



## Technology Spillover from Foreign Direct Investment in Turkey

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### Abstract

**Purpose** – The aim of this paper is to investigate the relationship between Foreign Direct Investment flows and economic growth using quarterly data for the period of 2002 and 2015 in Turkey. Thus we try to examine whether technological diffusion generated by FDI inflows to Turkey enhances the innovative capability of the country or not.

**Design/methodology/approach** – The variables Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) are sourced from Electronic Data Delivery System (EDDS) in Central Bank of the Republic of Turkey. FDI series consist of values called “Net Incurrence of Liabilities” in Balance of Payments Analytical Presentation while GDP series gather from the expenditure based GDP data in EDDS. Both Johansen Cointegration Test and Granger Causality Test are applied to examine between Foreign Direct Investment flows and economic growth in Turkey.

**Findings** – Results reveal that there is not any significant link among the FDI and economic growth during the studied time period in Turkey. It seems that FDI inflows to Turkey is not complementary to economic growth, which shows that positive spillover effect sourced from FDI inflows to Turkey does not exist.

**Research limitations/implications** – Policymakers should recognize that technology spillover effects of FDI do not occur without greater absorptive capacity. Attracting FDI is only one part of the story and thus not yield the desired benefits itself. Positive effects of FDI depends on the overall incentive and capacity structure of the host country. Then the key policy implication here is that policymakers should give same weight of policies aimed at attracting FDI versus those that seek to improve local economic conditions.

**Originality/value** – This study insight the spillover effects of FDI based on Turkish experience that benefits from FDI do not occur automatically and effortlessly in developing countries.

**Keywords:** Technology Spillover, Foreign Direct Investment, Turkey.

**JEL Classification:** F21, F43, O33

### 1. Introduction

Given the growing competition in international markets characterised by rapid technical change, companies are obliged to innovate. Accordingly, it has been widely accepted that international differences in technological capabilities fundamentally determine the economic growth differences among countries. Indeed, innovation based competitiveness dominates all of the dynamics of international economic relations today. This structure of international economy creates big struggle for developing countries suffering from deficiency of innovative capability. Indeed, scholars from a variety of economics disciplines have mostly indicated the lack of the capabilities needed to generate new technologies in developing countries. Thus, in the global economy the economic performance gaps between developing and developed countries expand permanently.

However, liberalisation process of goods and financial markets create a new external source to build innovative capabilities for developing countries. With the rapid expansion of liberalization policies in the global economy, the movements of Foreign Direct Investment (FDI) among countries have hugely increased. Foreign investments made by multinationals firms in developing countries does not bring only capital but also intangible assets like technological know-how, management and marketing

skills, which enable home country to compete successfully. Thus, FDI inflows to developing countries build a capability building for knowledge utilization and creation process that makes them much more productive. Economists have been considered FDI as an important external knowledge source to generate technical change for developing countries traditionally lacking the capabilities needed to generate new technologies. Economists have also pointed out the importance of FDI movements to narrow the technological and economic performance gaps between developed and developing countries.

Developing countries have been experienced high amount of FDI inflow during the liberalisation of their goods and financial markets. Empirical studies showed that some developing countries benefit the FDI inflow as an international sources of knowledge to generate technical change. Thus, FDI have been considered as a significant factor enhancing innovative capability building to gain competitiveness in a number of developing countries. In other words, FDI saves developing countries from relying on limited domestic sources of knowledge to generate technical change. Accordingly, the effect of FDI on the technological and economic performance in developing countries has been of great interest to policy-makers. In the framework of an active public policy

programme, developing countries start to attract FDI for their economies as much as possible.

Looking at the FDI inflows data over the last decades from Electronic Data Delivery System (EDDS) in Central Bank of the Republic of Turkey, it seems that Turkey has also increased its attraction for multinationals firms. The post-2000 period in Turkey witnessed a steady increase in FDI inflows. The average level of FDI inflows between 2000 and 2009 was USD millions 9060,2 while this value between 1990 and 1999 was USD millions 771,7. That means FDI flows to Turkey increase more than ten times in 2000s compared to the level in 1990s. This increasing trend has also continued and the average level of FDI inflows Turkey between 2010 and 2015 has been USD millions 13381,7. Thus, Turkish experience offers a superb sample to be examined the role of the FDI in technological improvement and economic growth processes. Accordingly, the aim of our study is to examine whether technological diffusion generated by FDI inflows to Turkey enhances the innovative capability of country or not.

The rest of the paper is organized as follows. Section 2 reviews literature that focuses on the relationship between technological spillovers from FDI inflows and economic growth in developing countries. Section 3 describes the used data and the model specification and presents empirical results. Final Section concludes and makes some policy implications.

## 2. Literature Review

In this section, main streams of literature on the relationship between FDI inflows and technological capability building are presented. There is a huge literature focusing on the relationship between technological capability building and FDI inflows, through spillovers effect of foreign firms. Economists have long recognized the potential for positive externalities from inward FDI in host economies. FDI inflows enhances the opportunity for local firms to benefit from knowledge transfer generated by better-endowed multinationals firms. Thus technological progress in host country is facilitated through inward FDI. That means the effect of FDI inflows to a host economy is beyond that of a simple import of capital into the country. Indeed, FDI is not merely defined as a source of physical capital but also knowledge-capital. Consequently, FDI inflows enable not only the increase of capital stock in the host economy but also increase technological improvements via "technology spill over effect".

In terms of technology spillover effect of FDI, multinational enterprises entry to local markets may generate productivity improvements for domestic firms. Local firms learn technological knowledge embodied in foreign firm operation to compete successfully in the domestic and international markets. This learning process may occur in host countries either directly or indirectly. Direct knowledge transfer from inward FDI can occur through the formal collaboration between a local firm and its foreign entrants. Indirect knowledge transfer can occur through informal knowledge spillover by observing and imitating foreign entrants. Local firms in host country observe and imitate the production models of multinational enterprises coming from FDI inflows. In

both cases by deepening linkages with multinational cooperation, local firms may get the technologies or organizational forms used by foreign better-endowed firms. Thus, the presence of multinational firms and their interaction with local firms in the host country can create virtuous cycles of technological capability building in the host country (Padilla-Perez and Matinez-Piva, 2009, 303).

Accordingly, studies regarding developing countries have found sound evidence for a positive link between FDI inflows and productivity in host countries' industries. Blalock and Gertler (2008) tested the hypothesis that multinational firms operating in emerging markets transfer technology to local suppliers to increase their productivity by using a panel dataset of Indonesian manufacturing establishments. Their findings indicated that foreign entrants transferred technology to upstream suppliers resulting in improvements in productivity for local firms. Using firm-level panel data from the Indian manufacturing sector from 2000-2008, Malik (2015) also examined the productivity effect of technology spillover via linkages through FDI in India. He found that technology spillover from FDI exists and its degree depends on technological ability of domestic firm. Consequently, firms in high-technology industries benefit more from technology spillover from foreign firms compared to firms in low-technology industries. Liu and Wang (2003) examined the impact of FDI on total factor productivity for a cross sectional sample of Chinese industrial sectors in 1995. Empirical findings indicated that foreign presence and the firm size are the most important factor enhancing total factor productivity in Chinese industries. Baltabaev (2014) also made a multinational study to examine the impact of FDI on total factor productivity growth in 49 countries for the period from 1974 to 2008. He found that FDI is an important factor of technological transfer. Thus this study indicated that technologically backward countries adopt new technologies via FDI inflows to make their countries more productive.

Empirical studies focusing on investigating spillover or technology transfer from FDI inflows to host countries also tested whether there is a positive association between FDI presence and labour productivity in the economy. Thus these studies used the variable of labour productivity as a dependent variable while FDI share in an industry was used as an explanatory variable. Liu et al (2001) analysed the effects of inward FDI on labour productivity in the Chinese electronics industry data for the period 1996-1997. The empirical findings suggested that foreign presence in the industry is associated with higher labour productivity. Thus, they confirmed that encouraging inward FDI into the electronics sector in China may be expected to have a beneficial effect on labour productivity. Ramirez (2006) analysed the impact of FDI on labour productivity between 1960 and 2000 in Chile by using cointegration analysis. Empirical results showed that FDI flows had a positive and significant effect on labour productivity growth during the 1960-2000 period and the effect was stronger during the 1996-2000 period. Buckley et al. (2007) specifically focused on the impact of FDI inflows on labour productivity in China's automotive industry using a panel data set over the period from 1995 to 1999. They found that inward FDI

plays a positive role in raising labour productivity, which supports the theory of positive FDI spillover effects.

Although the studies reviewed in this section until now examine the impact of inward FDI on the total factor productivity and labour productivity of local firms, there is also a good reason to believe that similar effects are likely to hold for innovation capability of the firms in host country. Thus, some researchers suggested that innovation might represent a fruitful alternative to the standard measures of FDI spillover effect instead of productivity. In fact, work in the innovation literature has long documented the role of competition in increasing incentives for firms to innovate. Cheung and Lin (2004) examined the impacts of FDI on the number of domestic patent applications in China using provincial data from 1995 to 2000. They found evidence of positive spill over effects of FDI on the number of domestic patent applications. In addition, exports by the FDI firms in China to international markets appear to have marginally significant and positive effects on domestic patent applications. Behera et al. (2012) empirically examined the technology spill overs of FDI across Indian manufacturing industries. The empirical evidence on Pedroni cointegration tests based on panel data from 1990 to 2007 across 16 Indian manufacturing industries showed the long-run relationship between foreign presence and innovation capability of domestic firms. Sivalogathan and Wu (2014) used a panel data approach to determine the spillover effect of FDI on domestic innovation capability for a group of emerging South Asian markets from 2000 to 2010. Empirical evidence showed that FDI inflows generated spillover effects on domestic innovation capability in South Asian countries. Thus, their results supported the hypothesis that inward FDI brings knowledge spillover into the host country and promotes domestic firms' innovation capability.

As can be seen from the findings indicated above, firms investing in foreign countries bring advanced technology to firms in host countries in different channels. Thus, it can be expected to have a positive effect of FDI on economic growth since FDI having a spill over effect of technology improves host countries' productivity and innovation capability. Therefore, understanding the impact of inward FDI on host country via technology spillovers aids also our understanding of how inward FDI can act as a catalyst for economic growth. Accordingly, in the framework of the endogenous growth model economists consider FDI as an important source of spillover of new ideas and technology change across countries. Amwar and Sun (2011) developed a simultaneous equations model to empirically examine the relationship between foreign direct investment and economic growth based on data for the period 1970-2007 in Malaysia. Findings of the study revealed that an increase in the stock of foreign investment in Malaysia has contributed to an increase in the stock of domestic capital and economic growth. Mehic et.al. (2013) investigated the impact of FDI on economic growth in the seven transition countries of southeast Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Romania and Serbia) for the period 1998-2007. The main results showed that positive and statistically significant effect of FDI on economic growth. Thus, they concluded

that FDI seems to be an important catalysis for output growth in southeast European countries. Concerning with the nexus between FDI attraction and economic growth, lastly some economics found the bidirectional relationship between them. Omri and Sassi-Tmar (2015) examined the relationship between FDI inflows and economic growth in three African economies (Tunisia, Morocco and Egypt) during 1985-2011. Their analysis based on a simultaneous equations model revealed that high level of foreign direct investment inflows accelerated economic growth in all three economies. In addition, they also indicated a mutually promoting two-way linkage between FDI and economic growth in these economies. Similarly, Baklouti and Boujelbene (2016) investigated the relationship between FDI and economic growth on the economies of the MENA region. They used panel data models with simultaneous equations by Generalized Method of Moments on the period 1998-2011. Their results showed that there is bidirectional causality between economic growth and FDI, Thus they concluded that economic growth and FDI attractiveness are complementary.

Besides the studies indicating the causal relationship from FDI inflows to productivity, innovation and economic growth, some other studies also showed that the spillover from FDI do not arise automatically in all case. For example, Chen (2007) analyse quantitatively the relationship between FDI and regional innovation capability for each province in China. He tests whether more inward FDI in a province will lead to a higher level of innovation capability. The results of his study showed that the more FDI will not necessarily bring the higher innovation. Similarly, Garcia et al. (2013), investigated the relationships between industry-level and firm-level inward FDI and the innovative performance of host country firms. By utilizing data from 1799 Spanish manufacturing firms from 1990 to 2002, they investigated the relationship between inward FDI and the innovative performance of Spanish manufacturing firms. Their results did not confirm the positive spillover effect of FDI inflows for Spanish local firms. Herzer (2015) examined the long-run effect of the level of FDI on the level of total factor productivity (TFP) for 70 developing countries for the period 1981-2011 using panel cointegration techniques. The results showed that FDI does not affect TFP in the short run while FDI has, on average, a robust negative long-run effect on TFP in developing countries.

Concerning with the studies focusing on relationship between FDI and economic growth in Turkey, researchers have also found the mixed results. Alagoz et al. (2008) examined the relationship between FDI and economic growth in Turkey's for the period 1992-2007 by using Granger Causality Test and Regression Analysis. The results of Granger Causality Test did not showed a causality between FDI and economic growth while regression analysis indicated the impact of FDI on economic growth between 2002 and 2007. Mucuk and Demirsel (2009) used Johansen Cointegration and Granger Causality Test and Impulse-Response Function and Variance Decomposition Analysis in order to analyse the relationship between FDI and economic growth for the period 1991-2007. Empirical results showed a mutual relationship between FDI inflows and economic growth. Bilgili et al. (2007) investigated the interaction between

economic growth and FDI by employing time series methods like Impulse-response Function and Variance Decomposition for the period of 1992 and 2004. They concluded that there is a mutual relationship between economic growth and FDI. Finally Ekinci (2011) also analysed the relationship between FDI and economic growth by using the Johansen Cointegration and Granger Causality Tests for the period 1980-2010. Empirical results indicated a two-way causality between FDI and economic growth.

On the other hand some economists analysing the interaction among FDI and economic growth in Turkey indicated that there is no any relationship between them. For example, Acikalin et al. (2006) examined the relationship among real wages, growth and FDI using the Johansen Cointegration and Granger Causality Tests for the period 1980-2002. Empirical findings did not confirm a causal relationship from FDI to economic growth. Kilic and Ates (2009) analysed the relationship between FDI and economic growth by using Johansen cointegration Test for the data between 1983 and 2000. Their findings determined that there are not any significant causality links from FDI to economic growth. Demirsel et al. (2014) analysed the relationship between FDI and economic growth in Turkey by using Johansen Cointegration Test and Variance Decomposition Analysis for the data covering the period between 2002 and 2014. They indicated that there is no any relationship between FDI and economic growth. Finally Gerceker (2015) analysed the relationship between FDI and economic growth by using the data covering the period 1998-2014. Johansen Cointegration test results indicated that there is no relationship between FDI and economic growth in the long run.

In conclusion, studies focusing on the effect of FDI on economy in Turkey and other developing countries have generated mixed results. Thus, it can be concluded that technology spillover effects arising from FDI do not occur automatically and effortlessly (Padilla-Perez and Matinez-Piva, 2009, 311). Accordingly, some empirical findings specifically indicated that local firms cannot successfully assimilate and apply external knowledge sourced from FDI without greater absorptive capacity. For example Du et al. (2008) analysed the factors generating a “spillover effect” in reaction to FDI by drawing upon data collected in 37 industries in China between 1998 and 2003. They demonstrated that a higher absorptive capacity can only strengthen the positive spillover effect of FDI. Borensztein et al. (1998) also examine empirically the role of FDI in the process of technology diffusion and economic growth in 69 developing countries between 1970-1989. They found that FDI may be the main channel through which advanced technology is transferred to developing countries if only human capital is available enough. Similarly, Li and Liu (2005) examine the impact of FDI on economic growth based on the panel data for 84 countries over the period 1970-99. They find that human capital and technology-absorptive ability are very important for FDI inflows to positively promote economic growth in developing countries. Alfaro et al. (2004) explored the links among FDI, financial markets and economic growth by using cross-country data between 1975 and 1995. Their empirical evidence suggested that FDI plays an important

role in contributing to economic growth if a country has developed financial market. Lastly Adams (2009) analysed the impact of foreign direct investment on economic growth in Sub-Saharan Africa for the period 1990-2003. The results showed that positive effects of FDI depends on the overall incentive and capacity structure of the host country.

### 3. Data, Methodology and Empirical Results

This section aims to investigate the cointegration between foreign direct investment flows and economic growth using quarterly data for the period of 2002 and 2015 in Turkey. The variables Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) are sourced from Electronic Data Delivery System (EDDS) in Central Bank of the Republic of Turkey. FDI series consist of values called “Net Incurrence of Liabilities” in Balance of Payments Analytical Presentation while GDP series gather from the expenditure based GDP data in EDDS.

#### 3.1 Unit Root Test

In this section the time series of FDI and Gross Domestic Product should be checked for the stationary. Both Johansen Cointegration Test and Granger Causality Test need stationary time series at same level to examine the relationship between these time series. Accordingly, we applied Augmented Dickey-Fuller and Phillips-Peron unit root test on time series. The results of unit root tests are presented in Table 1. The results of both test indicate that all the series are stationary in their first differences, I(1), at 1% significance levels while the variables are non-stationary in their levels.

**Table 1: Results of Unit Root Tests**

Variables	ADF		Philips Peron (PP)	
	Level	First Difference	Level	First Difference
FDI	-1.784 (0.2699)	-8.133 (0.000)*	-1.639 (0.1281)	-7.601 (0.0000)*
GDP	-2.159 (0.2351)	-7.379 (0.000)*	-2.809 (0.2010)	-9.488 (0.0000)*

Note: p-value in parentheses. \*, represents the statistical significance level of 1%

#### 3.2 Johansen Cointegration Test

Unit root tests show that both time series are stationary at their first difference. Thus, after determining that the series are integrated of the same order, we can test whether the series related to FDI and GDP are integrated by using the Johansen Procedure. Cointegration analysis in econometric studies can be used to evaluate the comovement of different time series in long-term. Accordingly, we applied Johansen’s Maximum Likelihood Method to examine the relationship between FDI and economic growth in this section. This method uses both the Trace Statistic and the Maximum Eigenvalue Statistics (Johansen 1991). The results from the cointegration test in Table 2 shows that both Trace and Maximum Eigenvalue Tests cannot reject the null of zero cointegrating vectors. Besides the hypothesis that there is one cointegrating

vector can be rejected. Thus, the results of cointegration test are not in favor of long co-movement between FDI and GDP. As a result, it has been indicated that no cointegration vector exist among the series. It can be concluded that there is no any long-term relationship between the FDI and economic growth in Turkey. In other words, technology spillover of FDI cannot be seen in Turkey.

**Table 2: Results of Johansen Test for Cointegration**

Hypothesis	Trace Test		Maximum Eigenvalue Test	
	Trace statistic	Prob.	Max-Eigen statistic	Prob.
$H_0 : r = 0$	12,73*	0,1363	11,45*	0,1418
$H_0 : r \leq 1$	1,36*	0,2811	1,31*	0,2989

Note: p-value in parentheses. r is the number of cointegrating vectors. \*denotes acceptance of the null hypothesis at the 0.05 level

### 3.2 Granger Causality Test

We also checked the relationship between FDI inflows and economic growth by using Granger Causality Test. This test allow us to make statements about the causal relationship between variables in econometric models. Thus the notion Granger-causality identifies whether one variable precedes another. In our case, Granger causality tests observe two time series, FDI and GDP, to identify whether series FDI precedes series GDP, GDP precedes FDI, or if the movements are contemporaneous. The test results are presented in Table-3. These results look like the indication of Johansen cointegration test and show that there is no any relationship between FDI and economic growth in Turkey. Both null hypothesis arguing non-causality from FDI to economic growth and from economic growth to FDI cannot be rejected. It can be concluded that technology spillover of FDI in Turkey do not exist since it cannot be indicated any causal relationship from FDI to GDP.

**Table 3: Results of granger Causality Test**

Null Hypothesis	F-Statistic	Prob.
FDI does not Granger cause GDP	1,7110*	0,1372
GDP does not Granger cause FDI	0,8235*	0,3691

\*denotes acceptance of the null hypothesis at 0.05 level

In conclusion the results of both Johansen Cointegration Test and Granger Causality Test show that there is no any relationship between FDI to economic growth, which indicates the non-existence of positive spillover effect of FDI. In other words our study could not find the expected causality from moving from FDI to economic growth in Turkey. Thus it can be concluded that Turkey do not have good economic condition enough to get the positive spillovers effect of FDI inflows. We know that technology transfer channelled through FDI arises from strategic interaction between foreign firms and local

firms. Thus, the magnitude of spillover depends on the motivation and “learning capabilities” of local firms. Then it can be argued that FDI inflows are beneficial to the host country when local firms can manage their interaction with foreign firms well. If local firms are unable to absorb the new technological challenge, FDI have a non-positive outcome on the local industry growth. The scope of technology transfer from FDI also depends on host country characteristics at macro level like human capital and ICT infrastructure. In conclusion, the findings from examining the case of Turkey shows that technology spillover effects of FDI do not occur automatically and effortlessly. Accordingly, policymakers aiming to enhance productivity growth via FDI inflows to Turkey should take into absorption ability of firms as well as structure of economy account rather than only focusing on attracting FDI to the country.

### 4. Conclusion

The liberalization process has opened a significant window of opportunity for developing countries to improve their technologies via learning from Foreign Direct Investment (FDI) inflows to their countries. Thus, economists examine the expansion of FDI as an important factor to facilitate technology progress for developing countries. However, the existing literature acknowledges that the technological spillover from FDI follows different paths in different countries. Accordingly, this study focus on the Turkish case in order to determine the positive spillover effect of FDI. In order to determine the positive spillover effect of FDI for Turkish economy, we examine the impact of FDI on economic growth based on quarterly data over the period 2002-2015. Results of both Johansen Cointegration Test and Granger Causality Test reveal that there is not any significant link among the FDI and economic growth during the studied time period in Turkey. It seems that FDI inflows to Turkey is not complementary to economic growth, which shows that positive spillover effect sourced from FDI inflows to Turkey does not exist.

Thus Turkish case indicates that domestic economies cannot successfully assimilate and apply external knowledge sourced from FDI without greater absorptive capacity. This result of the study holds important implications for policymakers aiming to enhance productivity growth via FDI inflows to their countries. Accordingly, policymakers should recognize that technology spillover effects of FDI do not occur automatically and effortlessly. Attracting FDI is only one part of the story and thus not yield the desired benefits itself. Positive effects of FDI depends on the overall incentive and capacity structure of the host country. Therefore, in order to get positive spillover effect from DFI, policymakers should also give special importance to provide suitable structural condition enhancing absorption capacity of their economies. Then the key policy implication here is that policymakers should give same weight of policies aimed at attracting FDI versus those that seek to improve local economic conditions.

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