexpensive labour in developing countries is becoming an increasingly important motivation among foreign investors. On the other hand, since TNCs generally respond to rising wage pressures at home by shifting labour-intensive production processes to developing countries, this type of FDI is also related with the efficiency-seeking approach.

***Market-seeking FDI*:** Especially in the manufacturing sectors of developing countries, where import-substitution and related policies hinder direct export from the home countries, market-seeking FDI is an important motive to access to host-country markets for processed goods. However many developing countries have liberalized their import regime after 1980s and this liberalization policy enabled TNCs to choose between exporting and undertaking FDI. According to Nunnenkamp (2001), there may be a decline in purely market-seeking FDI due to liberalization policies, but it should also be taken into account that the possible decline of market-seeking FDI is largely restricted to FDI in manufacturing industries. The opening of service industries to FDI is the reason behind the existence of market-seeking FDI motive today. Some other reasons of market-seeking FDI are transport costs, differences in consumer tastes and the total magnitude of the host economy.

***Efficiency-seeking FDI*:** TNCs invest in developing countries to boost efficiency beyond the simple reallocation of labour-intensive production. Key factors for efficiency seeking investment include labour costs, skills and availability, and access to international markets. Efficiency-seeking FDI is often made with the specific objective of accessing low-cost labour for labour-intensive production or taking advantage of relatively abundant supplies of educated and skilled workers. Efficiency-seeking FDI is motivated by creating new sources of competitiveness for firms and strengthening existing ones whereas market-seeking FDI aims at penetrating the local markets of host countries. Investment related to efficiency-seeking may be seen in different forms. One form is that firms in developing countries undertake to supply TNCs with fully manufactured products that will bear the TNCs' brand names. Another form is that foreign enterprises try to provide products adapted to local tastes and quality requirements. The composition of this

form of FDI may be either greenfield investment or M&A. This kind of FDI mostly goes to large or economically advanced developing countries.

Strategic asset-seeking FDI: FDI is a means to acquire strategic assets such as technology, marketing, and management expertise available in a host country. Companies investing abroad with the purpose of acquiring strategic assets aim at a competitive edge, as well a degree of a monopoly just at the beginning. Strategic asset-seeking FDI is popular among medium income and fast-growing industrializing countries as they seek to establish a speedy presence in the innovative and dynamic markets of the advanced countries (Dunning et al., 1996). Developing countries may make themselves more attractive to such FDI by investing in human resources and infrastructure. (OECD, 2002).

Table 2.3 below shows the predominant motivation factors and the modes of FDI entry to the recipient economy. According to this table, resource-seeking FDI comes mostly on the form of greenfield investments while efficiency-seeking and strategic-asset seeking FDI are shown in M&As mode.

Table 2.3: Predominant motivation factors and modes of delivery.

	Greenfield Investments	Mergers and acquisitions (M&As)
Resource-seeking FDI	Yes	Rare
Market-seeking FDI	Yes	Yes
Efficiency-seeking FDI	Rare	Yes
Strategic-asset seeking FDI	Rare	Yes

Source: OECD (2002).

FDI motives such as resource-seeking and efficiency-seeking FDI are due to the comparative advantage of the host country. If the FDI motive is the host country's comparative advantage instead of by-passing trade barriers in the host country, then it may contribute positively to the export growth. Thus, resource-seeking and

efficiency-seeking FDI would promote exports while market-seeking FDI and strategic asset-seeking FDI may not be a catalyst to export growth (Banga, 2003).

2.2.2. Determinants of FDI

Until the recent globalization wave, it was strongly agreed that FDI is mainly attracted by strong economic fundamentals such as market size, the costs and efficiency of production, the quality of infrastructure and access to skills. The most important determinants are market size and income level which shows that market-seeking is the major motive of investment flows to developing countries especially in the second wave of industrialization. Additionally; skills, trade policies, and political and macroeconomic stability are other central determinants. While investment incentives were seen as relatively minor determinants of FDI decisions, globalization has changed this picture and made incentives a more important determinant of international investment decisions (Kokko, 2003).

Besides many different options such as exporting, licensing, or entering into a joint venture or strategic alliance to extend operations abroad, Dunning (1993) explains why FDI is chosen by TNCs within OLI-framework (Ownership advantages, Location advantages, and Internalization advantages).

According to OLI-framework, ownership advantages (O) refer to the assets such as superior technology or management knowledge of a firm that allow it to compete successfully in overseas markets, despite a lack of knowledge of the local market and the costs of setting up a foreign affiliate. Location advantages (L) are the benefits that a host country can offer a firm: large markets, low labour or production costs or both, and a good infrastructure. Internalization advantages (I) refer to transaction-costs, and occur when it is cheaper to exploit ownership and location advantages through FDI rather than exporting. A firm can go abroad by simply exporting its products to foreign markets; however, uncertainty, search costs and tariff barriers are additional costs that will deter such trade. Similarly, the firm could license a foreigner to distribute the product but the firm must worry about opportunistic behaviour by the licensee. As a result, TNC can substitute its own internal market

and save more. While ownership and internalization advantages are investor specific determinants, the location advantage is specific to the host country (OECD, 2001).

Location determinants of FDI are categorized as in the Table 2.4 below firstly by Dunning (1993) and then, by UNCTAD (1998).

Table 2.4: Selected Host Country Determinants of FDI.

Overall Policy Framework	**Business Facilitation**
-Economic and political stability -Rules regarding entry and operations of TNCs -Bi- and multilateral agreements on FDI -Privatization policy	-Administrative procedures -FDI promotion (e.g. Facilitation services) -FDI incentives (subsidies)
Economic Determinants*	
*Differentiated by major motivations of FDI	
Relating to Resource-seeking FDI	**Relating to Market-seeking FDI**
-Raw materials -Complementary factors of production (labour) -Physical infrastructure	-Market size -Market growth -Regional integration
Relating to Efficiency-seeking FDI	
-Productivity-adjusted labour costs -Sufficiently skilled labour -Business-related services -Trade policy	

Source: UNCTAD (1998).

Recently, the location advantages gained additional importance in attracting FDI by host countries due to potential gains of investment flows. The development of capacities, the amount of investment flows that host country can hold, and capabilities, necessary conditions that host country can provide for investment climate, is important for attracting FDI. When the host country's local capabilities

such as human resource, supplier and technological capabilities are strengthened and new capabilities are created, FDI inflows start to rise. They stagnate or fall, otherwise. According to Borensztein et al. (1998) and Xu (2000), countries require a minimum stock of human capital to realize the growth effects of FDI through technology transfer. Blomström and Kokko (1997) also argue that benefits of FDI increase over time as the skill level of local entrepreneurs grows, new suppliers emerge and local content increases.

In terms of location determinants, absorptive capacity is an important concept related with FDI spillovers. Abramovitz (1979) uses the term "absorptive capacity" to denote domestic capabilities for assimilating knowledge as the benefit of FDI. Absorptive capacity includes the ability to internalize knowledge created by others and modifying it to fit their own specific applications, processes, and routines (Narula and Marin, 2003). According to Narula (2004), absorptive capacity is decomposed into four constituent parts: firm-sector absorptive capacity, basic infrastructure, advanced infrastructure and formal/informal institutions. Firm-sector absorptive capacity includes domestic firms with appropriate human and physical capital to internalize technology flows and TNC affiliates acting both as users and creators of technology flows. Basic infrastructure includes roads, railways, telephones, electricity, basic skilled human capital (primary and secondary education), primary and secondary schools, hospitals. Universities, advanced skilled human capital, research institutes, banks and insurance firms are classified as advanced infrastructure. Intellectual property rights regime, technical standards, weights and measures, incentives and subsidies to promote adoption and creation of new technologies, taxation, competition policy, investment promotion and targeting schemes, promotion of collaboration between economic actors (domestic or foreign), promoting entrepreneurship are formal and informal institutions constituent of absorptive capacity. At earlier stages of development, basic infrastructure is the main part associated with the increases in absorptive capacity.

In context of absorptive capacity, technology gap, i.e. the differential or ratio of domestic firms' productivity to the average or maximum productivity of foreign firms in the sector, is important since it is a signal to TNC about absorptive capacity.

It is thought that there should be some level of technological gap between domestic firms and TNCs in order for domestic firms to benefit from the higher technology associated with TNCs. If the technological gap is too small, TNCs will transmit few benefits to the domestic firms (Kokko, 1994). According to technological catch-up hypothesis of Findlay (1978) and, Wang and Blomström (1992), the magnitude of FDI spillovers will increase with the technological gap (relative backwardness), as it increases the opportunities for domestic firms to obtain higher levels of efficiency via imitation of foreign technology. According to technological catch-up hypothesis, technology diffusion is not an automatic and direct effect, but it also requires the recipient to have the capacity to absorb and adopt such technology. If there is a large technology gap between two countries, domestic firms have a human capital which is not probably as well as the physical infrastructure and distribution networks; that is, the system of intermediaries between the producer and the final users; required to support inward FDI. This, in turn, influences not only the decision to invest, but also the kind of technology transferred (Glass and Saggi, 1998). A large technology gap, therefore, signals small domestic absorptive capacity and decreases the potential gains by domestic firms.

Narula (2004) analyzes the level of absorptive capacity to obtain technological benefits. While insufficient absorptive capacity tends to lead to the inefficient use of technology inflows, knowledge accumulation is much more rapid once the threshold level of absorptive capacity is crossed. Countries that receive FDI with the highest potential for capability development are, ironically, those with strong domestic absorptive capacities.

Absorptive capacity is significant for development because it allows host country to capture knowledge that exists abroad. Where absorptive capacity is lacking in domestic firms, then they may be crowded out instead of absorbing technological benefits from FDI (Agosin and Mayer, 2000).

Regional dimension is another important location determinant to facilitate technology spillovers. In terms of the benefits of geographical proximity, firstly, direct contacts with local suppliers and distributors seem to be the main regional

benefit. This may be local in nature in order to minimize transport costs and facilitate communication between the supplier/distributor and the TNC. Secondly, training of employees by TNCs and subsequent turnover of labour is another way for spillovers (Haacker, 1999). As regional labour mobility is extremely low (Greenaway et al., 2000), many of the benefits in terms of a better skilled workforce with tacit technical knowledge gained from TNCs will be experienced by local employers. Thirdly, demonstration effects may also be local if firms only closely observe and imitate other firms in the same region (Blomström and Kokko, 1998). Finally, knowledge flows may be regional in character. For example, the spread of new ideas is realized most intensively in the area close to the innovation.

Differentials in factor endowments, cost structures, and market/institutional characteristics of the host country are other locational FDI determinants besides absorptive capacity and regional dimension (Lall, 1978).

Most developing countries lack technology capability. In these countries, FDI can serve to facilitate technology transfer and reduce the technology gap between developing countries and industrial countries. However, there is a basic paradox between FDI and local capabilities. When local capabilities are weak, industrialization has to be more dependent on FDI. However, FDI cannot drive industrial growth without local capabilities.

The growing empirical literature shows that FDI promotes growth with either absorptive capacity or supportive business environment in host countries. While higher per capita income (Blomström, Lipsey and Zejan, 1994), and better endowment of human capital (Borensztein, de Gregorio, and Lee, 1998) are factors related with absorptive capacity, trade openness (Balasubramanyam, Salisu and Sapsford, 1996) and domestic financial market development (Alfaro, Chanda, Kalemli-Ozcan and Sayek, 2004) are shown to be crucial for positive impact of FDI on growth in terms of supportive business environment.

The potential impact of FDI differs among sectors as well as among recipient countries. The benefits of FDI are not limited to the industry that receives FDI, but

they may also be diffused to the rest of the economy through the interactions with local suppliers and consumers - backward and forward linkages, respectively. Backward linkages might arise by helping prospective suppliers to set up production facilities or by providing technical assistance to raise the quality of supplier's products. Forward linkages, on the other hand, appear by the provision of help to the development of local distributors and sales organizations (Blomström and Kokko, 1997). According to World Investment Report 2001 (UNCTAD), the linkage potential differs across primary, manufacturing and services sectors. Since primary sector is mostly capital intensive and the scope for linkages between foreign companies and the rest of the economy is often limited, the growth impact of FDI is not obvious. On the other hand, FDI flows in manufacturing sector may have a larger impact in the economy due to a broad range of potential linkage-intensive activities. Greenfield investments in manufacturing sector, with efficiency-seeking motive besides market-seeking one, are the major factors for positive FDI impact on growth. Also, FDI to the services sector mostly serves to the domestic market since services sector includes wide range of different activities such as finance, infrastructure (such as electricity, water, and telecommunications), wholesale and retail, real estate as well as tourism. For this reason, potential forward linkages for the services sector are quite strong, while backward linkages may vary by industry. Most of the FDI in the sector come through M&As in developed countries and privatization deals in developing countries both of which are not necessarily associated with new investments as Klein, 2000 mentioned (Sayek and Aykut, 2005).

FDI remains the most important means of transferring technology either to domestic firms by spillovers or to only foreign firms in developing countries. Technology transfer through FDI generates benefits that cannot be obtained by using other modes of transfer. Besides technology, FDI brings with it know-how and managerial skills; influences the production, employment, income, prices, exports/imports; and thus accelerates growth and development (Aitken, Hanson, and Harrison, 1997; Blomström and Kokko, 1997; Borensztein, De Gregorio, and Lee, 1998). The growth and development effect of FDI can be seen as a result of the increasing returns in production via externalities and productivity spillovers. The typical features of TNCs such as marketing and sales experience can contribute significantly to exploiting the

technology in a profitable manner. TNCs also offer brand names and access to regional and global markets (UNCTAD, 1999). According to the empirical findings of Borensztein, De Gregorio, and Lee (1998), the impact of foreign investment exceeds the impact of domestic investment on growth.

The impact of FDI on growth is expected to be greater, the greater the value-added content of FDI-related production and productivity spillovers associated with FDI. Also, FDI plays a role on human capital augmentation and technological change in developing economies by providing specific productivity-increasing labour training and skill acquisition, encouraging the incorporation of new inputs and technologies in the production function of the recipient economy and promoting the use of more advanced technologies by domestic firms. In case of new inputs, output growth can result from the use of a wider range of intermediate goods in FDI-related production. In case of new technologies, FDI is expected to be a potential source of productivity gains via spillovers to domestic firms.

Entering dynamic trade and production systems, and contribution to increasing productivity and competitiveness of domestic industries can be seen as the main benefits of FDI for the recipient economy. Also, flows of FDI contribute to build strong economic links among developing countries, besides links between industrialized countries and developing countries. Due to the fact that, attracting foreign direct investment is an important policy motive for policy makers in many developing and transition economies.

However, these potential benefits are accompanied by probable costs. A highly efficient TNC operating in host country may lead to a fall in the number of domestic firms if the less efficient domestic firms are forced out of business. Although this may increase overall resource allocation in the long-term, the short-term consequences for local employment and market concentration may be severe (OECD, 2001).

2.3. FDI-related Spillovers and Technology Transfer

TNCs prefer to set up affiliates overseas rather than export directly or license their product or technology due to the existence of proprietary knowledge and market failures in protecting that knowledge at the same time. Thus TNCs internalize certain transactions to protect their brand, technology, and marketing advantages. Instead of exporting directly, TNCs also invest abroad to access new markets by eliminating transportation costs. However, when FDI is domestic market-oriented, the impact of FDI on technology diffusion is rather limited. Especially, it is observed in the import substitution era that since the main incentive for TNCs to undertake investment is the heavily protected domestic market; in such an environment, they prefer to transfer old and outdated technology to their factories in developing countries, creating little technology diffusion (Dutz et al., 2005).

On the other hand, if FDI is an export-oriented investment, the impact on technology diffusion will generally be more significant than the impact made by a domestic market-oriented investment. In fact, the more modern and complex the technology, the more TNCs prefer to transfer it to an affiliate rather than to a third party. Although TNCs wish to retain technology internally or to charge a market price for transfers to third parties, positive externalities in the form of technology spillovers may be created. This transfer and diffusion of technology is one of the important contributions of FDI to the host country. A TNC brings its production technology, its access to global production and distribution networks, and its know-how and experience by investing in the host country. The diffusion of technology may lead to improvements in the productivity of domestic firms in ways that do not allow the TNC to capture all the related benefits.

According to Blomström and Kokko (1998), as TNC affiliates become major players in the domestic market, domestic firms will be forced to adopt newer and more advanced technologies and to use the existing resources of the firm (either because they operate on an inefficient scale; that is, there exists idle resources which are not used in production process in the firm, or because they produce their output with inefficient combinations of inputs) more efficiently in order to survive.

The technology transfer may take the forms of either import of machinery/ equipment, i.e. embodied transfer, or know-how, knowledge and licenses, i.e. disembodied transfer. Embodied or disembodied technology transfer cause direct and indirect effects on productivity. The direct effect consists of increased productivity due to superior technology and human capital. The indirect effects of FDI on domestic firms such as change in the nature and evolution of concentration, changes in financing, marketing, technological and managerial practices and finally changes in productivity and growth of domestic firms are described as spillovers. The indirect effect results from increased absorptive capacity, which in turn increases the ability of the firm to internalize and utilize outside technology and knowledge. Domestic firms will not find it difficult to organize the transfer of embodied technology such as import of machinery, but disembodied technology like knowledge requires some additional operations to transfer.

To explain the transfer of disembodied technology or technology spillovers, there are three different models suggested by Marin and Bell (2006). The first model for the technology spillovers to the host country is *the pipeline model.* According to this model, technological spillover impact of FDI is seen in two steps. The first step involves TNC parent-to-affiliate international transfer of technology that is superior to the prevailing technology in the host country. The second step involves the subsequent spread of this technology to domestic firms – a technological spillover effect. Spillover effects arise from FDI independently of both the domestic firms' absorptive capacities and subsidiaries' knowledge-creating and accumulating activities in the host country. The second model is *the absorptive capacity model.* In this model, potential spillover effects arise from FDI, but they are captured only by domestic firms with high absorptive capacities. According to the third model, which is *the active affiliate model*, spillover effects arise from FDI only when foreign affiliates are technologically active in the host country.

Technology spillovers related with FDI are also classified in three types: horizontal, vertical and labour spillovers. Horizontal spillovers are spillovers from foreign firms to others operating in the same industry or in the same region, while vertical spillovers are defined as spillovers from foreign firms to others operating in

vertically related industries, either from foreign suppliers to domestic users or from foreign users to domestic suppliers. Spillovers through employment of workers who worked for foreign firms by domestic firms are called labour spillovers (Lenger and Taymaz, 2006). These three types of spillovers can occur through any of the five main channels: demonstration/imitation, labour mobility, exports, competition, and backward and forward linkages with domestic firms.

Demonstration/imitation: Spillovers may take place when domestic firms improve their efficiency by copying technologies of foreign affiliates operating in the domestic market via observation channel. Either demonstration of TNCs or imitation by domestic firms is the most evident spillover channel according to Das, 1987; Wang and Blomström, 1992. After the observation of a product innovation or a new form of organization adapted to local conditions, local entrepreneurs may attempt to imitate the innovation. The introduction of a new technology into a given market may be too expensive and risky for a domestic firm to undertake, due to the costs inherent in acquiring its knowledge and the uncertainty of the results that may be obtained. However, as domestic firms interact with existing technology users; this interaction reduces their innovation and imitation costs. Thus, information is diffused, uncertainty is reduced, and imitation levels increase (Blomström and Kokko, 1998). Finally, the improvement in total factor productivity speeds up (Helpman, 1999). Imitation of the technology either by reverse engineering or any other way works mainly among firms within same industries and referred as intra-industry spillovers.

Labour mobility: The second channel is related to the possibility of hiring workers who have knowledge and experience of the technology and who are able to apply this in that firm by domestic firms (Fosfuri, Motta, & Ronde, 2001; Glass & Saggi, 2002). This type of spillovers is also intra-industry spillovers such as the ones caused by demonstration effect. Domestic firms' internalization of improved management practices and organizational efficiency of TNCs is expected to be the result of training of local employees in TNCs (Globerman, 1979). Even supporting staff acquires skills, attitudes and ideas on the job through exposure to modern organization forms and international quality standards. These people make a

significant contribution by raising productivity when working for domestic firms or when setting up new entrepreneurial businesses. The productivity improvements caused by the movement of labour from TNCs to other existing or new domestic firms are realized through two mechanisms: through direct spillover to workers engaged in the same type of job and through knowledge carried by workers who move to another firm.

Nevertheless, it is important to note a possible negative impact arising through this channel, as TNCs may attract the best workers away from domestic firms by offering higher wages and leaving them with less-skilled employees (Girma et al., 2001; Sinani & Meyer, 2004). The market-stealing effect and the skill-stealing effect could be large enough to offset the positive effect of FDI. Also, the influence of labour mobility on the efficiency of domestic firms is difficult to evaluate, as it involves tracking the workers in order to investigate their impact on the productivity of other workers (Saggi, 2002). For this reason, if TNCs and domestic firms compete in the same labour market, domestic firms may have to pay higher wages to attract workers.

Exports: The third channel through which the presence of TNCs may benefit domestic firms is exports (Aitken, Hanson and Harrison, 1997; Greenaway, Sousa and Wakelin, 2004). TNCs enable domestic firms to become more successful exporters by spreading their knowledge of global markets to domestic firms. According to Görg and Greenaway (2004), domestic firms' exports can be affected through three primary channels. Firstly, export activity involves costs associated with the establishment of distribution networks, transport infrastructures or knowledge of consumers' tastes in foreign markets and TNCs have better access to information about foreign markets. This can spill over through their export activities. Secondly, demonstration effect also increases the export performance of domestic firms. They can learn the TNCs' superior production or management techniques through observation and this enables them to compete more successfully in export markets by reducing the entry costs in the foreign market. Finally, competition with TNCs at home and in foreign markets can induce domestic firms to improve their export performance.

Competition: When TNCs decide to penetrate a new market through directly investing in the country, they tend to bring with them more sophisticated technology and superior managerial practice in order to compete with domestic firms who tend to be more familiar with the consumer preferences and business practices in the local market (Blomstrom, Sjoholm, 1999). Since FDI promotes efficiency through the economy by increasing competition in domestic industries, an increased competition induced by TNCs becomes the fourth channel of spillovers from FDI (Markusen and Venables, 1999; Wang and Blomström, 1992). Technology advances due to increased competition may be both intra- and inter-industries spillovers.

Competition with TNCs may force domestic firms to increase their competitive capacity by reforming management styles and updating production technology. While competition between TNCs and domestic firms in the domestic economy is an incentive for the domestic firms to make a more efficient use of existing resources and technology or even to adopt new technologies, on the other hand, it may restrict the market power of domestic firms.

The efficiency of domestic firms may also be negatively affected through this channel, if foreign firms with advanced technologies produce at a lower marginal cost. By taking market share from domestic firms and forcing them to operate on a less efficient scale, with a consequent increase of their average costs, TNCs may lower the productivity of domestic firms (Aitken and Harrison, 1999). However, domestic firms may also react to foreign competition by using the existing technology more efficiently or by investing in new technology in order to maintain their market shares (Blomström and Kokko, 1998).

Linkages: The final channel is backward and forward linkages between TNCs and domestic firms. Domestic firms may learn by observing TNCs when there are close relationships between them, and may benefit from the technical support, the demand, and the supply provided by the TNCs with which they have an upstream or downstream relationship in the business chains (Aitken and Harrison, 1999; Buckley et al., 2002). The relationship that domestic firms establish in local markets as suppliers to TNCs is referred as backward linkages and the relationship that domestic

firms establish in local markets as customers of intermediate inputs produced by TNCs is referred as forward linkages (Lall, 1980; Rodrı´guez-Clare, 1996; Markusen and Venables, 1999; Lin and Saggi, 2004). Spillovers caused by backward or forward linkages are referred as inter-industry spillovers.

Backward linkages: With increasing returns to scale, if TNCs increase the demand for local inputs to save transportation costs or to accommodate local content requirements, this may benefit domestic suppliers by creating a backward linkage since they want to ensure a certain quality pattern. TNCs provide technical support for the improvement of the quality of goods or for the introduction of innovations by training personnel (supply-side). TNCs demand suppliers to meet standards of reliability and speed of delivery; which in turn creates a pressure on domestic suppliers (demand-side). Acquisition of raw materials, and support at the organizational and management levels are also provided by TNCs (Lall, 1980). Competition to become TNC suppliers also increases the efficiency of domestic firms.

Forward linkages: Forward linkages refer to relations with buyers, either consumers or other firms using the TNC's intermediate products in their own production process, as with machinery. These buyers can also be distributors, which can benefit from the marketing and other knowledge of TNCs. Forward linkages are observed when TNCs supply higher quality inputs to domestic producers or end-user consumer goods to consumers at a lower price (Markusen and Venables, 1999).

Technology spillovers related with FDI are more likely to be vertical rather than horizontal in nature. The reason of vertical spillovers is that although TNCs have an incentive to prevent information leakage that would enhance the performance of their local competitors, they may want to transfer knowledge to their local suppliers. On the other hand, TNC affiliates established through M&As or joint ventures are likely to source more locally than those taking the form of greenfield investments. Since full foreign ownership is a proxy for greenfield investments, it is expected that fully-owned foreign affiliates may rely more on imported inputs, while M&As with local capital participation will tend to source more locally due to the advantages of the

supplier relationships established by the acquired firm or their local partner. Then, M&As or joint ventures result in greater vertical spillovers than greenfield investments.

2.4. Empirical Studies about Spillovers

Studies about spillovers utilizing econometric models start to appear from the early 1970s. These econometric studies generally investigate the relationship between FDI and productivity. If there is a positive correlation between productivity and FDI, then it is considered that there are spillovers. However, according to Smarzynska (2002), TNCs tend to locate in high productivity industries; where they may force domestic firms to exit from the market during their attempt to increase their share of the host country market. This would raise the average productivity in the industry. Then the positive correlation between FDI and sectoral productivity can be attributed to the TNCs behaviour in the market rather than the productivity spillovers.

While the earliest analyses about spillovers focus on productivity and to some extent on the competitiveness, recent studies focus on the implications of changes in the market shares of foreign and domestic firms.

In all these models, labour productivity is used as a dependent variable with the explanatory variables being FDI, factor inputs, concentration ratio (sector level variable), and labour quality. Several empirical studies also searched possible heterogeneity in the estimated spillover effect between firms or sectors. Heterogeneity arising from differences in the level of technological advances (low versus large technological gap sectors), the degree of competition in the domestic market, the degree of foreign ownership, the relative size of the firm, and the level of development of the host country (developed versus developing countries) was investigated. The evidence from the literature leads to the view that some factors influencing spillovers depend on the characteristics of the specific firm, specific industry or the particular country hosting FDI (Dimelis, 2005). The host country characteristics such as industry and the policy environment (Blomström and Kokko

1998), the level of human capital stock (Borensztein et al. 1998; Noorbakhsh et al. 2001), and the absorptive capacity of domestic firms (Kinoshita 2001) affect the spillover effects of FDI.

Although FDI is considered as an important channel for the transfer of advanced technologies introduced by TNCs to developing countries, there is no consensus on the direction, extent or even the existence of these spillover effects of TNCs in empirical studies. Early studies using industry level and cross-sectional designs find positive results, but cannot identify the relevant causality (Marin and Bell, 2006). Using firm level designs combined with panel data analysis, recent studies find evidence of spillovers in some cases. However, the positive results generally seen in the earlier research are not replicated in a wide range of countries. Empirical research analyzing FDI spillovers via technology transfer to domestic firms in transition, developing, and developed economies provides mixed results. While many empirical studies find that there exist significant positive spillovers from FDI, some others find no or statistically insignificant spillover effects.

The reason of the variation in the outcome of empirical studies of different countries on spillover effects may be the use of different methods to conduct empirical estimation. The empirical studies are categorized based on the level of aggregation. Some studies utilize data collected at the firm/plant level, while others examine the FDI spillover effects on the more aggregate level using sectoral data. Moreover, the studies are grouped into either cross-sectional studies where information is collected at one point of time or panel studies where firm/sector specifics are gathered over a period of time. Direction of causality between FDI and productivity improvements cannot be identified with the cross-section specifications. For instance, a positive coefficient may be due to FDI spillovers contributing to domestic firms' productivity or it may be caused by TNCs investing in more productive sectors in the host economy. On the other hand, panel data allows measuring not only the effect of foreign firms on the productivity levels of domestic firms but also the effect on the rate of productivity growth of domestic firms across the sectors of manufacturing industry. Panel data permit the investigation of the development of domestic firms' productivity over a longer time period, rather than at one point in time and allow

investigation of spillovers after controlling for other factors. According to Görg and Ströbl (2001) and Aitken and Harrison (1999), panel data analysis is a more appropriate method to determine productivity spillovers.

Besides the methodological problems stated above, any unspecified factor such as the technology gap between domestic firms and TNCs or their local affiliates may be a reason of variation in the studies.

When the empirical studies are analyzed in terms of the results which they obtain specifically, the early studies of spillovers are undertaken by Caves (1974), Globerman (1979), and Blomström and Persson (1983). Caves (1974) tests the spillover benefits of FDI in the manufacturing sectors of Australia and Canada. Using foreign firms' share of industry employment as a proxy for foreign presence, Caves finds a positive correlation between the foreign share and the productivity level in competing domestic firms. Globerman (1979) also studies on Canadian manufacturing industries and uses the labour productivity as a dependent variable in domestic manufacturing plants for his model. The results also provide support for the proposition that spillover efficiency benefits domestic firms.

Blomström and Persson (1983) carry out their analysis using the Mexican industries data from the 1970 census. They relate labour productivity to capital intensity, labour quality, economies of scale, FDI, average effective work days during 1970, and the degree of competition measured by different concentration indices such as the Herfindahl index. This study finds strong support for the existence of spillover benefits from FDI.

In these three models, the dependent variable is defined as the ratio of total value added in locally owned plants in an industry to total employment engaged in the plants. The key independent variable is a measure of the foreign share, such as the share of foreign-owned plants in total employment or value added. Other variables affecting average labour productivity in the industry are also included as independent variables. These studies interpret the coefficient on the foreign share variable as an indication of the magnitude of spillovers.

Besides the common definitions used, findings of these studies are also similar. In these studies, it is thought that there are positive spillovers if the coefficient on the foreign share variable is statistically significant and positive. This interpretation is initiated by Findlay (1978). According to this study, technical innovations are most effectively copied when there is personal contact between those who already have the knowledge of the innovation and those who eventually adopt it. This implies that larger foreign shares at the industry level are positively correlated with the potential opportunities for locally owned plants to interact with foreign-owned plants. This interaction then facilitates the spread of sophisticated technology from TNCs to locally owned plants.

FDI-related spillovers have lasted to be examined empirically as well as theoretically after these studies. For example, Blomström (1986) tests spillovers based on an efficiency index for Mexican manufacturing industry using industry level data in a period from 1970 to 1975. An industry may be viewed as a number of establishments embodying techniques ranging from the most modern one, using the current best-practice technique, to the oldest operating establishment incorporating the best-practice technique of an earlier age. The ratio between the actual labour productivity in industry and the productivity of the best practice of the industry is defined as efficiency index. The Herfindahl index, market growth variables, the rate of technological progress (the changes in labour productivity in the best practice plants within each industry) and foreign share (the share of employees in foreign plants) are independent variables of the model. According to this model, foreign presence is positively correlated with structural efficiency in Mexican manufacturing industries. Industries dominated by foreign firms tend to be more efficient than others in the sense that the average firms come closer to the best-practice firm. On the other hand, foreign entry is positively related to productivity changes in the industry average; that is, structural changes only in the modern part of the industries. As a result, the most important source of spillover efficiency is found to be in the competitive pressure induced by foreign firms.

Another study by Blomström and Wolff (1989) tries to explain the effects of the penetration of a sector by foreign-owned firms on the productivity of domestic firms

in that sector in Mexican manufacturing industries, using data of year 1965 to year 1984. They also examine the convergence of productivity between foreign-owned and domestic firms in the industry. The results provide support for the spillover hypothesis.

Aitken and Harrison (1991) test the impact of foreign firms on the productivity of Venezuelan manufacturing industry firms between 1976 and 1989. They find that domestic firms exhibit higher productivity in sectors with a larger foreign share. They also examine the geographical dispersion of FDI and suggest that the positive spillovers of FDI accrued mainly to the domestic firms located close to the foreign firms.

Also, Kokko (1994) and Kokko (1996) find evidence for positive spillover effects of FDI on the productivity of domestic firms. Kokko (1994) uses the Mexican manufacturing data at the industrial level in 1970 to account for the magnitude of spillovers. Using three technological characteristics of the industries which are average payments of patent fees per employee, average capital intensity of foreign affiliates, and the labour productivity gap between local and foreign firms in each industry; he estimates the relationship between spillovers and the foreign share. Then, he compares the magnitude of the coefficients on foreign share variable indicating the magnitude of spillovers. Productivity gap and foreign share together explains the spillovers according to empirical results.

On the other hand, Blomström, Kokko, and Zejan (1994) conduct a study to test the determinants of technology transfer. For Mexican manufacturing firms from 1970 to 1975, they test the hypothesis that market rivalry and the availability of skilled labour may encourage TNCs to introduce more technology into their foreign operations. The estimation results show that there is a significant relationship between the technologies imported by foreign affiliates and the local competitors' investment, output growth, and labour skills and support the hypothesis regarding foreign firms' technology imports.

According to the firm-level study of China in 1991 by Chuang and Lin (1999), FDI and local technology purchase are substitutes for domestic firms' R&D activity. This study suggests the policy of encouraging FDI to foster technology transfer and knowledge spillovers to developing countries at first. Once a country's technological capability is established, it appears critical to switch to policies that provide a favourable environment to stimulate R&D investment.

Although most studies that measure the spillover effects of TNCs on host countries are cross sectional and limited to labour productivity in manufacturing for a single country, Hejazi and Safarian (1999) extends this approach by adding FDI stocks to foreign trade as a channel linking total factor productivity (TFP) levels between countries. They use TFP levels from 1971 to 1990 and argue that technological spillovers through multinational production and FDI are likely to be larger than the one through international trade.

Sjöholm (1999) applies the methodology that a number of factors affect the magnitude of spillovers to plant-level data for Indonesian manufacturing in 1980 and 1991. He examines the relationships between spillovers and productivity gaps, between spillovers and the level of competition in industries. He finds that spillovers are larger for locally owned plants in industries with a high degree of competition and industries where technology in domestic firms is far behind technology in TNCs.

Blomström and Sjöholm (1999) analyze spillovers from foreign-owned plants in Indonesian manufacturing sector in 1991. They group the foreign-owned plants according to their ownership share, and conclude that there is not any role of TNCs on facilitation of technology diffusion for the local plants with foreign participation. Also, the type of ownership of foreign-owned plants does not seem to be a determinant of the degree of spillovers. According to their findings about the relationship between spillovers and exports of plants, non-exporters benefit from spillovers, while exporters already facing competition in world markets do not.

Another study on Indonesian manufacturing industry by Takii (2005) also finds supporting evidence for spillover effects from FDI. Investigating technology

spillovers for manufacturing industries using panel data, Griffith (1999), Liu et al. (2000), Harris and Robinson (2003), and Haskel et al. (2002) find evidence that a foreign presence in the sector affects the productivity of domestic firms in the UK positively.

Besides the studies suggesting that foreign presence will create a spillover effect, a number of studies find no significant spillover effects on domestic productivity from FDI. In some studies, FDI may even have a negative effect on domestic firms' output growth. Haddad and Harrison (1993) examine the effect of foreign presence on the relative productivity of domestic firms by comparing firm level productivity with that of the best practice firm in the industry and find no evidence of spillovers. There is no significant relationship between larger foreign presence and higher productivity growth. In their analysis, they use Moroccan firm level panel data. According to these results, FDI associates with a one-time increase in domestic firm efficiency rather than a long-term dynamic association between FDI and domestic firm efficiency although domestic firms exhibit higher levels of productivity in sectors with a larger foreign presence.

For Venezuela, Aitken and Harrison (1999) estimate the production function of a group of Venezuelan plants and find negative spillovers. Although they find positive correlation between foreign presence at the firm level and plants' productivity (the "own-plant" effect), FDI from joint ventures to Venezuelan firms has a negative effect on domestic firms' productivity growth. Thus, the gains from FDI appear to be entirely captured by joint ventures. Since FDI reduces domestic plant productivity in the short run by forcing domestic firms to cut production, they describe the negative spillover effect as market stealing effect.

Okamoto (1999) examines the spillover hypothesis using firm-level data for Japanese investment in the US auto parts industry from 1982 to 1992. According to his analysis, contrary to the expectation, Japanese-owned firms are less productive than their US counterparts. Additionally, there is an improvement on US-owned suppliers' performance, but this improvement is to a small extent due to the technology transfer from Japanese assemblers to US-owned suppliers. He interprets

the improvement in productivity as an increase in competitive pressure rather than technology transfer; however, there is not enough explanation about the contradiction between the spillover hypothesis and the findings.

Kathuria (2000) analyzes the spillover effect using the data for India. He finds that when foreign presence is measured as a share of sales, there is no benefit for domestic firms. However, they benefit from having foreign capital stock available. He finds spillover effects in scientific industries where domestic firms invest in R&D activities, whereas there is no spillover effect for non-scientific industries. Kathuria (2002) runs over the study for the firms with and without R&D for the 1989-90 period and obtain the same results that only the domestic firms who are actively engaged in R&D are affected by the spillovers. According to these studies, domestic efforts are important to benefit from spillovers. Also, the study of Feinberg and Majumdar (2001) estimates the production functions for foreign and domestic firms in India and find that TNCs gain from each others' R&D spillovers, although domestic firms do not.

Using firm-level panel data, Djankov and Hoekman (2000) investigate spillovers for Czech firms in 1992-96 period. Although they find a positive significant impact of FDI on the growth of sales for their entire sample of Czech firms including both domestic and foreign firms, spillovers have a negative impact on the growth of sales of domestic firms since growth of sales in the industry occurs in the foreign-owned firms.

Konings (2001) also finds negative spillovers to domestic firms in Bulgaria and Romania while no evidence of any spillovers to domestic firms in Poland. The negative spillover effect is caused by the crowding-out effect of competition dominating the positive effect of technology transfer.

Liu, et al. (2001) analyzes the spillover effects in China using the ownership structure as a main determinant in 1995. According to this cross section analysis, they find spillovers for state owned enterprises due to increased competition. On the other hand, private and collectively owned firms benefit from spillovers through

demonstration and contagion effects. Also, market oriented TNCs produce spillover effects by increasing competition whereas there is not any increase in the competition for export oriented TNCs.

Liu (2002) investigates the correlation between FDI presence and productivity growth in China using industry-level data for the 1993-98 period for the intra- and inter-industry types of spillovers. He finds a positive and significant effect of spillovers for overall sample and for the sub-sample of domestic firms. However, these results may not be robust to use more disaggregated, firm-level panel data. According to empirical results, the ownership structure is an important determinant to benefit from FDI in Chinese manufacturing industry. State owned sector and joined owned sector get positive spillovers from FDI whereas collective owned sector (including township and village enterprises) is affected negatively from FDI. Liu (2002) also finds that foreign sectors (sectors dominated by foreign-owned firms) do not benefit from other foreign investments.

In the empirical analysis of Czech manufacturing industry for the 1995-98 period, Kinoshita (2001) examines the indirect effect of R&D in productivity growth. He looks for any intra-industry spillover effect of R&D via developing domestic absorptive capacity. According to his findings, foreign presence in the industry such as joint ventures with foreign partners has no contribution in the form of spillover effects.

Yudaeva et al. (2003) also investigate technology spillovers based on firm-level panel data for transition economies and find no or negative spillovers to domestic firms. Some other studies finding negative results are Kokko, Tansini and Zejan (1996) on Uruguayan manufacturing sector, Aslanoğlu (2000) on Turkish manufacturing industry, Hu and Jefferson (2002) on Chinese manufacturing sector.

CHAPTER 3

FDI IN TURKEY

3.1. Historical Background

The history of FDI in Turkey begins in 1954. The Foreign Capital Law, enacted in 1954, is the first legislation governing foreign investments to Turkey. This law remained in force until the late 1980s and allowed utilization of foreign capital for all sectors open to local private capital. Also, the foreign capital investment was allowed to be not only in the form of money but also in forms of tangible and intangible assets by this law (Kepenek and Yentürk, 2003). As Öniş (1994) mentioned, although this early legislation provided a liberal framework designed to create a favourable environment for FDI, the cumulative authorized FDI reached only $229 million from 1950 to 1980.

According to statistics, level of FDI was low in the pre-1980 period. It is thought that this low level of FDI was due to restrictive bureaucratic practices (Erdilek, 1982). Besides these restrictions, another possible reason is that as a consequence of the import substitution industrialization strategy, Turkey was a relatively closed market to foreign companies until 1980. Turkey had to abandon this strategy after the severe balance of payments crisis in 1979. On January 24, 1980, the Turkish government announced a stabilization program that was implemented under the military regime after September 1980 and initiated a series of reforms which aims minimization of state intervention, establishment of a free market economy and integration of the economy with the global economic system. After following inward-oriented development strategies for 50 years, Turkey switched to outward-oriented policies in 1980, pressurized by the IMF. According to this program, which especially focused on attracting foreign investors and promoting export; product and capital markets

were liberalized. In 1980s, The Foreign Investments Act was reorganized and the investment climate was made more attractive by eliminating all discriminatory treatment of foreign investors, requirements on local equity participation, and restrictions on the transfer of earnings (Erdilek, 1986; Akpınar, 2001).

Besides transition to free market economy, opening to foreign markets, and export-led growth strategy, many other structural reforms and legislative regulations such as reducing the weight of public sector in the economy, privatization, liberalization of the financial system, facilitating to enter the banking sector, developing non-banking financial institutions, utilization of flexible interest and exchange rates, lifting restrictions in foreign currency and free flow of capital or at least alleviating these restrictions, allowing those living in Turkey to open foreign exchange accounts (FX deposits), establishing a capital market, re-organizing the body of Istanbul Stock Exchange and activating it, encouraging both foreign and local investments, funding public expenses heavily with debt due to loss of public revenue because of tax incentives and discounts were made in early 1980s in scope of the recent globalization wave in the world (Alıcı and Ucal, 2003). These policy changes attracted the interest of foreign investors in Turkey.

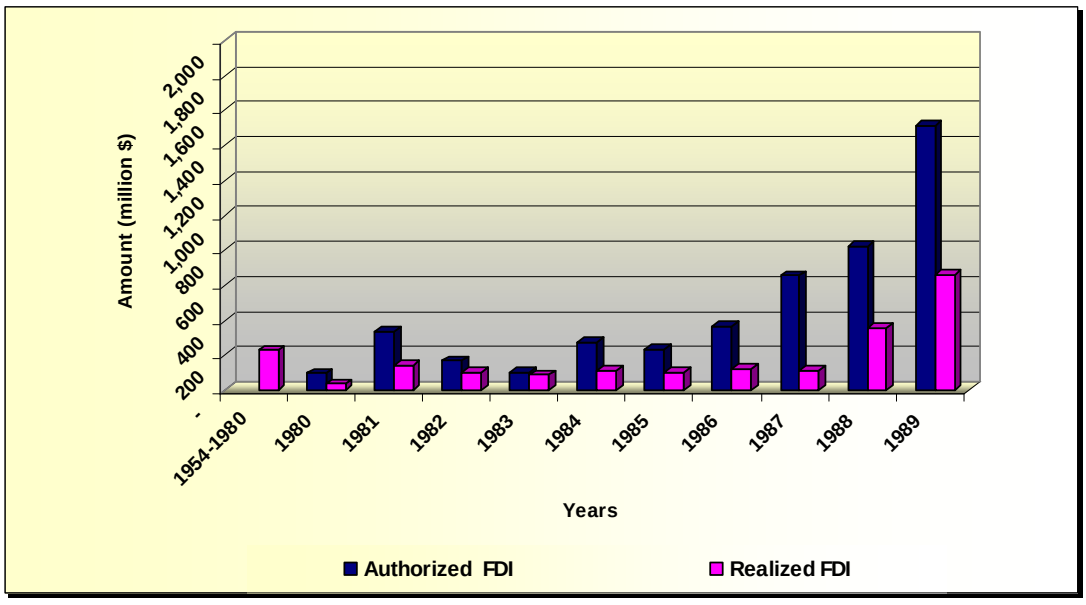

Figure 3.1: Foreign Direct Investment in Turkey between 1954 and 1989. Source: Undersecretariat of Treasury, CBRT.

As seen from Figure 3.1, FDI inflows increased from $35 million level in 1980 to $663 million in 1989. Foreign investors' role in the Turkish economy increased substantially in 1980s. In Figure 3.1, authorized FDI means what investors said they were going to invest, while realized FDI shows what they actually invested. Although there is difference between authorized and realized FDI in this period, they show an increasing trend parallel to each other towards the end of 1980s. The most important reason of this difference is the realization time of investments. Since investments could not be completed in the authorization year and continue in years following the authorization year, a difference is seen between authorized and realized FDI. According to data obtained from Undersecretariat of Treasury, total amount of authorized FDI is $ 4,6 billion between 1980 and 1989.

The adopted economic approach including amendments in legal procedures, newly established institutions, free flow of capital movements, improved level of communication technology, the policy of funding the public sector have been concretely effective on the economy as of the beginning of 1990 (Alıcı and Ucal, 2003). The authorized FDI amount increased to $21 billion totally in 1990-1999 period compared to the 1980-1989 period while the average annual FDI inflows reached the $770 million level in 1990s from $184 million level in 1980s. Although the approved and realized FDI has been quite closely matched during 1990s (shown in Figure 3.2), realized FDI deviated from the approved one between 1995 and 1997. It was during this period that Turkey and the EU formed a Customs Union, which was associated with a wave of new announcements of manufacturing investment in Turkey. However, most of the new investment was not realized due to the negative or at least not positive conditions in reverse of the investors' expectations.

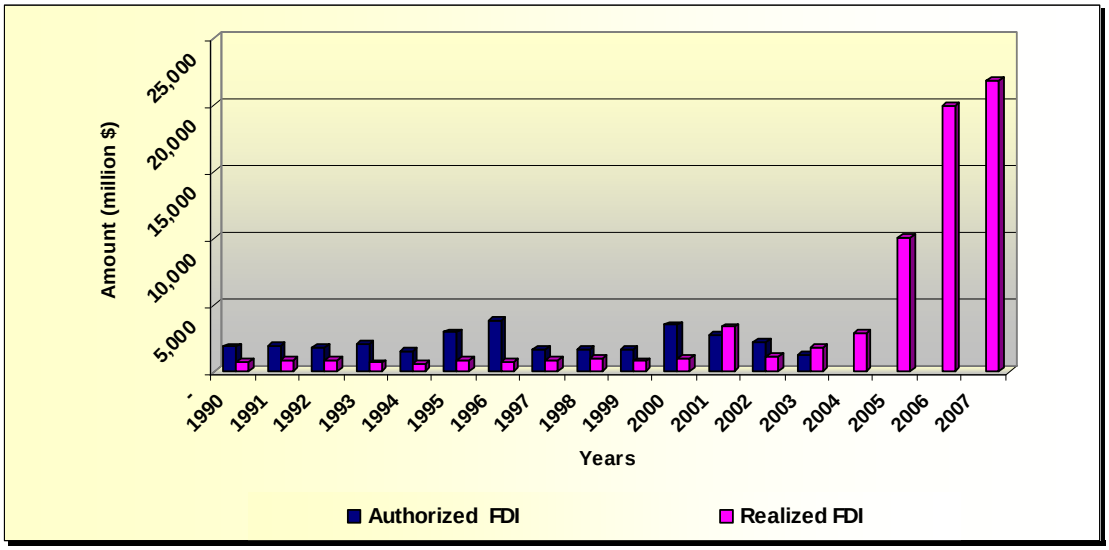

Figure 3.2: Foreign Direct Investment in Turkey between 1990 and 2007. Source: Undersecretariat of Treasury, CBRT.

As seen from Figure 3.2, annual FDI flows remained static during 1990s although global FDI flows accelerated in this period exceeding the growth in world trade since 1989. The reasons behind the inadequate long-term investment were increasing vulnerability of Turkish economy due to the liberalization and integration of Turkish financial sector with the world economy, dependency to short-term capital flows, and two significant economic crises in Turkey in 1994 and in 1999. The economic crises caused some policy interventions such as exchange-rate intervention and stimulated an IMF supported stabilization program. Also during 1990s, the Asian Economic Crisis and Russian crisis affected the Turkish economy negatively together with the effects of the Marmara earthquake in August 1999, adding further fiscal burdens to the Turkish economy. Furthermore, the effects of Customs Union with the European Union (EU) were added to those mentioned in mid-1990s.

After the increasing trend of both global and local FDI inflows in 1990s, global FDI flows decreased by 51% in 2001 due to the economic recession which was deepened after the September 11 terrorist attacks. Turkey faced the effects of this decline in

global FDI in 2002. As seen in Figure 3.2, FDI inflows to Turkey decreased by 66% during this period.

The new Foreign Direct Investment law, which was enacted in 2003, brought a new system for potential investors. The new system was based on providing information about the investment process instead of authorization and approval procedure.

FDI inflows reached $9,7 billion level in 2005. It was 3,5 times greater than the FDI level in 2004. When the components of these inflows are analyzed, it is seen that 80% of FDI was in the form of capital transfer while the rest of them was purchase of real-estates in Turkey by residents abroad.

Upturn on the macroeconomic indicators such as growth, inflation and interest rates, the positive reflections of negotiations about full membership to European Union on expectations and the acceleration of the structural reforms to improve the investment conditions made Turkey more attractive to FDI. The interest of foreign investors especially on M&As in finance sector and privatizations are examples of this attractive situation of Turkey.

The ongoing improvements in economic conditions provided an upward trend in FDI inflows in 2006. Although the composition of FDI and FDI trends in Turkey are similar to global FDI inflows, the increase in FDI inflows in 2005-2006 period is greater than the increase in developed and developing countries at the same period. According to the estimations on FDI amounts in 2006, 98% increase in Turkey compared to previous year is observed while the increase is just only 34,5% globally. According to provisional data of CBRT, this upward trend was continuing in 2007.

Table 3.1: Top Ten FDI Recipient Countries and Turkey.

2002			2003		
Rank	**Country**	**FDI amount**	**Rank**	**Country**	**FDI amount**
1	USA	74.4	1	China	53.5
2	Germany	53.5	2	USA	53.1
3	China	52.7	3	France	42.5
4	France	49	4	Belgium	33.4
5	Spain	39.2	5	Germany	29.2
6	İreland	29.3	6	Spain	25.9
7	Netherlands	25	7	Ireland	22.8
8	UK	24	8	Netherlands	21.7
9	Canada	22.2	9	UK	16.8
10	Mexico	18.3	10	Switzerland	16.5
53	Turkey	1.1	53	Turkey	1.8
	World Total	617.7		World Total	557.9
2004			**2005**		
Rank	**Country**	**FDI amount**	**Rank**	**Country**	**FDI amount**
1	USA	122.4	1	UK	164.5
2	China	60.6	2	USA	99.4
3	UK	56.2	3	China	72.4
4	Australia	42.4	4	France	63.6
5	Belgium	42	5	Netherlands	43.6
6	Hong Kong	34	6	Hong Kong	35.9
7	France	31.4	7	Canada	33.8
8	Spain	24.8	8	Germany	32.7
9	Mexico	18.7	9	Belgium	23.7
10	Brazil	18.1	10	Spain	23
37	Turkey	2.8	22	Turkey	9.7
	World Total	710.8		World Total	916.3

Source: UNCTAD (2006).

The upward trend of FDI inflows in recent years is not enough to provide Turkey a competitive position in attracting investment flows. According to Table 3.1, approximately 65% of global FDI inflows go to top ten recipient countries and the best ranking of Turkey is 22, which is attained in 2005. According to WIR (2006), only 1% of global investment, which creates production capacity and employment in a remarkable level, flows to Turkey. Also, the increase in FDI inflows to Turkey mostly depends on M&As and privatizations of state enterprises.

Although there is an upward trend of FDI inflows through the macroeconomic improvements and reforms in public finance sector, the investment flows is still

unsatisfactory due to microeconomic situation in Turkey. Insufficient skilled labour force, education system which is far from growing up competitive skilled labour, insufficient R&D investments and technology development structure, high tax rates on inputs in manufacturing sector are main determinants of the level of FDI inflows (Yılmaz, 2006).

From a long-term perspective on economic history of Turkey, there have been some structural problems that caused the low levels of FDI inflows since 1950s. One of the major obstacles to investment inflows was the high rate of inflation, to which all companies (disregarding whether they were local or international corporations) operating in Turkey was exposed. Upward trend in government debt as a result of high real interest rates and high public sector borrowing increased the probability of financial crisis and discouraged foreign investors from investing in Turkey. Also, according to Yılmaz and Barbaros (2005), the burden of steady budget deficit which originated from high interest expenses, inefficient tax collection, failure to reform social security, agriculture, banking and privatization made the economy insolvent in financial difficulties and these difficulties limited the level of FDI due to uncertainty about Turkey's future.

According to Yılmaz and Barbaros (2005), Turkish legal structure comprises many problematic aspects, which may also negatively impact the investors. The slow progress of judgment process, low protection for minority shareholders, uncertainty about certain business laws, disallowance of international sharing for large projects involving government concessions seem to be the major problematic issues related to legal structure.

Another obstacle to FDI is restrictions on ownership. Since 100% ownership eases the decision process inside the company and allows for a better control over intangible assets such as technology, product quality and credibility, the investors may prefer full ownership of the investment.

Some other factors preventing FDI inflows to Turkey may be listed as; complex tax system and insufficient collection of taxes, subjective application of law and

regulations. Additionally, Turkey's negative image (scandals corruption, bribery, misuse of authority, mistrust), lack of transparency, political interference, negative government attitudes towards foreign investments and internal social tensions may be considered as obstacles for FDI.

Table 3.2: Matrix of Inward FDI performance and potential, 2004*.

	High FDI Performance	Low FDI Performance
High FDI Potential	**Front-runners** Australia, Bahamas, Bahrain, Belgium, Botswana, Brunei Darussalam, Bulgaria, Chile, China, Croatia, Cyprus, Czech Republic, Dominican Republic, Estonia, Finland, Hong Kong(China), Hungary, Iceland, Ireland, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Netherlands, New Zealand, Panama, Poland, Portugal, Qatar, Singapore, Slovakia, Slovenia, Spain, Sweden, Trinidad and Tobago and United Arab Emirates.	**Below potential** Algeria, Argentina, Austria, Belarus, Brazil, Canada, Denmark, France, Germany, Greece, Islamic Republic of Iran, Israel, Italy, Japan, Kuwait, Libyan Arab Jamahiriya, Mexico, Norway, Oman, Philippines, Republic of Korea, Russian Federation, Saudi Arabia, Switzerland, Taiwan Province of China, Thailand, Tunisia, **Turkey**, Ukraine, United Kingdom and United States.
Low FDI Potential	**Above potential** Albania, Angola, Armenia, Azerbaijan, Bolivia, Congo, Costa Rica, Ecuador, Ethiopia, Gabon, Gambia, Georgia, Guyana, Honduras, Jamaica, Kyrgyzstan, Mali, Mongolia, Morocco, Mozambique, Namibia, Nicaragua, Nigeria, Republic of Moldova, Romania, Sudan, Tajikistan, Uganda, United Republic of Tanzania, Viet Nam and Zambia.	**Under-performers** Bangladesh, Benin, Burkina Faso, Cameroon, Colombia, Cote d'Ivoire, Democratic Republic of the Congo, Egypt, El Salvador, Ghana, Guatemala, Guinea, Haiti, India, Indonesia, Kenya, Madagascar, Malawi, Myanmar, Nepal, Niger, Pakistan, Papua New Guinea, Paraguay, Peru, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Suriname, Syrian Arab Republic, TFYR of Macedonia, Togo, Uruguay, Uzbekistan, Venezuela, Yemen and Zimbabwe.

***** Three-year average for 2002-2004. Because of unavailability of data on FDI potential for 2005, the data for 2004 have been used.

Source: UNCTAD (2006).

As a result, Turkey has not attracted FDI parallel to her potential. Although there are some advantages in terms of market size, infrastructure, liberalization on economy and market attraction; economic instability affects FDI inflows negatively (Erdal and Tatoğlu, 2002).

As a developing country, Turkey's policy change from import-substituting industrialization to a more outward-oriented industrialization is a result of the recent globalization wave around the world and the liberalization period after 1980s. Removal on the protection of foreign capital inflows in 2003 made Turkey possessing a high FDI potential. Table 3.2 shows the FDI performance matrix of world countries: Turkey is one of the countries below potential, with a high FDI potential but low FDI performance.

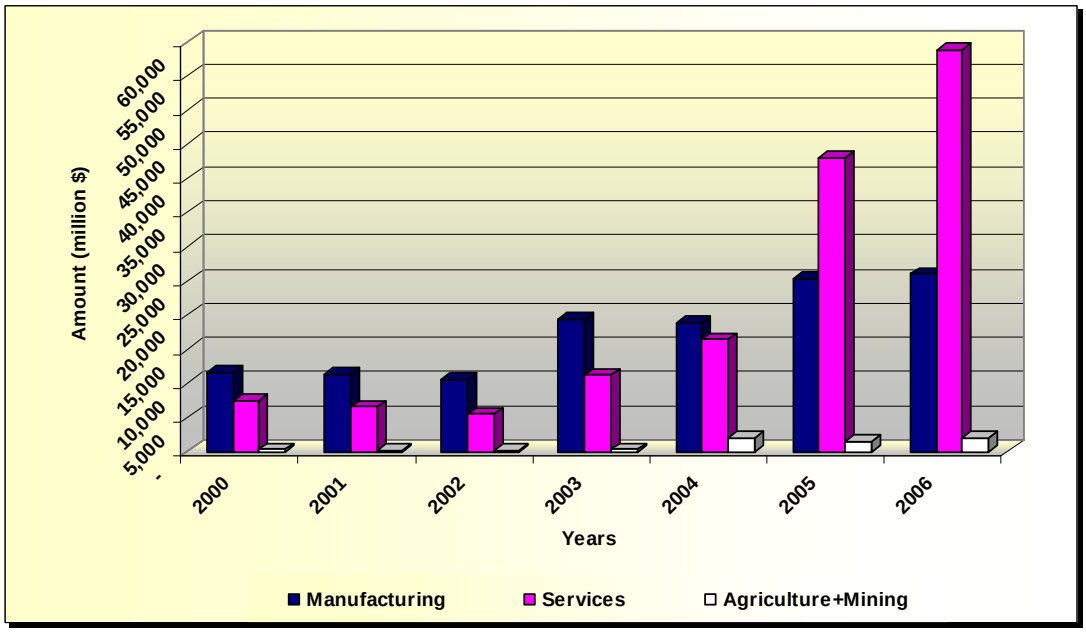

Figure 3.3: Sectoral Breakdown of FDI in Turkey.
Source: Undersecretariat of Treasury, CBRT.

When sectoral breakdown of FDI in Turkey is analyzed, it is seen that investments flows are transferred from manufacturing sector to services sector in 2000s (as in Figure 3.3). As 60% of FDI goes to manufacturing sector and 38% goes to services sector in 2000, the percentages approximately become reverse of this in 2006 (30% to manufacturing sector and 68% to services sector). There are no considerable amounts of FDI flows into agriculture and mining sectors (primary sectors). This trend of FDI inflows from manufacturing to services sector is seen in most of the developed and developing countries after the second phase of 1990s. Moreover, most of the investment in services sector, especially in infrastructure and finance sub-sectors, goes to developing countries in response to the privatization and liberalization policies of these countries. This is acceptable for investment inflows to Turkey in recent years.

Sectoral composition of FDI is an important concept in the analysis of FDI and its effects on economic growth. According to the studies in this context such as Sayek and Aykut (2007), an increase in the share of investment flows to manufacturing sector may increase productivity and provide economic growth. Whereas, increases in the share of primary or services sector investments has an insignificant effect on economic growth. In case of Turkey, when productivity and number of foreign firms in manufacturing sector are compared between 2000 and 2006, it is seen in Figure 3.4 that there is a similar pattern in these values.

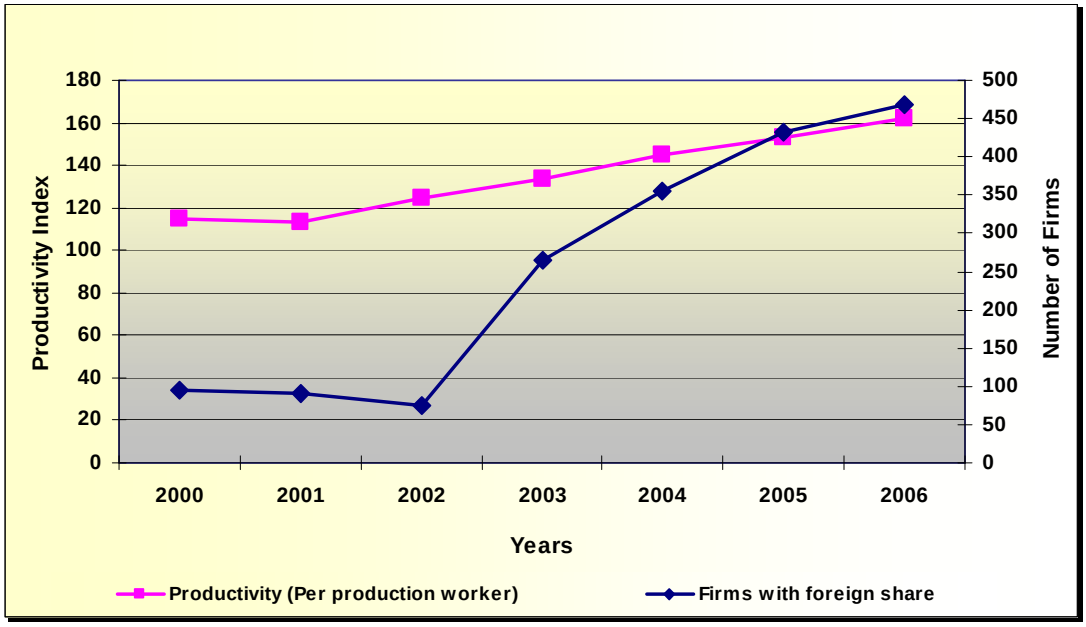

Figure 3.4: Productivity and Foreign Share in Manufacturing Sector. Source: TURKSTAT.

According to data, it is seen that Turkey is closely affected from the world trends. With the recent globalization wave, there have been many structural changes in Turkish economy and these changes have reflected in most of the economic indicators. After seeing the historical background of investment inflows of FDI, it is worth noting the empirical studies in Turkish manufacturing industry.

3.2. Empirical Analysis of Spillovers for Turkish Manufacturing Industry

Spillover analysis has become an important debate for developing economies especially after 1980s. This is due to the fact that the globalization wave after 1980s affects all developing countries and causes a policy shift towards more liberal policies in these countries. This fact is valid for Turkey as well who faces a policy change from import substituting industrialization to export-promoting industrialization policies in 1980s.

Although there was a policy change in 1980, the stock and inflows of FDI to Turkey was relatively negligible till the end of the 1980s. Since this negligible amount of FDI has no significant impact on economic development, there is no quantitative study examining the impact of FDI on Turkish economy at the sector or firm-level until the 2000s. Also, another reason of limited studies on analysis of impacts of FDI is "the availability of disaggregated data" problem on the performances of both domestic and foreign firms (Aslanoğlu, 2000). The considerable amount of FDI inflows to Turkey after 1990s makes spillover analysis an important debate for Turkey, although the data problem still exists.

Aslanoğlu (2000) is the first study about spillover effects of FDI on Turkish manufacturing industry. He uses regular survey results of Istanbul Chamber of Commerce (ISO) on the largest 500 industrial firms of Turkey as data source. In this study, spillover effects of FDI are examined by five single equation econometric models using the data of the largest 500 firms in 1993. For some variables which need data for different time periods, the data of 1988 is used. According to the ISIC (International Standard of Industrial Classification) 3-digit industrial classification, 28 sectors of the manufacturing industry are analyzed. In terms of composition of capital, firms having at least 15% of foreign share are considered as foreign firms.

The first two models estimate the spillover effects of the presence of foreign firms on the productivity and competitiveness of domestic firms. Different proxies for the presence of foreign firms such as the share of foreign firms in total employment, total sales of an industry, total gross value added or total net assets of an industry are used in these models.

The three remaining models measure the importance of technology gap on the productivity of domestic firms. Estimation results suggest that while the presence of foreign firms increases competition in domestic industries, there is no significant contribution on the productivity of domestic firms. According to two of the remaining three models, no significant relation is found between domestic and foreign firms in terms of the impact of technology gap on the productivity and market growth of domestic firms. The final model estimates the impact of the initial

technology gap on the change in technology gap in the course of time and a significant correlation is found. The conclusion of the study is that if locational advantages of the country are developed by proper policies, spillover effects on the domestic industries could be materialized with the rising competition, which has already brought into by the presence of foreign firms.

In Alıcı and Ucal (2003), the developments in Turkish economy in relation to growth rate, export and FDI are investigated using Granger causal relationship in macro level. The effect of Turkey's liberalization process on economic growth is demonstrated by investigating a Granger causal relationship running from exports to economic growth in Turkey from 1987-I to 2002-IV. Additionally, causality tests among trade, FDI and output for the same period are performed to show the inter-relatedness of trade, FDI and growth. Three variables were utilized in the model: export, industrial production and FDI. Although this paper does not concentrate on the manufacturing industry in terms of FDI-led growth, it is one of a few empirical studies which are analyzing FDI and growth relationship and the spillover effects in Turkey.

According to estimation results, industrial production and export are causally related in the long run, and the Granger causality is uni-directional running from export growth to output growth. There exists no causality link between FDI-industrial production and FDI-export, in other words for the Turkish economy it is not found any significant positive spillovers from FDI to export suggesting a kind of FDI-led export growth linkage.

The results of this study are in line with the export-led growth (ELG) hypothesis, but do not confirm the existence of FDI-growth relationship. The results indicate that the integration of the Turkish economy with the world economy should be enhanced with policies to attract more FDI in order to gain the spillover effects of FDI to output and FDI-led export growth. According to the findings of this study, Turkey's outward looking development strategy should include FDI as an essential part in addition to export-promotion strategy followed from 1980 on.

Lenger and Taymaz (2004) is another quantitative study about productivity spillovers in Turkish manufacturing industry. This study examines the role of TNCs as creator and diffuser of new and superior technologies. The role of TNCs is discussed with respect to the spillover effects those firms create on domestic firms. The question of the study is whether size of the recipient firms and the R&D intensity matter in productivity spillovers from the activity of TNCs, and whether spillovers change as time goes by.

The empirical investigation utilizes a longitudinal data over the 1983-2000 period consisting of 28 industries in three-digit level in various categories such as public firms, and private small, medium and large sized firms in Turkey. The data set used in this study was obtained from Turkish Statistical Institute (TurkStat).

According to results of the study, there are negative spillover effects in Turkish manufacturing industry although spillovers from TNCs for the domestic sector of the Turkish manufacturing industry differentiate with respect to time and to some industry specific characteristics. Foreign market share has a negative and significant spillover effect on all industries but the sign of this spillover turns to positive when one period lagged value of market share of TNCs employed. Spillover effects can vary with respect to ownership structure, size categories and R&D profile of industries. For example, small and large firms get negative spillovers from the activities of TNCs whereas there is no evidence of any kind of spillover for public firms and medium sized firms. However, this explanation does not hold in the case of low tech medium sized firms that are exposed to negative competition effect.

One of the most important conclusions derived from the theoretical and empirical literature review is that technological capability is the major determinant in the process of benefiting from productivity spillovers potentially available in Turkish manufacturing industry. Therefore, this intuitive thinking lends some support to the interpretation of the gap between productivity of domestic and foreign industries such that the domestic firms were exposed to negative spillover effects. Econometric analysis precisely and strongly supports this argument.

Lenger and Taymaz (2006) is an empirical study estimating the impact of horizontal, vertical and labour spillovers on technological activities of Turkish manufacturing firms. They model and estimate the determinants of two types of technology acquisition, innovation and technology transfer, respectively; and test whether foreign ownership matters for technology decisions. They test whether foreign firms are more likely to transfer technology from abroad, and whether they have any impact on the technology transfer decisions of domestic firms.

Their model consists of a number of firm- and sector-specific factors and a number of variables are defined as proxy for horizontal, vertical and labour spillovers. The data on innovativeness are collected by TurkStat through two Innovation Surveys following the methodology set by the Oslo Manual (OECD, 1997), and the Community Innovation Survey of the European Union. The first survey conducted in 1998 covers the period 1995–1997 and the second one conducted in 2002 covers the period 1998–2000. The data on technology transfer come from the Annual Survey of Manufacturing Industries, collected by the TurkStat.

Their analysis shows that foreign firms are more innovative than their domestic counterparts, and transfer technology from abroad (mostly from their parent companies). Horizontal spillovers from foreign firms seem to be insignificant. The effects of foreign firms on technological activities of other firms in vertically related industries are ambiguous. High-tech suppliers tend to have a high rate of innovation when the share of foreign users is high, but the opposite is true for users: high-tech users supplied mainly by foreign firms tend to have a lower rate of innovation. Labour turnover is found to be the main channel of spillovers. Their findings repeat the importance of tacitness of knowledge, and confirm that technology cannot easily be transferred through passive mechanisms.

Another econometric study estimating the effects of FDI on productivity and development in the Turkish economy is Ayvaz, Baldemir and Ürüt (2006). They investigate whether there are externalities of fully foreign-owned firms to the labour and capital productivity of local and public enterprises.

The data used in this study is obtained from the Largest 500 Industrial Cooperation study of Istanbul Chamber of Industry for the manufacturing sector in 2001. The data is classified as fully foreign-owned firms, domestic firms and public firms. The model analyzes whether there is positive spillover effects from foreign firms on total labour productivity.

According to empirical results, there is no difference between domestic and foreign firms in terms of externality effects of foreign presence in the sector. Also, there are positive spillover effects of foreign share in Turkish manufacturing industry. The study concludes that domestic firms must increase their capital and labour resources to compete with foreign firms.

However, there is a problematic aspect of this study. Their analysis does not produce results about spillover effects. According to regressions, only the difference between foreign-owned and domestic firms in terms of productive efficiency is tested. For this reason, the empirical results of this study are not reliable enough.

Yılmaz and Özler (2004) analyzes direct and indirect effects of foreign ownership on productivity using plant-level data for Turkish manufacturing industry between 1990 and 1996. Productivity measures are obtained from Olley-Pakes production function estimates. This paper aims to identify horizontal and vertical linkages at the plant level and hence improve over the results with industry-based measures of linkages instead of proposing a new methodology or an approach to the analysis of FDI and productivity spillovers. A disaggregated database on products sold and inputs purchased by manufacturing plants in Turkey is used to identify linkages.

In this study, data set is collected by TurkStat for the Turkish manufacturing industry. Sample consists of plants with 25 or more employees and is limited only on private establishments.

According to Olley-Pakes production function estimations using total factor productivity measures; the following results are obtained. First, foreign affiliates are shown to be more productive than local plants. Furthermore, majority foreign-owned

foreign affiliates are more productive than minority foreign-owned foreign affiliates, and fully foreign-controlled plants are more productive compared to majority foreign-owned foreign affiliates.

Second, using sectoral output shares of foreign affiliates as a measure of horizontal linkages, and 1990 input-output flows to identify vertical linkages, regression results support the presence of productivity spillovers from foreign affiliates to local plants through horizontal and forward linkages. However, the coefficient estimates on linkage measures are sensitive to the inclusion of other linkages.

When the plant level data is used on the value of output and inputs to obtain product-based measures of horizontal and vertical linkages, the regression results do not fully support the results obtained with the industry-based measures of linkages. Statistically meaningful positive spillovers are found to be generated through backward linkages only. The magnitude of spillover effects are much smaller than the ones obtained with industry-based measures.

Another paper testing FDI spillovers is Bertinelli, Pamukçu and Strobl (2007). They test for the existence of intra-industry FDI spillovers in the Turkish manufacturing sector over the period 1983-1994 by using firm-level data that come from the Annual Surveys of Manufacturing Industry of TurkStat. This dataset covers all establishments in the manufacturing industry employing ten or more employees.

In this study, an index of total factor productivity in local firms is used as dependent variable. To analyze productivity spillovers, different indicators are used as explanatory variables like the share of foreign enterprises in the number of employees or in gross output at the four-digit sector level. Also, some control variables are included in estimations either firm-level or sector-level such as scale, skill level, Herfindahl index, import penetration and relative productivity. Firm-specific and sector-specific determinants of productivity level are introduced in the regressions accompanied with an interaction term in order to find out whether productivity gaps existing between foreign and local firms exert a positive or negative effect on the productivity of local firms. Other interaction terms are also

added to the productivity equation in order to figure out whether explanatory variables reduce or increase a possible spillover effect.

According to estimation results, activities of foreign firms in the Turkish manufacturing sector do not generate any spillover that impact positively on local firms' productivity levels. In this study, four spillover indicators are used and all point to a negative spillover effect. The results of estimations with interaction terms show that productivity of firms that face extensive import competition and have a large market share benefit less from FDI-based spillovers.

As a result, there are some critical points to mention for all these empirical studies. Firstly, firm-level studies use Istanbul Chamber of Commerce (ISO) data while sector and plant-level studies use TurkStat data. Although dataset obtained by annual reports on 500 largest firms of ISO do not include all industrial value added, it is the most reliable dataset for the firm-level spillover analyses. In this context, the desegregation level of data is an important factor in terms empirical results. Secondly, these studies differ in terms of the cross-section or panel data. This may be a reason of different results of the spillover analyses.
Thirdly, spillover effects are analyzed using total factor productivity or labour productivity as a dependent variable. Different foreign share variables such as the share of foreign firms in total employment, total sales of an industry, total gross value added or total net assets of an industry are used as spillover measures. Modelling with these measures, some studies provide negative results while most of the studies produce positive results either significant or significant. The intuition behind the negative results is the gap between productivity of domestic and foreign industries since technological capability is the major determinant in the process of benefiting productivity spillovers potentially available in Turkish manufacturing industry according to empirical and theoretical literature.

The empirical studies mentioned above are shown in Table 3.3. Table 3.3 provides a comparison of the empirical studies about Turkey in terms of period covered, data used, aggregation level, variables chosen and the result obtained.

Table 3.3: Papers on Productivity Spillovers.

Papers on Productivity Spillovers								
Author	**Period**	**Data**	**Data Resource**	**Aggregation Level**	**Estimation Method**	**Dependent variables**	**Independent variables**	**Result**
Aslanoğlu (2000)	1993	Cross-section	Istanbul Chamber of Commerce (ISO) Annual Reports on 500 largest firms	Firm-level	OLS	Productivity of domestic firms (labour productivity)	1.Foreign Share 2.Capital-labour ratio of domestic firms 3.Scale 4.Herfindahl Index 5.Annual Hours worked per employee 6.Labour quality	Foreign Share variable has positive and insignificant coefficient estimates.
						Efficiency Index (the ratio of average productivity in an industry to the average of highest productivity size in the related industry)	1.Foreign Share 2.Technology 3.Market Growth 4.Herfindahl Index 5.Rate of Profit	The sign of the coefficient is positive and is statistically significant at the 0.05 level
						1.Domestic Firm's Productivity Growth 2.Change in Technology Gap 3.Growth of Domestic Firms Market Share	Technology Gap (the ratio of average productivity in foreign firms to the average productivity of domestic firms)	1. There is no significant correlation between technology gap and productivity growth of domestic firms. 2. Significant correlations (downward oriented parabola) 3. The estimation results gave neither a negative sign nor a statistically significant coefficient.

Table 3.3: Papers on Productivity Spillovers. (Cont'd)

Papers on Productivity Spillovers								
Author	**Period**	**Data**	**Data Resource**	**Aggregation Level**	**Estimation Method**	**Dependent variables**	**Independent variables**	**Result**
Lenger and Taymaz (2004)	1983-2000	Longitudinal	State Institute of Statistics (SIS)	Industry-level	Arellano-Bond type of GMM estimation	Labour productivity	1.Market share 2.Effects of foreign market share on the different ownership and size categories 3.Wages per employee 4.Capital-labour ratio 5.Labour 6.Energy 7.Input	Negative significant spillover effect at 5% level.
Lenger and Taymaz (2006)	1995-2000	Panel	SIS (Innovation Surveys and Annual Surveys of Manufacturing Industries)	Firm-level	OLS (Binary Choice Model for Innovativeness and Technology transfer)	Innovativeness Technology transfer	1.Labour turnover in foreign firms 2.Market Share of foreign firms 3.Regional foreign R&D intensity 4.Sectoral foreign R&D intensity 5.Market share of foreign firms in supplier ind. 6.Market share of foreign firms in user ind.	Positive significant labour spillovers for innovativeness at 1% level. No significant effect of labour spillovers on technology transfer. No significant effect of labour spillovers on technology transfer. No significant effect of labour spillovers on technology transfer. Significant vertical spillovers for innovativeness in high-tech industries, but with a mixed outcome.

Table 3.3: Papers on Productivity Spillovers. (Cont'd)

Papers on Productivity Spillovers								
Author	**Period**	**Data**	**Data Resource**	**Aggregation Level**	**Estimation Method**	**Dependent variables**	**Independent variables**	**Result**
Ayvaz, Baldemir and Ürüt (2006)	2001	Cross-section	Istanbul Chamber of Commerce (ISO) Annual Reports on 500 largest firms	Firm-level	Binary Choice Model ANOVA	Labour productivity	1.Capital Intensity 2.Dummy var. for domestic firms 3.Dummy var. for foreign firms	Positive significant spillover effect at 1% level.
Yılmaz and Özler (2004)	1990-1996	Panel	State Institute of Statistics (SIS) Industrial Analysis Database	Plant-level	OLS	Total Factor Productivity	1.Labour 2.Material Inputs 3.Energy 4.Capital 5.Backard linkages 6.Forward linkages 7.Horizontal linkages	Positive significant spillovers related with backward linkages at 5% level.
Bertinelli, Pamukçu and Strobl (2006)	1983-1994	Panel	SIS (Annual Surveys of Manufacturing Industries)	Firm-level	OLS and fixed effect methods	Total Factor Productivity	1. Foreign Share variables 2.Skill level 3.Market Share 4.Scale 5.Import Penetration 6.CR4 or Herfindahl Index 7.Relative Productivity	Negative spillover effect

CHAPTER 4

ESTIMATION

4.1. Data

To analyze the spillover effects of foreign direct investment, the dataset including sectors of Turkish manufacturing industry is obtained by TurkStat. The data involve sectoral level determinants including 89 different sectors according to ISIC 4-digit industrial classification. Data source is Annual Survey of Manufacturing Industries (ASMI) made periodically by TurkStat. In this type of studies, desagregation of data is a limitation for the analysis. Using 4-digit industrial classification for this industry-level study, desagregation problem is tried to be solved. For different sectors, a panel is used with a sample period from 1983 to 2001.

Dataset has some limitations. Firstly, the sample period ends in 2001 due to the changes in data collection methodology of TurkStat. The data collected for the sample period cannot be obtained for the period after 2001. Secondly, dataset covers all public enterprises and private enterprises only in which working 10 or more employees. Foreign firms are defined as the firms with at least 10% foreign ownership. Then, data covers minority foreign owned firms besides totally or majority foreign owned firms.

In the spillover analysis, sectors in Turkish manufacturing industry are classified as high-technology-using (High-Tech) sectors and low-technology-using (Low-tech) sectors. Dataset is also organized according to this classification.

4.2. Methodology

Spillover effects arising from foreign industrial activity on the industry is investigated analyzing the effects of foreign share on productivity as a proxy for FDI spillovers. Since productivity is analyzed with production functions, firstly, a Cobb-Douglas form of the production function with constant returns to scale (CRS) is specified. To produce value added Y; capital stock K, labour L are used as determinants where A refers to the baseline productivity level.

$$Y = A\, K^{\alpha}\, L^{1-\alpha} \qquad (1)$$

By multiplying each side of the equation with L^{-1}, Equation 2 is obtained.

$$(L^{-1})\, Y = A\, K^{\alpha}\, L^{1-\alpha}\, (L^{-1}) \qquad (2)$$

$$Y/L = A\, (K/L)^{\alpha} \qquad (3)$$

According to Equation 3, on the left-hand side of the equation labour productivity measure is obtained while on the right-hand side multiplication of A; baseline productivity level and (K/L); capital intensity remains as a measure of labour productivity. When Equation 3 is written in intensive form for ***y*** referring (Y/L) and ***k*** referring (K/L), the equation below is obtained.

$$y = A\, k^{\alpha} \qquad (4)$$

And in logarithmic form;

$$\ln y = \ln A + \alpha \ln k \qquad (5)$$

This equation will be made use of to analyze spillover effects of TNCs in the Turkish manufacturing industry. For baseline productivity level; variables such as FDI share, labour quality, import penetration, export intensity, concentration ratio and scale are

used. In this model, different proxies of some variables are used. All variables and their explanations are presented below:

Labour Productivity: It is the dependent variable of the equation. Labour productivity is calculated for each sector of the dataset in Turkish Manufacturing Industry. Three different proxies are used for the estimation. The first one, ***prod1***, is the ratio of value added of the sector in constant terms calculated with double deflation to the employees worked in the same sector. Second one, ***prod2***, only differs from the first one in terms of the calculation of value added constant which is deflated with output deflator. The last one, ***prod3***, is calculated using output data for the production level.

FDI Share: Market share of foreign investors in each sector is calculated using the turnover of each sector as a percentage (%). Foreign firms are defined as firms with at least 10% foreign ownership and only firms with at least 10% foreign ownership are used for the creation of this data. This variable is used as a proxy for analyzing horizontal spillover effects. The coefficient on the FDI share variable indicates the short-run impact of FDI-based technology spillovers on sector-level productivity.

Capital Intensity: As an explanatory variable of the productivity model, capital intensity is defined as capital-labour ratio, simply. But six different calculations of capital intensity are used for the estimation in order to see the robustness of results to capital intensity. In the first two proxies of capital intensity, electricity and power capacity are used as proxies for capital stock. Remaining four capital intensity variables are calculated using four different calculations of capital stock variable using perpetual inventory method. The calculation of these variables and utilization in this study is new since electricity and power capacity are mostly preferred as a measure of capital stock in previous studies.

These four capital stock variables were calculated in scope of a project[iii] on the basis of firm-level data. In these calculations, perpetual inventory method was used. Now on, there will be given some information about this method and different specifications to calculate different capital stock variables.

According to this method where δ is the constant rate of depreciation taking values between 0 and 1 ($0<\delta<1$), capital stock is calculated as:

$$K_t = (1-\delta)\, K_{t-1} + I_t \qquad (6)$$

In this equation, I_t refers to the gross investment in current year while K_t and K_{t-1} refer to capital stock of current year and previous year, respectively. This method is used to create a stock of capital from a flow of investments.

$$K_{t-1} = (1-\delta)\, K_{t-2} + I_{t-1} \qquad (7)$$

$$K_t = (1-\delta)\, [(1-\delta)\, K_{t-2} + I_{t-1}] + I_t \qquad (8)$$

Using this iterative formulation, an equation which is including an estimate for the initial period capital stock (K_0) and a series of annual investments is obtained to calculate current capital stock of the firm.

The third capital stock variable used in the model is the value of real depreciation. The fourth and fifth proxies were calculated using K_0 and annual investment amounts. In these calculations, it is assumed for the firms established before 1983 that the firms' capital stock values in 1983 are the first data obtained for capital stock and they are established in 1983. Using the given depreciation rate, start-up capital stock values are calculated. The difference for these two proxies are the rate of depreciation, it is 10% for the fourth one and 6,7% for the fifth one. For the last proxy of capital stock; while different series of initial capital are calculated based on depreciation, the initial capital values of the firms established after 1983 come from

[iii] An ongoing project, "Türkiye İmalat Sanayiinde Yapısal Dönüşüm, Üretkenlik ve Teknolojik Değişme Dinamikleri", lead by Erol TAYMAZ, Ebru VOYVODA and Kamil YILMAZ at TUBITAK.

their first year investment.[iv] More information about the calculation of the capital intensity variables is presented in Appendix A Table A.1. Using these six proxies for capital intensity, robustness of the model to the capital intensity is tested.

Labour Quality: Another explanatory variable used in the model is labour quality. It reflects the absorptive capacity of domestic industries in adopting new technologies. It is assumed that higher labour quality is associated with higher productivity. Two proxies of labour quality were used for Turkish data. For the first proxy, ***qual1***, number of skilled employees and number of employees in production is used as a determinant. For the Turkish manufacturing industry, the employment data on skilled workforce is collected only in November. For this reason, ***qual1*** is the ratio of qualified employees in November to employees in production in November. The second proxy, ***qual2***, is a ratio of qualified employees in November to total employees in November.

Import Penetration: This variable is an indicator of the degree of competition brought by imports at the sector level. It is intended to account for technological changes generated by domestic firms in response to increased competition from FDI. This variable captures the potential efficiency-enhancing effects of international product market competition. However, more competitive and better foreign products can attract demand away from local firms instead of efficiency-enhancing effect. It is expected that firms in industries with higher market concentration would experience lower productivity growth. Two different proxies are used for import penetration. The first one, ***mpen1***, is defined as imports divided by domestic output plus imports minus exports. The second one, ***mpen2***, is defined as imports divided by domestic output plus imports. This second measure is used in order to circumvent problems due to the difference between output data, which is collected for the firms at least 10 employees, and export and import data, which is collected for all firms in the sector.

Export Intensity: Exposure to international trade is an important force imposing competition on domestic firms. The choice set of foreign technologies available to an

[iv] See Taymaz et al. (2006-ongoing) for more details on the calculation of capital stock variables using PIM.

export-oriented firm would be larger leading to better choice in technological solutions. This would finally result in improved efficiency of the firm. Export intensity (***xint***) is used as a variable to see the effect of firm's outward orientation in explaining the productivity of the firm. Export intensity is defined as a ratio of exports to production level in the sector and used as an explanatory variable in the estimation. It is assumed that increasing export intensity increases or at least does not affect negatively the productivity.

Concentration Ratio: The level of concentration in an industry may affect its productivity. This issue has been analyzed in many studies, but there is no significant result about the effects of market structure. According to Blomström and Persson (1983), it is believed that firms in higher concentrated industries have certain market power and are in more advantageous position in price setting. As a result, they tend to have higher productivities. Due to the potential effect of market structure on productivity, it is included as a variable. Herfindahl index (***HI***) and four firm-level concentration ratio (***CR4***) are used for estimation as different proxies to concentration ratio. ***HI*** is defined as the sum of the squares of each firm's market share in an industry, while ***CR4*** consists of the market share, as a percentage, of the four largest firms in the industry.

Scale: Scale is used as a variable measuring the average firm size at the sector level. It is thought that scale economy –increasing or decreasing- in the sector is a determinant of productivity and there should be a positive or negative correlation between scale and productivity. Scale is defined as the ratio of number of employees to the number of firms in each sector.

Industry dummies are included in OLS estimation only and time dummies are included to Fixed Effect Method (FEM) estimation to account for the effect of macro shocks which are common to all sectors.

To assess the robustness of the estimation results, an alternative model is estimated. In this model, a production function approach is used to analyze the FDI-related spillover effects. In this production function, production (***Q***) is identified with two

proxies, that is value added (***vad_cons1*** and ***vad_cons2***) and gross output (***output_cons***). Details about variables are given in Appendix B Table B.1. General form of this function is defined as below.

$$Q = A\, f(K, L, M, E) \qquad (8)$$

where capital stock is referred as K, labour L, material inputs M, energy consumption E and baseline productivity level A. Due to data limitations, M and E is included together as M*.

$$Q = A\, f(K, L, M^*) \qquad (9)$$

In Cobb-Douglas form;

$$Q = A\, K^{\alpha} L^{\beta} M^{\gamma} \qquad (10)$$

Then, this function can be written in logarithmic form;

$$\ln Q = \ln A + \alpha \ln K + \beta \ln L + \gamma \ln M \qquad (11)$$

This function is used for gross output. When value added is used as a proxy of production, material inputs are not included into estimations. This method is used in Haskel, Pereira and Slaughter (2002) to investigate whether inward FDI generates productivity spillovers for domestic plants. According to this study, (11) is a production function, augmented by measures of foreign presence and other controls, where coefficient estimates on the non-input regressors capture their contribution to ***total factor productivity***. In this model; six different proxies of capital stock is used as in the first model. Labour is included into model in two ways: the first one is the variable ***labour*** which refers to total employees and the second one is defined as ***labour_pr*** and ***labour_adm. labour_pr*** refers to employees working in production while ***labour_adm*** refers to employees working in administration.[v] For material

[v] Although *labour_pr* and *labour_adm* produce significant results, these results are not presented here due to the constraint on the number of Appendix pages.

inputs, ***input*** variable is used in the estimation of gross output function. As a proxy of foreign presence (***FP***), market share of foreign firms for each sector is used again as in the first model. The control variables are import penetration (***mpen1*** and ***mpen2***), export intensity (***xint***) and concentration ratio (***HI*** or ***CR4***).

4.3. Estimation Results

In order to analyze the spillover effects of FDI on Turkish manufacturing industry, two different models specified in Equation (5) and (11) were estimated. In the first model, labour productivity was regressed on capital intensity, foreign share in the industry, labour quality, export intensity, import penetration, scale and Herfindahl index. In the second model, a production function approach was used to analyze spillover effects in a different manner. Dependent variable was measured alternatively as value added and gross output and; besides FDI spillovers, capital, labour, material input, import penetration, export intensity and Herfindahl index were used as explanatory variables. For two models, different specifications were made and the results are analyzed below:

4.3.1. Cobb-Douglas Function in Intensive Form (Eqn. 5)

In the first model, estimations were carried out by ordinary least squares (OLS) method, random effects method (REM) and fixed effects method (FEM). Since it allows us to obtain consistent estimates of parameters in case an unobservable time-invariant factor correlated by the dependent variable is part of the error term, fixed effects method (FEM) was chosen as the estimation method.[vi] The results are presented in Appendix A.

Firtsly, **fdishare** is used as the sole explanatory variable in the labour productivity equation. For three proxies for dependent variable, different results were obtained. Only one of these proxies produced positive and significant result for spillover effect, while other two proxies producing insignificant positive and negative effect results.

[vi] Inconsistency might arise due to the inclusion of a lagged dependent variable in the productivity equation. Generalized Method of Moments (GMM) should be used –beyond the scope of this study.

Then, one of these proxies was eliminated and only two productivity variables were used for estimations.

According to regression results presented in Tables A.5-A.10 of Appendix A, coefficient of spillover variable changes when generally, specifications change. In Table A.5, ***fdishare*** and ***capint1*** are regressed on ***prod1*** and the negative and insignificant spillover effect is obtained whereas ***capint1*** is positive and significant at 5% level. When one period lagged value of labour productivity is added to the equation, the sign of the ***fdishare*** variable turns to positive but remains insignificant. For the first proxy of labour productivity, all other equations including other control variables produce positive but insignificant results. As seen from Table A.2, constant price value added takes negative values. Since it is calculated with double deflation method using output and input deflators, the construction of input deflator may involve some problems and as a result, this may affect the regression results.

When ***prod2*** is used as dependent variable with first proxy of capital intensity, ***capint1***; all regressions produce positive spillover coefficient estimates always significant at 10% level. ***Capint1*** has also a positive sign and significant at 1% significance level. In Table A.5, Model 9 produces the most meaningful results when other variables added to the equation, Herfindahl index, labour quality and import penetration, are all significant. This equation is also a dynamic one and shows that productivity is affected from the one period lagged value. In Model 10, export intensity and scale is added to the regression together with one period lagged value of ***fdishare***, which shows the long-term effect of foreign investment to sector on productivity of that sector. In this model, while export intensity is positive and significant at 1% level, scale and lag of fdishare produce meaningful results. Although the lag of fdishare is insignificant in this regression, it is interesting to note that it produces negative results. Lenger and Taymaz (2004) use the lagged value of foreign market share in their econometric study and they obtain similar results. Spillover effects are not compensated in the following period even at moderate levels. In other words, the estimated coefficients of lagged variables are negative but insignificant.

In Appendix A from Table A.5 to Table A.10, regressions were made for different capital intensity variables. The robustness of the results was tested using different capital intensity variables. First two tables show proxies for capital intensity variables since electricity and power are two proxies for capital. Remaining capital intensity variables are calculated using real capital stock data as it was mentioned before. Among all results, regressions where ***prod2*** is used as dependent variable and ***capint1*** as one of the explanatory variables produce most meaningful results. In other words, equations from 7 to 12 in Table A.5 produce significant results for many of the explanatory variables used. So this model is "preferred model".

4.3.2. Production Function Approach (Eqn. 11)

The results of the second model involving a production function approach were presented in Appendix B, Tables B.3-B.8. Using different capital stock and output variables again, many alternative regressions were made. According to this estimation method, foreign share variable produce different results such as a negative sign for ***vad1*** and ***output*** variables whereas the sign is positive for ***vad2*** variable. Although only equations including ***vad2*** variable produce significant results at 10% significance level, this significance of spillover effect changes when any other variables added to the regressions. Among the estimations of different proxies of dependent variable, ***vad1*** also has smaller R^2 value.

In this model, it is important to note about the results that for value added regressions the sum of capital and labour coefficient estimates and for gross output regressions the sum of capital, labour and material input are close to the value 1, which means constant returns to scale for the sector and produces meaningful results although test for this equality is not done in this study.

To analyze whether these positive spillover effects are seen in low-tech sectors or high-tech sectors mostly, the data was classified into two sub-categories and the estimations were done for both low-tech and high-tech sectors. The sectors are defined as high tech if they are R&D intensive, and as low tech if they are non-R&D intensive following the OECD classification. In low-tech sectors, foreign firms have

%15-20 of market share, while %45-50 of market is obtained by foreign firms in high-tech sectors (Lenger and Taymaz, 2004). According to regression results, the coefficient estimate of foreign share variable provided positive and significant results at only %10 level for low-tech sectors while it does not provide significant results for high-tech sectors. In these regressions, since most of the foreign investment flows went to high-tech sectors, it is expected that high-tech sectors should provide positive spillover effects. However, the regression results differed from our expectations, probably, due to the decline on number of observations with classification. On the other hand, estimation results of Lenger and Taymaz (2004) show that the generation of spillover effects does not differentiate in low tech and high tech industries. The current effect of foreign market share is negative both for low and high tech firms. No significant dynamic spillover effect was generated for high tech and low tech industries.

For the production function approach, again FEM was used and different specifications were tried. In this estimation, besides labour and capital as the main determinants of output, Herfindahl Index, import penetration, export intensity and foreign share variables were used as explanatory variables. For two different models, similar results were obtained.

Regression results show that foreign share is one of the determinants of productivity in each sector and the presence of foreign investors in the sector affects productivity of the sector positively. It was observed that in Turkish manufacturing industry, there were positive technology spillovers to domestic firms.

According to the project (Taymaz et al., 2006-ongoing) mentioned before, where the different capital stock variables are calculated, a similar estimation is done but using firm-level data. The relationship between foreign share and productivity is analyzed with FEM using firm-level data in the Turkish Manufacturing Industry for 1983-2001 period. In this estimation, import penetration, export intensity, scale and foreign share are used together with some other firm and region-specific variables. According to estimation results, foreign share exerts a negative and significant effect at 5% level. Import penetration has positive impact and significant at 1% level. These

results are different from findings of this study, but sector-level data is used in this study.

CHAPTER 5

CONCLUSION

FDI has been one of the major components of globalization waves beginning from 1870s. Since then, it is also a major policy issue of governments especially in developing countries in the context of development literature. There are many studies investigating the importance of foreign investment flows in terms of economic growth in developing countries, either theoretically or empirically. According to discussions about the effects of FDI on economic growth, it is thought that technology spillovers through FDI inflows to the host country are one of the factors encouraging economic growth.

Many factors are influential in transferring technology through FDI. These factors may be either internal such as absorptive capacity or external such as investment decisions of host countries to developing countries. From this perspective, firstly, theoretical background of FDI decisions and FDI-related spillovers were analyzed in this study. According to this analysis, it is seen that FDI went to developing countries with one of the four main motives; resource-seeking, market-seeking, efficiency-seeking and strategic asset-seeking motives and mostly in two types; either M&As or greenfield investments. Another point is that the investment decisions were given according to analysis of some determinant factors such as ownership, location or internalization advantages which were mentioned in OLI-framework. In terms of spillovers, it is seen in the literature that there are three types of spillovers; horizontal, vertical and labour spillovers in nature and these spillovers occur in five main channels; demonstration/imitation, labour mobility, exports, competition and backward and forward linkages.

Secondly, empirical studies in the literature related with technology spillovers were reviewed and using the findings of these studies, for both Turkey and other countries, an econometric estimation was made for Turkish manufacturing industry.

In econometric analysis, using data for 89 different sectors in Turkish manufacturing industry obtained, horizontal spillovers were tested. This sector-level data was analyzed in an 18-year time period from 1983 to 2001. According to regression results, it was seen that there is positive spillovers from foreign firms to domestic firms in Turkish manufacturing industry. As one of the determinants of labour productivity, foreign share produced positive significant results for each sector in most of the regressions. Robustness of regression results were tested using six different capital stock variables. Although there were negative coefficient estimates for foreign share variable in some regressions, these results were not significant.

In addition to capital intensity and foreign share, some control variables were used in productivity estimation. It was seen that concentration level in the sector, labour quality and export intensity produced positive and mostly significant results while import penetration affected labour productivity negatively. The productivity model was a dynamic model since one year lagged value of labour productivity produced positive and significant results.

Another relevant analysis made in this study was about which sectors were mostly affected by the foreign presence, either low-tech sectors or high-tech sectors. It was expected that the positive spillover effects were mostly due to the high-tech sectors since FDI went to high-tech sectors in general. However, the results were significant only for the low-tech sectors. When the data was classified into two sub-categories of low-tech and high-tech sectors, the sample size for regressions of these two sub-categories declined. Then, it was thought that due to the insufficient number of observations, the results differed from the expected one.

Besides the productivity model, a production function approach was examined as an alternative to test the existence of spillover effects. Using some control variables again, spillover effects were analyzed. The coefficient estimate of foreign presence

variable was used for the spillover analysis for different capital stock variables. Same dataset was used for two models. The regressions produced similar results for foreign presence variable. However, in this model some regressions produced negative coefficients for foreign presence variable although these results were statistically insignificant.

For both models, the preferred estimations were similar due to significant results were obtained with same variables for each model. In terms of variables chosen, the regression results were consistent for two models.

As a result, technology spillovers through FDI can be seen as an important channel of economic growth for developing countries. Although in recent wave of globalization period FDI composition changed from manufacturing industry to services industry for developing countries, spillover effects are mostly seen in manufacturing industry; that is, productivity increase and economic growth may be a reason of FDI in manufacturing industry. Then, attracting FDI mostly to manufacturing industry is important for developing countries.

In conclusion, FDI inflows to Turkish manufacturing industry produce positive horizontal spillover effects in sectoral level. FDI-related technology spillovers are also shown in types of vertical and labour spillovers. To obtain more clear-cut and comprehensive results, Turkish manufacturing industry can be studied in terms of horizontal, vertical and labour spillovers with firm-level data for further analysis. Also, validation of the model used in this study, in other countries can be another interesting research topic.

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APPENDIX A – Results of Model 1 (Cobb-Douglas Function in Intensive Form)

Table A1: Variables and Definitions of Model 1.

Variable	Name	Calculation	Explanation
fdishare	FDI share	Share of foreign firms at the market level	Proxy for potential FDI Spillovers
prod1	Labour productivity	Vad_cons1/employees	Vad_cons1 refers to constant price value added and employees variable refers to total number of employees. vad_cons1=output_cons - input_cons Constant price value added is calculated with double deflation.
prod2	Labour productivity	Vad_cons2/employees	vad_cons2=vad_crt/poutput Constant price value added is calculated with price output.
prod3	Labour productivity	Output_cons/employees	Output_cons refers to constant price gross output which is deflated with output deflator. output_cons=output_crt/poutput Deflation
qual1	Labour quality	empnovqual/empnovprod	Empnovqual refers to total qualified labour in November and empnovprod refers to labours working on production in November.
qual2	Labour quality	empnovqual/empnov1	Empnov1 refers to total labour working in November.
mpen1	Import penetration	m_tl/(output_crt-x_tl+m_tl)	Share of imports in domestic demand
mpen2	Import penetration	m_tl/(output_crt+m_tl)	Share of imports in domestic demand
xint	Export Intensity	x_tl/output_crt	Export output ratio.
capint1	Capital Intensity	electricity/employees	Electricity is in kwh.
capint2	Capital Intensity	power_dec1/employees	Power_dec is in Horse Power (HP).

Table A.1: Variables and Definitions of Model 1. (Cont'd)

capint3	Capital Intensity	K_3/employees	K_3 is deflated real price on depreciation.
capint4	Capital Intensity	K_4/employees	K_4 is calculated using Perpetual Inventory Method (PIM).[1] $\delta = 0{,}10$
capint5	Capital Intensity	K_5/employees	K_5 is calculated using Perpetual Inventory Method (PIM). $\delta = 0{,}67$
capint6	Capital Intensity	K_6/employees	K_6 is calculated using Perpetual Inventory Method (PIM).
scale	Scale	Number of employees/ total number of firms	It is calculated for each sector.
Hi	Herfindahl Index	$H = \sum_{i=1}^{n} s_i^2$	S refers to market share of each firm in the sector and n refers to number of firms.
cr4	Concentration Ratio	$S_1+\ldots+S_4$	For four highest firms in terms of their market share s.

[1] See Taymaz et al. (2006-ongoing) for details.

Table A.2: Descriptive Statics of Model 1.

Variable	Obs	Mean	Std. Dev.	Min	Max
input_cons	1181	1.60E+10	2.66E+10	3.85E+07	2.45E+11
output_cons	1181	2.63E+10	4.03E+10	1.72E+08	3.69E+11
vad_cons1	1181	1.03E+10	1.47E+10	-3.37E+09	1.24E+11
vad_cons2	1181	9.72E+09	1.41E+10	5.54E+07	1.24E+11
prod1	1181	839719.6	795198.5	-898471.3	7079927
Lprod1	1141	13.29063	1.003681	6.451975	15.77277
prod2	1181	777182.9	660195.9	66740.07	4337115
Lprod2	1181	13.28228	0.73759	11.10856	15.28272
prod3	1181	1993873	1421238	206909.1	9900509
Lprod3	1181	14.26868	0.701991	12.24004	16.1081
K_3	1208	1083143	2048586	1617	2.01E+07
K_4	1208	1.10E+07	2.07E+07	13701	1.95E+08
K_5	1208	1.52E+07	2.85E+07	22391	2.71E+08
K_6	1189	1.21E+07	2.30E+07	14427	2.02E+08
Capint1	1212	20595.68	38289.75	656.7046	356176.9
Lcapint1	1212	9.182506	1.100105	6.487234	12.78318
Power_dec1	1211	143085	276782.1	295	2780288
Capint2	1211	11.89178	24.92519	0.0488412	476.6928
Lcapint2	1211	1.948098	0.949244	-3.019181	6.166873
capint3	1208	77.39611	74.99393	1.807548	579.5337
Lcapint3	1208	3.995507	0.867007	0.5919714	6.362224
capint4	1208	817.0779	808.5034	20.87523	6174.07
Lcapint4	1208	6.331716	0.887196	3.038563	8.728113
capint5	1208	1133.458	1118.95	30.93419	7656.341
Lcapint5	1208	6.662784	0.878846	3.431862	8.94329
capint6	1189	890.3827	883.1554	23.95807	6639.015
Lcapint6	1189	6.405952	0.897542	3.176305	8.800719
Fdishare	1204	10.4799	16.34395	0	76.68394
Xint	1212	0.20349	0.202789	0	0.99781
mpen1	1212	0.268774	0.259753	0	0.995301
mpen2	1212	0.231971	0.233358	0	0.972965
cr4	1212	47.58852	20.63459	7.68	100
HI	1212	0.102254	0.08905	0.0064	0.62154
Lscale	1212	4.543361	0.782206	2.071598	7.115582
qual1	1212	0.067286	0.036497	0	0.327285
qual2	1212	0.064912	0.035758	0	0.285632

Source: TurkStat Database, Annual Survey of Manufacturing Industries (ASMI).

Table A.3: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001. (OLS Estimation)

	(1) Lprod1	(2) Lprod2	(3) Lprod3
Fdishare	0.010	0.013	0.011
	(5.73)	(10.18)	(8.92)
Constant	13.183	13.146	14.155
	(375.21)	(532.31)	(597.18)
Observations	1133	1173	1173
R-squared	0.03	0.08	0.06

Table A.4: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001.

	(1)**** Lprod1	(2) Lprod1	(3) Lprod2	(4) Lprod3
Fdishare	-0.001	-0.001	0.002**	0.000
	(0.59)	(0.59)	(2.10)	(0.36)
Constant	13.780****	12.822****	13.554****	14.476****
	(47.83)	(151.74)	(343.97)	(397.81)
Observations	1133	1133	1173	1173
Number of sector	66	66	66	66
R-squared		0.32	0.69	0.68

Absolute value of z statistics in parentheses

*significant at 10%; **significant at 5%; ***significant at 1%

****Random effects method is used. Fixed effects method (FEM) is used for the other estimations.

Time dummies are used.

Table A.5: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capintl).

	(1) Lprodl	(2) Lprodl	(3) Lprodl	(4) Lprodl	(5) Lprodl	(6) Lprodl	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002***	0.002***	0.001**	0.001**		0.002***
	(0.62)	(0.97)	(0.83)	(1.10)		(1.19)	(2.16)	(2.28)	(1.91)	(1.92)		(2.17)
Lcapintl	0.332***	0.245***	0.222***	0.214***	0.214***	0.211***	0.164***	0.120***	0.080***	0.081***	0.077***	0.074***
	(4.80)	(4.78)	(4.31)	(4.15)	(4.13)	(4.05)	(5.37)	(4.36)	(2.98)	(2.99)	(2.84)	(2.72)
Lprodl_1		0.477***	0.470***	0.466***	0.464***	0.466***						
		(21.21)	(20.91)	(20.75)	(20.64)	(20.66)						
Hi			1.409***	1.456***	1.434***	1.417***			1.546***	1.548***	1.590***	1.579***
			(4.22)	(4.35)	(4.15)	(4.09)			(8.67)	(8.62)	(8.60)	(8.54)
Lprod2_1								0.370***	0.352***	0.349***	0.351***	0.353***
								(15.74)	(15.51)	(15.37)	(15.27)	(15.39)
qual2			0.308	0.195	0.261	0.196			1.072***	1.009***	1.044***	0.991***
			(0.47)	(0.30)	(0.40)	(0.30)			(3.16)	(2.97)	(3.07)	(2.92)
mpen1			0.022	-0.258	-0.259	-0.248			-0.194***	-	-	-
										0.340***	0.366***	0.358***
			(0.14)	(1.36)	(1.36)	(1.30)			(2.28)	(3.36)	(3.59)	(3.52)
Xint				0.345***	0.354***	0.341***				0.205***	0.222***	0.208***
				(2.36)	(2.42)	(2.32)				(2.64)	(2.85)	(2.67)
Lscale				-0.112*	-0.109*	-0.105				-0.014	-0.018	-0.013
				(1.69)	(1.66)	(1.57)				(0.41)	(0.55)	(0.39)
Fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.10)	(0.49)					(0.50)	(1.14)
Constant	9.804***	4.600***	4.734***	5.364***	5.384***	5.368***	11.163***	7.447***	7.935***	8.028***	8.078***	8.050***
	(16.15)	(9.23)	(9.43)	(8.86)	(8.85)	(8.78)	(41.91)	(18.62)	(20.28)	(19.04)	(18.94)	(18.92)
Observations	1133	1113	1113	1113	1113	1109	1173	1171	1171	1171	1171	1167
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.33	0.56	0.57	0.57	0.57	0.57	0.70	0.76	0.78	0.78	0.78	0.78

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
L refers to natural logarithm of variable and ._1 refers to one year lag value of variable.
Fixed Effect Method (FEM) is used.

Table A.6: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capint2).

	(1) Lprod1	(2) Lprod1	(3) Lprod1	(4) Lprod1	(5) Lprod1	(6) Lprod1	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002**	0.002**	0.001*	0.001*		0.002**
	(0.54)	(0.96)	(0.77)	(1.10)		(1.19)	(2.11)	(2.22)	(1.85)	(1.88)		(2.14)
Lcapint2	0.066*	0.006	0.007	-0.004	-0.005	-0.004	0.001	-0.016	-0.008	-0.009	-0.010	-0.010
	(1.94)	(0.23)	(0.26)	(0.15)	(0.19)	(0.15)	(0.04)	(1.21)	(0.64)	(0.67)	(0.77)	(0.75)
Lprod1_1		0.492***	0.482***	0.479***	0.477***	0.479***						
		(21.70)	(21.31)	(21.18)	(21.09)	(21.12)						
Hi			1.561***	1.614***	1.609***	1.581***			1.612***	1.618***	1.665***	1.648***
			(4.66)	(4.81)	(4.65)	(4.55)			(9.08)	(9.06)	(9.06)	(8.97)
Lprod2_1								0.383***	0.360***	0.356***	0.358***	0.360***
								(16.19)	(15.77)	(15.64)	(15.56)	(15.68)
qual2			0.416	0.299	0.374	0.291			1.098***	1.036***	1.071***	1.011***
			(0.63)	(0.45)	(0.56)	(0.44)			(3.22)	(3.04)	(3.14)	(2.97)
mpen1			-0.055	-0.342*	-0.351*	-0.336*			-0.215**	-	-	-
										0.361***	0.388***	0.379***
			(0.35)	(1.80)	(1.84)	(1.76)			(2.53)	(3.57)	(3.80)	(3.73)
Xint				0.356**	0.368**	0.355**				0.202***	0.221***	0.206***
				(2.41)	(2.50)	(2.40)				(2.59)	(2.82)	(2.64)
Lscale				-0.136**	-0.135**	-0.130*				-0.020	-0.026	-0.020
				(1.99)	(1.98)	(1.87)				(0.57)	(0.75)	(0.58)
Fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.15)	(0.54)					(0.51)	(1.14)
Constant	13.581***	5.998***	5.956***	6.650***	6.677***	7.193***	13.553***	8.481***	8.636***	8.758***	8.783***	8.725***
	(119.50)	(18.97)	(18.90)	(14.84)	(14.83)	(16.11)	(273.89)	(26.07)	(27.50)	(24.98)	(24.68)	(24.56)
Observations	1132	1113	1113	1113	1113	1109	1172	1171	1171	1171	1171	1167
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.32	0.55	0.56	0.56	0.56	0.56	0.69	0.75	0.77	0.78	0.78	0.78

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table A.7: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capint3).

	(1) Lprod1	(2) Lprod1	(3) Lprod1	(4) Lprod1	(5) Lprod1	(6) Lprod1	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002***	0.002***	0.001**	0.002***		0.002***
	(0.49)	(0.91)	(0.71)	(1.15)		(1.24)	(2.19)	(2.32)	(1.92)	(2.08)		(2.34)
Lcapint3	0.061	0.033	0.032	0.027	0.035	0.027	0.018	0.029	0.028	0.025	0.032	0.025
	(1.14)	(0.83)	(0.82)	(0.68)	(0.89)	(0.69)	(0.77)	(1.38)	(1.38)	(1.22)	(1.57)	(1.21)
Lprod1_1		0.495***	0.485***	0.481***	0.479***	0.481***						
		(21.99)	(21.62)	(21.43)	(21.33)	(21.36)						
Hi			1.613***	1.683***	1.654***	1.627***			1.669***	1.694***	1.713***	1.695***
			(4.82)	(5.02)	(4.80)	(4.70)			(9.57)	(9.62)	(9.46)	(9.36)
Lprod2_1								0.381***	0.358***	0.356***	0.357***	0.359***
								(16.33)	(15.96)	(15.84)	(15.70)	(15.82)
qual2			0.319	0.238	0.308	0.240			1.081***	1.052***	1.085***	1.039***
			(0.48)	(0.36)	(0.47)	(0.36)			(3.22)	(3.12)	(3.21)	(3.08)
mpen1			-0.063	-0.318*	-0.317	-0.304			-	-	-	-
									0.232***	0.326***	0.346***	0.337***
			(0.39)	(1.66)	(1.64)	(1.57)			(2.76)	(3.24)	(3.39)	(3.32)
Xint				0.277*	0.287*	0.274*				0.111	0.130	0.115
				(1.85)	(1.91)	(1.81)				(1.42)	(1.64)	(1.46)
Lscale				-0.166***	-0.160***	-0.159***				-0.042	-0.042	-0.039
				(2.46)	(2.40)	(2.32)				(1.23)	(1.24)	(1.13)
Fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.15)	(0.54)					(0.55)	(1.21)
Constant	12.549***	6.726***	6.723***	7.547***	7.522***	6.635***	12.508***	8.314***	8.500***	8.730***	8.702***	8.687***
	(62.76)	(18.36)	(18.16)	(15.37)	(15.23)	(14.06)	(141.80)	(24.53)	(26.03)	(23.79)	(23.33)	(23.36)
Observations	1129	1110	1110	1110	1110	1106	1169	1167	1167	1167	1167	1163
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.32	0.55	0.56	0.56	0.56	0.56	0.70	0.76	0.78	0.78	0.78	0.78

Absolute value of t statistics in parentheses

*significant at 10%; **significant at 5%; ***significant at 1%

Time dummies are used.

Fixed Effect Method (FEM) is used.

Table A.8: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capint4).

	(1) Lprod1	(2) Lprod1	(3) Lprod1	(4) Lprod1	(5) Lprod1	(6) Lprod1	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002**	0.002**	0.001**	0.002**		0.002**
	(0.44)	(0.91)	(0.74)	(1.16)		(1.23)	(2.20)	(2.36)	(1.98)	(2.13)		(2.35)
Lcapint4	0.100*	0.074*	0.042	0.044	0.055	0.047	0.061**	0.064***	0.034	0.033	0.042*	0.034
	(1.75)	(1.74)	(0.98)	(1.03)	(1.30)	(1.08)	(2.41)	(2.83)	(1.57)	(1.52)	(1.92)	(1.52)
Lprod1_1		0.496***	0.486***	0.482***	0.480***	0.482***						
		(22.05)	(21.63)	(21.46)	(21.36)	(21.38)						
Hi			1.558***	1.624***	1.578***	1.561***			1.628***	1.652***	1.659***	1.651***
			(4.60)	(4.78)	(4.51)	(4.44)			(9.28)	(9.30)	(9.07)	(9.03)
Lprod2_1								0.381***	0.357***	0.355***	0.356***	0.358***
								(16.36)	(15.95)	(15.84)	(15.69)	(15.81)
qual2			0.289	0.190	0.251	0.189			1.058***	1.023***	1.050***	1.011***
			(0.43)	(0.28)	(0.38)	(0.28)			(3.14)	(3.03)	(3.10)	(2.99)
mpen1			-0.072	-0.337*	-0.340*	-0.322*			-	-	-	-
									0.239***	0.339***	0.361***	0.349***
			(0.46)	(1.76)	(1.76)	(1.67)			(2.85)	(3.37)	(3.55)	(3.44)
Xint				0.294*	0.306**	0.291*				0.121	0.141*	0.124
				(1.95)	(2.03)	(1.92)				(1.54)	(1.79)	(1.58)
Lscale				-0.165***	-0.158***	-0.157***				-0.040	-0.039	-0.037
				(2.44)	(2.36)	(2.29)				(1.17)	(1.15)	(1.07)
Fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.09)	(0.49)					(0.43)	(1.13)
Constant	12.172***	6.356***	6.581***	7.357***	7.290***	7.014***	12.214***	8.020***	8.406***	8.619***	8.567***	8.577***
	(35.43)	(14.56)	(14.99)	(13.41)	(13.22)	(13.39)	(80.45)	(22.49)	(24.40)	(22.31)	(21.90)	(22.01)
Observations	1129	1110	1110	1110	1110	1106	1169	1167	1167	1167	1167	1163
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.32	0.55	0.56	0.56	0.56	0.56	0.70	0.76	0.78	0.78	0.78	0.78

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table A.9: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capint5).

	(1) Lprod1	(2) Lprod1	(3) Lprod1	(4) Lprod1	(5) Lprod1	(6) Lprod1	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002**	0.002**	0.001**	0.002**		0.002**
	(0.40)	(0.94)	(0.76)	(1.17)		(1.23)	(2.26)	(2.43)	(2.02)	(2.15)		(2.36)
Lcapint5	0.123**	0.085*	0.056	0.052	0.063	0.055	0.063**	0.066***	0.040*	0.038	0.047**	0.038
	(2.02)	(1.88)	(1.24)	(1.13)	(1.39)	(1.19)	(2.35)	(2.76)	(1.75)	(1.61)	(1.99)	(1.63)
Lprod1_1		0.496***	0.486***	0.481***	0.480***	0.482***						
		(22.05)	(21.65)	(21.46)	(21.36)	(21.38)						
Hi			1.554***	1.625***	1.581***	1.561***			1.632***	1.654***	1.662***	1.652***
			(4.61)	(4.80)	(4.53)	(4.45)			(9.32)	(9.33)	(9.11)	(9.05)
Lprod2_1								0.381***	0.357***	0.355***	0.356***	0.358***
								(16.35)	(15.96)	(15.84)	(15.68)	(15.81)
qual2			0.271	0.184	0.248	0.183			1.055***	1.023***	1.052***	1.010***
			(0.41)	(0.28)	(0.37)	(0.27)			(3.13)	(3.03)	(3.11)	(2.99)
mpen1			-0.074	-0.336*	-0.339*	-0.321*			-	-	-	-
									0.240***	0.338***	0.360***	0.348***
			(0.47)	(1.76)	(1.75)	(1.66)			(2.86)	(3.36)	(3.54)	(3.43)
Xint				0.294*	0.305**	0.290*				0.120	0.140*	0.123
				(1.95)	(2.02)	(1.92)				(1.53)	(1.78)	(1.57)
Lscale				-0.159**	-0.151**	-0.152**				-0.036	-0.035	-0.033
				(2.35)	(2.25)	(2.20)				(1.05)	(1.01)	(0.95)
Fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.08)	(0.49)					(0.42)	(1.12)
Constant	12.055***	6.253***	6.464***	7.266***	7.188***	6.923***	12.362***	7.982***	8.351***	8.558***	8.500***	8.515***
	(30.68)	(13.60)	(14.02)	(12.51)	(12.31)	(12.51)	(71.45)	(21.88)	(23.73)	(21.44)	(21.05)	(21.17)
Observations	1129	1110	1110	1110	1110	1106	1169	1167	1167	1167	1167	1163
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.32	0.55	0.56	0.56	0.56	0.56	0.70	0.76	0.78	0.78	0.78	0.78

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table A.10: The Effects of Foreign Firms on the Productivity of Domestic Firms, 1983-2001, (Capint6).

	(1) Lprod1	(2) Lprod1	(3) Lprod1	(4) Lprod1	(5) Lprod1	(6) Lprod1	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
Fdishare	-0.001	0.001	0.001	0.002		0.002	0.002***	0.002***	0.001***	0.002***		0.002***
	(0.39)	(0.92)	(0.76)	(1.15)		(1.23)	(2.27)	(2.41)	(2.00)	(2.14)		(2.38)
Lcapint6	0.110*	0.081*	0.046	0.042	0.052	0.044	0.050*	0.058***	0.028	0.026	0.035	0.026
	(1.79)	(1.79)	(0.99)	(0.91)	(1.14)	(0.94)	(1.81)	(2.33)	(1.14)	(1.08)	(1.45)	(1.05)
Lprod1_1		0.493***	0.483***	0.480***	0.478***	0.480***						
		(21.66)	(21.24)	(21.11)	(21.01)	(21.03)						
Hi			1.539***	1.612***	1.566***	1.549***			1.617***	1.643***	1.651***	1.644***
			(4.48)	(4.67)	(4.41)	(4.33)			(9.09)	(9.12)	(8.90)	(8.86)
Lprod2_1								0.378***	0.357***	0.355***	0.357***	0.358***
								(16.02)	(15.70)	(15.62)	(15.48)	(15.60)
qual2			0.302	0.207	0.272	0.208			1.074***	1.037***	1.062***	1.025***
			(0.45)	(0.31)	(0.40)	(0.31)			(3.15)	(3.04)	(3.10)	(3.00)
mpen1			-0.043	-0.305	-0.309	-0.289			-	-	-	-
									0.236***	0.337***	0.365***	0.348***
			(0.26)	(1.51)	(1.52)	(1.42)			(2.71)	(3.19)	(3.42)	(3.28)
Xint				0.276*	0.287*	0.272*				0.116	0.137*	0.120
				(1.80)	(1.87)	(1.77)				(1.45)	(1.71)	(1.50)
Lscale				-0.158***	-0.150***	-0.150***				-0.041	-0.040	-0.038
				(2.30)	(2.21)	(2.16)				(1.17)	(1.15)	(1.08)
fdishare_1					-0.000	-0.001					-0.000	-0.001
					(0.12)	(0.52)					(0.47)	(1.18)
Constant	12.090***	6.342***	6.576***	7.355***	7.292***	7.314***	12.363***	7.481***	7.756***	7.970***	7.910***	8.625***
	(32.12)	(13.94)	(14.46)	(12.84)	(12.67)	(12.69)	(72.63)	(22.30)	(24.05)	(21.69)	(21.24)	(21.44)
Observations	1110	1091	1091	1091	1091	1087	1150	1148	1148	1148	1148	1144
Number of sector	65	65	65	65	65	65	65	65	65	65	65	65
R-squared	0.32	0.55	0.56	0.56	0.56	0.56	0.70	0.76	0.78	0.78	0.78	0.78

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table A.11: The Effects of Foreign Firms on the Productivity of Domestic Low-Tech and High-Tech Sectors, 1983-2001.

	LOW-TECH SECTORS						HIGH-TECH SECTORS					
	(1) Lprod2	(2) Lprod2	(3) Lprod2	(4) Lprod2	(5) Lprod2	(6) Lprod2	(7) Lprod2	(8) Lprod2	(9) Lprod2	(10) Lprod2	(11) Lprod2	(12) Lprod2
fdishare	0.002*	0.002*	0.001	0.001		0.002	0.002	0.002	0.001	0.002		0.002
	(1.79)	(1.70)	(1.11)	(1.14)		(1.42)	(1.21)	(1.50)	(1.28)	(1.38)		(1.54)
Lcapintl	0.239***	0.186***	0.143***	0.143***	0.134***	0.133***	0.038	0.020	-0.002	0.002	0.007	-0.003
	(6.90)	(5.81)	(4.46)	(4.44)	(4.13)	(4.09)	(0.66)	(0.37)	(0.04)	(0.04)	(0.15)	(0.06)
Lprod2_1		0.326***	0.325***	0.325***	0.329***	0.331***		0.406***	0.355***	0.327***	0.326***	0.328***
		(12.06)	(12.30)	(12.28)	(12.26)	(12.31)		(8.66)	(7.93)	(7.25)	(7.14)	(7.21)
hi			1.477***	1.461***	1.570***	1.540***			1.324***	1.424***	1.403***	1.398***
			(6.06)	(5.92)	(6.05)	(5.90)			(4.82)	(5.25)	(5.10)	(5.11)
qual2			0.897	0.862	0.888	0.825			1.151**	0.966**	1.021**	0.959**
			(1.60)	(1.53)	(1.59)	(1.47)			(2.53)	(2.15)	(2.25)	(2.13)
mpen1			-0.070	-0.144	-0.170	-0.165			-0.709***	-1.172***	-1.206***	-1.192***
			(0.76)	(1.29)	(1.51)	(1.46)			(3.71)	(5.22)	(5.33)	(5.28)
xint				0.112	0.111	0.113				0.491***	0.533***	0.506***
				(1.19)	(1.18)	(1.20)				(3.45)	(3.69)	(3.52)
Lscale				-0.008	-0.005	-0.013				-0.061	-0.067	-0.051
				(0.18)	(0.12)	(0.28)				(1.12)	(1.25)	(0.92)
fdishare_1					-0.001	-0.001					-0.001	-0.001
					(0.67)	(1.10)					(0.49)	(0.96)
Constant	10.489***	7.393***	7.674***	7.707***	7.734***	7.753***	13.437***	7.348***	8.169***	8.892***	8.921***	8.892***
	(34.46)	(16.41)	(17.16)	(15.30)	(15.22)	(15.22)	(24.32)	(10.13)	(11.90)	(12.48)	(12.34)	(12.36)
Observations	797	795	795	795	794	793	376	376	376	376	377	374
Number of sector	45	45	45	45	45	45	21	21	21	21	21	21
R-squared	0.70	0.75	0.76	0.76	0.76	0.76	0.75	0.80	0.83	0.83	0.83	0.83

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Fixed Effect Method (FEM) is used.

APPENDIX B – Results of Model 2 (Production Function Approach)

Table B.1: Variables and Definitions of Model 2.

Variable	Name	Calculation	Explanation
FP	Foreign Presence	Share of foreign firms at the market level	Proxy for potential FDI Spillovers
Vad_cons1	Constant price value added	output_cons-input_cons	Constant price value added is calculated with double deflation.
Vad_cons2	Constant price value added	vad_crt/poutput	Constant price value added is calculated with price output.
Output_cons	Constant price gross output	output_crt/poutput	Deflated
K1	Capital	electricity	Electricity is in kwh.
K2	Capital	Power_dec1	Power_dec is in HP.
K3	Capital		K_3 is deflated real price on depreciation.
K4	Capital		K_4 is calculated using Perpetual Inventory Method (PIM) $\delta = 0,10$
K5	Capital		K_5 is calculated using Perpetual Inventory Method (PIM). $\delta = 0,67$
K6	Capital		K_6 is calculated using Perpetual Inventory Method (PIM).
labour	Labour	employees	Total number of employees in the sector.
Labour_pr	Production labour	Emp_prod	Number of employees in production sphere.
Labour_adm	Non-Production labour	Emp_admin	Number of employees in administration sphere.
Linput	Material input	ln(input_cons)	Input is deflated with pinput.
mpen1	Import penetration	m_tl/(output_crt-x_tl+m_tl)	Share of imports in domestic demand.
mpen2	Import penetration	m_tl/(output_crt+m_tl)	Share of imports in domestic demand.
xint	Export Intensity	x_tl/output_crt	Export output ratio.
hi	Herfindahl Index	$H = \sum_{i=1}^{n} s_i^2$	S refers to market share of each firm in the sector and n refers to number of firms.
cr4	Concentration Ratio	$S_1+\ldots+S_4$	For four highest firms in terms of their market share s.

Table B.2: Descriptive Statics of Model 2.

Variable	Obs	Mean	Std. Dev.	Min	Max
input_cons	1173	1.61E+10	2.67E+10	3.85E+07	2.45E+11
Linput	1173	22.68917	1.375205	17.46541	26.22569
output_cons	1173	2.64E+10	4.04E+10	1.72E+08	3.69E+11
vad_cons1	1173	1.03E+10	1.48E+10	-3.37E+09	1.24E+11
vad_cons2	1173	9.77E+09	1.41E+10	5.54E+07	1.24E+11
Lvad_cons1	1133	22.2943	1.483029	15.71714	25.54079
Lvad_cons2	1173	22.25908	1.334158	17.82999	25.54364
Loutput_cons	1173	23.24528	1.33715	18.96146	26.63392
K1	1204	3.60E+08	9.81E+08	426858	9.51E+09
lnK1	1204	18.08359	1.877789	12.96421	22.97508
power_dec1	1194	142530	275843.8	112	2780288
K2	1194	142530	275843.8	112	2780288
lnK2	1194	10.84378	1.567992	4.718499	14.83807
K3	1200	1085534	2053316	1617	2.01E+07
lnK3	1200	12.89865	1.587402	7.388328	16.81623
K4	1200	1.10E+07	2.08E+07	13701	1.95E+08
lnK4	1200	15.23555	1.579896	9.525224	19.08851
K5	1200	1.53E+07	2.85E+07	22391	2.71E+08
lnK5	1200	15.56658	1.577222	10.01641	19.41763
K6	1181	1.22E+07	2.31E+07	14427	2.02E+08
lnK6	1181	15.31905	1.602839	9.576857	19.12378
labour_pr	1204	10064.03	16289.95	84	149305
lnlabour_pr	1204	8.594409	1.163026	4.430817	11.91375
labour_adm	1204	2900.981	3255.61	8	24577
lnlabour_adm	1204	7.432339	1.193566	2.079442	10.10957
labour	1204	13026.85	19289.16	127	174007
lnlabour	1204	8.900392	1.137883	4.844187	12.06685
FP	1196	10.53364	16.38315	0	76.68394
xint	1204	0.202614	0.201873	0	0.99781
mpen1	1204	0.267272	0.2586	0	0.995301
mpen2	1204	0.230883	0.232825	0	0.972965
HI	1204	0.101863	0.088864	0.0064	0.62154
CR4	1204	47.48989	20.61048	7.68	100

Source: TurkStat Database, ASMI.

Table B.3: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K1).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK1	0.326***	0.303***	0.299***	0.305***	0.303***	0.166***	0.124***	0.124***	0.126***	0.123***	0.054***	0.040**	0.040***	0.042***	0.039**
	(4.69)	(4.32)	(4.29)	(4.35)	(4.31)	(5.43)	(4.15)	(4.18)	(4.22)	(4.11)	(2.56)	(1.90)	(1.96)	(2.01)	(1.87)
Lnlabour	0.576***	0.646***	0.644***	0.618***	0.644***	0.882***	0.945***	0.943***	0.931***	0.948***	0.208***	0.269***	0.268***	0.255***	0.268***
	(5.90)	(6.50)	(6.53)	(6.34)	(6.48)	(20.23)	(21.96)	(22.04)	(21.87)	(22.00)	(5.85)	(7.48)	(7.58)	(7.24)	(7.56)
FP	-0.001	-0.001	-0.001		-0.002	0.002*	0.001	0.001		0.001	0.000	-0.000	-0.000		-0.000
	(0.38)	(0.59)	(0.58)		(0.99)	(1.90)	(1.47)	(1.44)		(1.03)	(0.01)	(0.32)	(0.40)		(0.34)
HI		1.540***	1.524***	1.451***	1.475***		1.727***	1.715***	1.669***	1.677***		0.963***	0.950***	0.921***	0.929***
		(3.32)	(3.32)	(3.15)	(3.18)		(8.68)	(8.67)	(8.39)	(8.42)		(6.94)	(6.98)	(6.74)	(6.79)
mpen1		0.109	-0.474**	-0.426	-0.430**		-0.174**	-	-	-		0.003	-0.259***	-0.244***	-0.241***
								0.386***	0.374***	0.366***					
		(0.49)	(1.85)	(1.64)	(1.65)		(1.80)	(3.45)	(3.28)	(3.23)		(0.04)	(3.38)	(3.14)	(3.10)
Xint			0.856***	0.826***	0.817***			0.312***	0.313***	0.297***			0.384***	0.378***	0.369***
			(4.41)	(4.19)	(4.13)			(3.69)	(3.64)	(3.45)			(6.68)	(6.48)	(6.31)
Linput											0.680***	0.655***	0.654***	0.655***	0.658***
											(29.87)	(28.70)	(29.23)	(29.13)	(29.30)
FP_1				0.002	0.003				0.001	0.001				-0.000	-0.000
				(1.04)	(1.31)				(1.37)	(0.97)				(0.28)	(0.15)
Constant	11.458***	11.065***	11.086***	11.301***	10.988***	10.726***	10.768***	10.776***	10.798***	10.701***	5.092***	5.309***	5.305***	5.359***	5.241***
	(11.66)	(10.74)	(10.85)	(11.05)	(10.59)	(26.81)	(26.66)	(26.84)	(26.72)	(26.25)	(12.96)	(13.02)	(13.27)	(13.41)	(13.04)
Observations	1133	1133	1133	1127	1123	1173	1173	1173	1167	1163	1173	1173	1173	1167	1163
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.41	0.42	0.43	0.43	0.43	0.79	0.81	0.81	0.80	0.81	0.89	0.89	0.90	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.4: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K2).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK2	0.052	0.050	0.049	0.044	0.045	0.011	0.012	0.013	0.009	0.010	0.003	0.004	0.004	-0.001	-0.000
	(1.58)	(1.53)	(1.51)	(1.22)	(1.24)	(0.74)	(0.88)	(0.93)	(0.57)	(0.63)	(0.32)	(0.37)	(0.45)	(0.11)	(0.05)
Lnlabour	0.858***	0.908***	0.902***	0.877***	0.900***	1.041***	1.062***	1.060***	1.046***	1.060***	0.247***	0.299***	0.298***	0.286***	0.297***
	(11.18)	(11.55)	(11.55)	(11.50)	(11.48)	(30.68)	(31.62)	(31.70)	(31.71)	(31.56)	(7.48)	(9.03)	(9.14)	(8.83)	(9.11)
FP	-0.001	-0.001	-0.001		-0.002	0.002*	0.001	0.001		0.001	-0.000	-0.000	-0.000		-0.000
	(0.35)	(0.62)	(0.63)		(0.91)	(1.86)	(1.38)	(1.34)		(1.01)	(0.04)	(0.38)	(0.48)		(0.36)
HI		1.788***	1.762***	1.703***	1.715***		1.839***	1.827***	1.788***	1.789***		1.002***	0.987***	0.959***	0.964***
		(3.81)	(3.79)	(3.68)	(3.67)		(9.18)	(9.16)	(8.94)	(8.93)		(7.19)	(7.21)	(7.01)	(7.03)
mpen1		0.023	-0.561***	-0.544***	-0.544***		-0.205***	-0.410***	-0.421***	-0.412***		0.013	-0.246***	-0.251***	-0.247***
		(0.10)	(2.14)	(2.07)	(2.07)		(2.09)	(3.58)	(3.66)	(3.59)		(0.19)	(3.15)	(3.21)	(3.16)
Xint			0.843***	0.841***	0.831***			0.296***	0.315***	0.299***			0.372***	0.379***	0.369***
			(4.23)	(4.22)	(4.15)			(3.41)	(3.62)	(3.44)			(6.36)	(6.46)	(6.29)
Linput											0.693***	0.664***	0.663***	0.663***	0.666***
											(30.97)	(29.43)	(29.92)	(29.86)	(30.01)
FP_1				0.001	0.002				0.001	0.001				-0.000	-0.000
				(0.69)	(0.95)				(1.11)	(0.74)				(0.40)	(0.25)
Constant	13.650***	13.019***	13.061***	13.310***	13.108***	12.069***	11.719***	11.739***	12.276***	11.773***	5.431***	5.147***	5.185***	5.682***	5.554***
	(19.17)	(17.34)	(17.54)	(17.93)	(17.27)	(38.60)	(36.96)	(37.20)	(38.22)	(36.45)	(14.54)	(14.28)	(14.65)	(14.99)	(14.63)
Observations	1123	1123	1123	1123	1119	1163	1163	1163	1163	1159	1163	1163	1163	1163	1159
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.40	0.41	0.42	0.42	0.42	0.78	0.80	0.80	0.80	0.80	0.89	0.89	0.89	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.5: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K3).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK3	0.040	0.050	0.047	0.044	0.043	0.019	0.027	0.026	0.031	0.025	-0.033**	-0.021	-0.023	-0.022	-0.025
	(0.74)	(0.91)	(0.87)	(0.80)	(0.79)	(0.77)	(1.15)	(1.10)	(1.31)	(1.04)	(1.94)	(1.26)	(1.43)	(1.33)	(1.50)
lnlabour	0.813***	0.851***	0.862***	0.842***	0.865***	0.984***	0.991***	0.995***	0.981***	0.998***	0.265***	0.310***	0.309***	0.297***	0.308***
	(9.47)	(9.78)	(9.97)	(9.87)	(9.88)	(26.19)	(27.03)	(27.19)	(26.96)	(26.97)	(7.97)	(9.34)	(9.49)	(9.09)	(9.41)
FP	-0.000	-0.001	-0.001		-0.002	0.002***	0.001	0.001		0.001	0.000	-0.000	-0.000		-0.000
	(0.11)	(0.40)	(0.44)		(0.80)	(2.14)	(1.64)	(1.59)		(1.20)	(0.34)	(0.05)	(0.18)		(0.14)
HI		1.725***	1.706***	1.651***	1.659***		1.849***	1.838***	1.807***	1.801***		0.978***	0.953***	0.928***	0.927***
		(3.73)	(3.71)	(3.59)	(3.58)		(9.41)	(9.38)	(9.17)	(9.12)		(7.02)	(6.97)	(6.75)	(6.74)
mpen1		-0.025	-0.570***	-0.532***	-0.531***		-0.279***	-0.438***	-0.426***	-0.419***		-0.038	-0.291***	-0.278***	-0.273***
		(0.11)	(2.19)	(2.01)	(2.00)		(2.86)	(3.88)	(3.71)	(3.66)		(0.55)	(3.75)	(3.51)	(3.46)
xint			0.813***	0.783***	0.777***			0.238***	0.237***	0.222***			0.383***	0.377***	0.369***
			(4.09)	(3.86)	(3.82)			(2.77)	(2.71)	(2.54)			(6.51)	(6.31)	(6.17)
Linput											0.690***	0.653***	0.660***	0.661***	0.664***
											(29.64)	(27.62)	(28.41)	(28.30)	(28.49)
FP_1				0.002	0.002				0.001	0.001				-0.000	-0.000
				(0.93)	(1.14)				(1.33)	(0.91)				(0.20)	(0.12)
Constant	13.917***	14.237***	13.217***	14.293***	14.106***	12.480***	12.183***	12.168***	13.340***	13.265***	5.415***	5.594***	5.488***	5.940***	5.790***
	(18.39)	(16.44)	(16.41)	(16.72)	(16.18)	(37.24)	(35.22)	(35.28)	(36.08)	(35.43)	(14.72)	(14.64)	(14.62)	(14.75)	(14.27)
Observations	1129	1129	1129	1123	1119	1169	1169	1169	1163	1159	1169	1169	1169	1163	1159
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.39	0.40	0.41	0.40	0.41	0.78	0.80	0.80	0.79	0.80	0.88	0.88	0.89	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.6: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K4).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK4	0.073	0.053	0.075	0.083	0.083	0.065***	0.042**	0.047**	0.059***	0.051***	-0.018	-0.025	-0.017	-0.010	-0.014
	(1.23)	(0.89)	(1.27)	(1.41)	(1.40)	(2.49)	(1.65)	(1.85)	(2.33)	(2.01)	(1.00)	(1.38)	(0.99)	(0.56)	(0.82)
lnlabour	0.796***	0.851***	0.846***	0.820***	0.842***	0.956***	0.983***	0.982***	0.965***	0.982***	0.258***	0.312***	0.307***	0.292***	0.305***
	(9.35)	(9.72)	(9.74)	(9.60)	(9.57)	(25.62)	(26.65)	(26.73)	(26.49)	(26.41)	(7.75)	(9.35)	(9.37)	(8.91)	(9.24)
FP	-0.000	-0.001	-0.001		-0.002	0.002***	0.001*	0.001		0.001	0.000	-0.000	-0.000		-0.000
	(0.12)	(0.36)	(0.43)		(0.81)	(2.06)	(1.66)	(1.59)		(1.17)	(0.21)	(0.09)	(0.27)		(0.21)
HI		1.664***	1.630***	1.574***	1.579***		1.807***	1.794***	1.754***	1.755***		1.006***	0.981***	0.952***	0.957***
		(3.59)	(3.54)	(3.42)	(3.40)		(9.21)	(9.17)	(8.93)	(8.91)		(7.26)	(7.21)	(6.97)	(6.99)
mpen1		-0.038	-0.593***	-0.551***	-0.550***		-0.281***	-0.447***	-0.435***	-0.426***		-0.034	-0.282***	-0.269***	-0.263***
		(0.17)	(2.29)	(2.10)	(2.09)		(2.90)	(3.99)	(3.81)	(3.74)		(0.50)	(3.64)	(3.41)	(3.35)
xint			0.838***	0.807***	0.803***			0.250***	0.251***	0.235***			0.377***	0.373***	0.363***
			(4.20)	(3.98)	(3.94)			(2.91)	(2.87)	(2.69)			(6.40)	(6.23)	(6.07)
Linput											0.687***	0.653***	0.658***	0.657***	0.661***
											(29.43)	(27.70)	(28.39)	(28.25)	(28.43)
FP_1				0.002	0.002				0.001	0.001				-0.000	-0.000
				(0.97)	(1.18)				(1.41)	(0.98)				(0.30)	(0.20)
Constant	13.490***	13.137***	12.843***	12.913***	13.596***	11.994***	11.979***	11.908***	12.970***	11.825***	5.427***	5.682***	5.519***	5.914***	5.784***
	(15.49)	(14.52)	(14.26)	(14.35)	(14.00)	(31.22)	(31.02)	(30.88)	(31.39)	(30.29)	(14.20)	(14.37)	(14.18)	(14.13)	(13.75)
Observations	1129	1129	1129	1123	1119	1169	1169	1169	1163	1159	1169	1169	1169	1163	1159
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.39	0.40	0.41	0.41	0.41	0.78	0.80	0.80	0.80	0.80	0.88	0.88	0.89	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.7: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K5).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK5	0.092	0.077	0.099	0.110*	0.110*	0.069***	0.051**	0.055***	0.069***	0.061***	-0.019	-0.021	-0.015	-0.006	-0.011
	(1.44)	(1.20)	(1.56)	(1.73)	(1.72)	(2.45)	(1.86)	(2.04)	(2.54)	(2.24)	(0.97)	(1.11)	(0.78)	(0.32)	(0.57)
lnlabour	0.787***	0.839***	0.834***	0.808***	0.829***	0.956***	0.979***	0.979***	0.962***	0.979***	0.257***	0.309***	0.305***	0.290***	0.303***
	(9.20)	(9.56)	(9.59)	(9.46)	(9.42)	(25.49)	(26.50)	(26.59)	(26.39)	(26.29)	(7.75)	(9.30)	(9.34)	(8.88)	(9.20)
FP	-0.000	-0.001	-0.001		-0.002	0.002***	0.001*	0.001		0.001	0.000	-0.000	-0.000		-0.000
	(0.11)	(0.36)	(0.43)		(0.81)	(2.10)	(1.68)	(1.61)		(1.18)	(0.19)	(0.13)	(0.29)		(0.23)
HI		1.668***	1.639***	1.585***	1.588***		1.815***	1.803***	1.766***	1.763***		0.999***	0.976***	0.950***	0.953***
		(3.60)	(3.57)	(3.45)	(3.43)		(9.27)	(9.23)	(9.01)	(8.97)		(7.21)	(7.17)	(6.95)	(6.97)
mpen1		-0.032	-0.589***	-0.547***	-0.546***		-0.278***	-0.444***	-0.431***	-0.422***		-0.034	-0.282***	-0.269***	-0.263***
		(0.14)	(2.28)	(2.08)	(2.08)		(2.87)	(3.96)	(3.78)	(3.71)		(0.49)	(3.64)	(3.41)	(3.35)
xint			0.841***	0.810***	0.806***			0.250***	0.250***	0.234***			0.378***	0.374***	0.364***
			(4.22)	(3.99)	(3.96)			(2.91)	(2.86)	(2.68)			(6.42)	(6.24)	(6.09)
Linput											0.687***	0.653***	0.658***	0.657***	0.661***
											(29.33)	(27.57)	(28.26)	(28.10)	(28.28)
FP_1				0.002	0.002				0.001	0.001				-0.000	-0.000
				(0.98)	(1.19)				(1.44)	(1.00)				(0.30)	(0.20)
Constant	13.253***	12.857***	12.544***	12.570***	13.233***	11.911***	11.859***	11.788***	11.712***	11.682***	5.443***	5.671***	5.509***	5.887***	5.763***
	(14.28)	(13.35)	(13.09)	(13.08)	(12.79)	(29.12)	(28.89)	(28.76)	(28.43)	(28.14)	(13.99)	(14.11)	(13.93)	(13.84)	(13.49)
Observations	1129	1129	1129	1123	1119	1169	1169	1169	1163	1159	1169	1169	1169	1163	1159
Number of sector	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66
R-squared	0.39	0.40	0.41	0.41	0.41	0.78	0.80	0.80	0.80	0.80	0.88	0.88	0.89	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.8: The Spillover Effects of Foreign Firms on the Domestic Production, 1983-2001, (K6).

	(1) Lvad_cons1	(2) Lvad_cons1	(3) Lvad_cons1	(4) Lvad_cons1	(5) Lvad_cons1	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2	(11) Loutput_cons	(12) Loutput_cons	(13) Loutput_cons	(14) Loutput_cons	(15) Loutput_cons
lnK6	0.071	0.049	0.072	0.079	0.081	0.056**	0.033	0.039	0.052**	0.043	-0.020	-0.030	-0.021	-0.013	-0.017
	(1.07)	(0.75)	(1.09)	(1.20)	(1.22)	(1.89)	(1.17)	(1.37)	(1.80)	(1.50)	(0.98)	(1.49)	(1.07)	(0.64)	(0.88)
lnlabour	0.800***	0.862***	0.858***	0.833***	0.854***	0.964***	0.991***	0.990***	0.974***	0.990***	0.252***	0.309***	0.304***	0.291***	0.303***
	(9.46)	(9.85)	(9.86)	(9.74)	(9.70)	(25.89)	(26.65)	(26.69)	(26.46)	(26.41)	(7.60)	(9.23)	(9.24)	(8.81)	(9.13)
FP	-0.000	-0.001	-0.001		-0.002	0.002***	0.001*	0.001*		0.001	0.000	0.000	-0.000		-0.000
	(0.08)	(0.30)	(0.37)		(0.75)	(2.13)	(1.73)	(1.66)		(1.25)	(0.26)	(0.00)	(0.17)		(0.11)
HI		1.637***	1.612***	1.560***	1.562***		1.783***	1.772***	1.733***	1.734***		0.983***	0.963***	0.938***	0.943***
		(3.49)	(3.46)	(3.35)	(3.33)		(8.99)	(8.96)	(8.73)	(8.71)		(7.09)	(7.05)	(6.84)	(6.86)
mpen1		0.083	-0.469**	-0.441	-0.441		-0.251***	-0.414***	-0.415***	-0.403***		0.057	-0.184***	-0.189***	-0.182***
		(0.36)	(1.74)	(1.62)	(1.62)		(2.51)	(3.55)	(3.52)	(3.42)		(0.81)	(2.30)	(2.33)	(2.25)
xint			0.796***	0.767***	0.763***			0.235***	0.238***	0.221***			0.350***	0.349***	0.339***
			(3.93)	(3.73)	(3.69)			(2.69)	(2.68)	(2.50)			(5.90)	(5.79)	(5.63)
Linput											0.689***	0.662***	0.665***	0.663***	0.667***
											(29.88)	(28.27)	(28.85)	(28.61)	(28.79)
FP_1				0.002	0.002				0.001	0.001				-0.000	-0.000
				(0.98)	(1.17)				(1.40)	(0.95)				(0.27)	(0.20)
Constant	14.396***	13.991***	13.598***	13.682***	13.491***	12.050***	12.016***	11.939***	13.005***	11.865***	5.444***	5.570***	5.416***	5.818***	5.343***
	(14.16)	(13.38)	(13.04)	(13.15)	(12.80)	(28.42)	(28.67)	(28.50)	(29.00)	(28.01)	(13.61)	(13.56)	(13.37)	(13.34)	(13.11)
Observations	1110	1110	1110	1105	1101	1150	1150	1150	1145	1141	1150	1150	1150	1145	1141
Number of sector	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
R-squared	0.40	0.40	0.41	0.41	0.41	0.78	0.80	0.80	0.80	0.80	0.88	0.89	0.89	0.89	0.89

Absolute value of t statistics in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%
Time dummies are used.
Fixed Effect Method (FEM) is used.

Table B.9: The Spillover Effects of Foreign Firms on the Production of Domestic Low-Tech and High-Tech Sectors, 1983-2001.

	LOW-TECH SECTORS					HIGH-TECH SECTORS				
	(1) Lvad_cons2	(2) Lvad_cons2	(3) Lvad_cons2	(4) Lvad_cons2	(5) Lvad_cons2	(6) Lvad_cons2	(7) Lvad_cons2	(8) Lvad_cons2	(9) Lvad_cons2	(10) Lvad_cons2
lnK1	0.247***	0.212***	0.212***	0.209***	0.208***	0.034	0.011	0.005	0.018	0.004
	(7.09)	(6.06)	(6.06)	(5.99)	(5.93)	(0.60)	(0.21)	(0.10)	(0.34)	(0.08)
lnlabour	0.829***	0.888***	0.885***	0.892***	0.891***	1.003***	0.970***	0.998***	0.966***	1.018***
	(17.34)	(18.46)	(18.38)	(18.57)	(18.45)	(11.42)	(11.02)	(11.74)	(11.58)	(11.85)
FP	0.002	0.001	0.001		0.001	0.001	0.001	0.001		0.001
	(1.56)	(1.01)	(1.03)		(0.61)	(1.04)	(1.11)	(0.91)		(0.70)
HI		1.490***	1.464***	1.450***	1.426***		1.559***	1.674***	1.587***	1.609***
		(5.56)	(5.45)	(5.43)	(5.29)		(5.19)	(5.77)	(5.38)	(5.48)
mpenl		-0.042	-0.128	-0.100	-0.099		-0.833***	-1.407***	-1.516***	-1.480***
		(0.41)	(1.05)	(0.81)	(0.80)		(3.68)	(5.77)	(6.08)	(5.97)
xint			0.132	0.103	0.104			0.772***	0.873***	0.850***
			(1.32)	(1.01)	(1.02)			(5.21)	(5.70)	(5.57)
FP_1				0.001	0.001				0.000	0.000
				(1.25)	(0.97)				(0.37)	(0.02)
Constant	9.741***	9.704***	9.724***	10.542***	10.577***	11.990***	12.766***	12.759***	14.061***	12.457***
	(20.06)	(19.76)	(19.80)	(19.96)	(19.91)	(18.30)	(18.92)	(19.62)	(19.67)	(18.80)
Observations	798	798	798	794	793	382	382	382	379	376
Number of sector	45	45	45	45	45	21	21	21	21	21
R-squared	0.80	0.80	0.80	0.80	0.80	0.82	0.84	0.86	0.85	0.85

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%