Effect of Foreign Direct Investments on the Domestic Investments of Developing Countries: A Dynamic Panel Data Analysis[i]

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Abstract: *Foreign Direct Investments (FDI) are regarded as a significant source of investment in developing countries. However, FDI may affect domestic investments in different aspects. They can enforce the domestic firms to crowd out or crowd in of the sector.*

In this study; the effects of FDI on developing countries was examined by means of dynamic panel data analysis for 30 developing countries using 1992-2010 period data. According to the empirical analysis results; FDI have crowding in effects in Asian, Latin American and Caribbean countries, although they have crowding out effects in the African

FDI is an investment involving a long term relationship that control of a resident entity in one economy reflects a lasting interest and in that

enterprise resident in an economy other than that of the foreign direct investor (OECD, 1992). FDI refers to the net inflows of investment to acquire a lasting management interest, 10 percent or more of voting stock, in an enterprise operating in an economy other than the investor (World Bank, 1999). These kinds of investments involve setting up the factory; purchasing a domestic firm and privatisation, joint venture with a local firm, licensing agreements and purchases real estate.

FDI have significant effects on economies. It can provide a country with access to new markets, cheap production, new technology, alternative products, labour and management skills and financing (Sun, 1996; Barelli and Pain, 1997; Sun, 1998; Jayaraman, 1998; Borensztein, Gregoria and Lee, 1998 and Javorcik, 2004).

FDI has recently begun to play a major role in the internationalisation of business. FDI reached this volume due to liberalisation policies, new economic integrations, trade acts, tariff liberalisation, thanks to new information technology that negates communication and remote management costs.

FDI may have different effects on host country economies. It may cause crowding out or crowding in of domestic firms from the sector. The purpose of this study is to analyse these effects on developing countries. These effects will be analysed via the dynamic panel data analysis method using the 1992-2010 period data from 30 developing countries.

Theoretical Framework

The impacts of the FDI on domestic investments are determined by the complementarily and substitution features. While FDI producing substitute goods, it may cause crowding out, especially of inefficient domestic firms; conversely FDI will cause crowding in of domestic investment that produces complementary good so it will use row material from the domestic market (Van, 1977; Buffie, 1993).

If FDI have got crowding out effects on domestic investments, a unit FDI leads to an increase of total investment in the host country smaller than one unit. Conversely, if FDI have got crowding in effects on the domestic investment, one unit of FDI increase will lead to more than one unit increase of total investment in the host country. If the effect is neutral, a unit FDI increases causes a unit increases on total investment (Misun and Tomsik, 2002).

Crowding out effects of FDI may take place when foreign and domestic firms are in the same industry. When FDI comes to a sector that includes intensive domestic activities, domestic firms cannot with stand the resulting competition and they will be crowded out of the sector (Driffield and Hughes, 2003). If the FDI go towards the indigenous sectors, which there are less investment in this sector, through increase in the volume of trading and market in this sector, they will be crowding in the domestic firms in this sector (De Mello, 1999).

FDI positively effects domestic investments by means of its investments to factor markets, because they increase revenues of domestic firms and factory owners (Cardoso and Dornbusch, 1989). The positive externality and the spreading tendency of FDI empower domestic investors (Kim and Seo, 2003). To sum up, foreign investment by creating new markets, increasing the demand for inputs, supply new technologies will creates pill over effects and domestic investment will stimulate the economy (Cotton and Ramachandran, 2001: 1).

Conversely, FDI increases wages and the price of inputs in the host country and this causes a decrease in the use of input and employment and leads to crowding out (Apergis, Katrakilidis and Tabakis, 2006). When the technological differences between foreign and domestic investors are on a large scale and there are few skilled labour; FDI will enforce the domestic firms to crowd out (Kokko, 1994; Aitken and Harrison, 1999).

For analysis of crowding in and crowding out effects of FDI, we can begin with a simple model[ii] where investment (INV) in a country is the sum of domestic investment (INV^d) and FDI;

$$INV = INV^d + FDI \tag{1}$$

Domestic investment depends on the Gross Domestic Product (GDP) and domestic interest rate (INT). The model maybe arranged as follows:

$$INV^d = \alpha_0 + \alpha_1 GDP + \alpha_2 INT \tag{2}$$

By replacing (2) in (1) a model for total investment was obtained:

$$INV = \alpha_0 + \alpha_1 GDP + \alpha_2 INT + FDI \tag{3}$$

In the equation (3) it is assumed that FDI haven't got any macroeconomic externalities on domestic investment. Therefore, FDI have a neutral effect.

Since the equation (3) is rearranged in order to determine the effect of externalities:

$$INV = \alpha_0 + \alpha_1 GDP + \alpha_2 INT + \alpha_3 FDI \tag{4}$$

While investors are investing not only the current year, but also look at the past years' economic growth rate. Therefore the investment dynamic process can expand as follows:

$$INV_{i,t} = \alpha_i + \sum_{j=0}^{p} \beta_j FDI_{i,t-j} + \sum_{j=0}^{p} \gamma_j INT_{i,t-j} + \sum_{j=0}^{p} \varphi_j GDP_{i,t-j} + \sum_{j=1}^{p} \psi_j INV_{i,t-j} + \varepsilon_{i,t} \tag{5}$$

Here p is the optimum lag[iii]. Weather long term crowding in and crowding out effects will be tested with this relevant coefficient:

$$\beta_{LT} = \frac{\sum_{j=0}^{p} \beta_j}{1 - \sum_{j=1}^{p} \psi_j} \tag{6}$$

If $\beta_{LT} > 1$, means that FDI haveacrowding in effect on domestic investment that a unit of FDI can bring more than one unit of total investment. If $\beta_{LT} < 1$, it means that FDI haveacrowding out effect on domestic investment that a unit of increase in FDI to the total increase in investment is less than one unit.

There have been many studies on the FDI effects on domestic investment in the economy literature. These studies have reached different conclusions. Lubitz (1966) determined a significant effect of FDI on domestic investments in Canada and found that; $1 of FDI led to $3 of capital formation in the host country. Similarly, Van Loo (1977) studied Canada with 1948-1966 period data and found that; $1 of FDI led to $1.4 of capital formation in the host country. Borensztein, et al, (1998), tested these effects on69 developing countries for the 1970 to 1989 period and founded that FDI has encouraged domestic investments. Jomo (1997) studied for Indonesia, Malaysia and Thailand the mainly microelectronics-related toys and other consumer goods and determined that FDI has crowding in effects in these industries. Massimiliano and Massimiliano (2003) tested the relationship between economic growth, domestic investment and FDI inward in Korea for the 1970 to 1989 period. They found that FDI has some positive effects on domestic investments. Ang (2009) studied the impact of FDI on domestic investment for Malaysia through VAR analysis using 1960-2003 periods and found that; $1 FDI increase domestic investments $1.25. Therefore, FDI involves crowding in effects in the Malaysian economy. Gan and Gao (2010)

studied the impact of FDI on domestic investment for China via panel data analysis methods using 1992-2007 period data and found that: $1 FDI increase the domestic investment in central region $4.08 and $5.88 in Shanxi region. So, FDI have got crowding in effects in China economy.

Agosin and Machado (2005), studied of the impact of FDI on domestic investments and found FDI don't have a positive effect on domestic investment. Apergis, Katrakilidis and Tabakis (2006), with a panel study involving 30 countries found that; FDI have crowding in effects in the single-variable model, but have crowding out effects in the multivariate model. Lin and Chuang (2007) tested the effects for the Taiwan economy and found FDI crowding out to little domestic firms and crowding in the big domestic firms.

Agosin and Mayer (2000) conducted an econometric study on the effects of FDI on domestic investments. This study covers the 1970-1996 period data for 39 developing countries by means of panel data analysis. They found that; while there was crowding in effects in Asia and Africa countries, while there was crowding out effects in Latin American countries. Driffield and Hughes (2003) found FDI have crowding in effects. According to Backer and Sleuwaegen (2003), in the context of occupational choice models, FDI declines the power of local entrepreneurs. However, FDI increases domestic investments through networking, chains and learning effects. Acar et al. (2012) have seen that FDI have crowding out effects in MENA countries.

FDI in Developing Countries

Global FDI flows increased from $54 billion in the 1980's to $1.524 trillion in 2011. Emerging regions, such as East and South-East Asia and Latin America experienced strong growth in FDI inflows (UNCTAD, 2012). FDI has changed course and has been directed towards developing countries in recent years. Table 1 shows the distribution of FDI in the economies.

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Table 1. Distribution of the FDI in Economies (Billion $)

	World	Developing Economies	Share of Developing Economies	Transition Economies	Share of Transition Economies	Developed Economies	Share of Developed Economies
1980	54	7	14	0	0	47	86
1990	207	35	17	0	0	173	83
2000	1403	258	18	7	1	1 138	81
2005	983	332	34	31	3	619	63
2006	1 462	429	29	55	4	978	67
2007	1 971	573	29	91	5	1 307	66
2008	1 744	658	38	121	7	965	55
2009	1 185	511	43	72	6	603	51
2010	1 244	574	46	68	5	602	48
2011	1 524	684	45	92	6	748	49

Source: UNCTADSTAT.

According to Table 1, while FDI inflows are increasing in developing countries, they are decreasing in developed countries. Developing and transition economies together attracted more than half of global FDI flows. Most FDI attracting developing countries in 2011are shown in Table 2.

Table 2. Most FDI Attracting Developing Countries (Million $)

YEAR	1980	1990	2000	2006	2007	2008	2009	2010	2011
China	57	3 487	40 175	72 715	83 521	108 312	95 000	105 735	123 985
Hong Kong	710	3 275	61 937	45 060	54 341	59 620	52 393	71 069	83 155
Brazil	1 910	989	32 779	18 822	34 585	45 058	25 949	48 438	66 660
Singapore	1 236	5 575	16 484	29 348	37 033	8 588	15 279	38 638	64 003
India	79	237	3 588	20 328	25 350	42 546	35 649	24 640	31 554
Mexico	2 099	2 633	18 110	20 052	29 734	26 295	15 334	18 679	19 554
Indonesia	180	1 092	-4 495	4 914	6 928	9 318	4 877	13 304	18 906
Chile	213	661	4 860	7 298	12 534	15 150	12 874	15 095	17 299
Saudi Arabia	-3 192	312	183	17 140	22 821	38 151	32 100	28 105	16 400
Turkey	18	684	982	20 185	22 047	19 504	8 411	9 071	15 876

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Source: UNCTADSTAT.

According to Table 2, China was the best FDI attracter among developing countries in 2011. China and Hong Kong's share is 13.5% of the world. Other countries are following them. Turkey attracted $15.8 billion FDI in 2011.

Empirical Analysis

Data Set

A balanced panel of 570 annual observations from 30 developing countries over the period of 1992-2010 was used in this study. The sample of countries represents all major regions in the world as FDI attracting in 2010. It includes 11 countries from Latin America[iv] and the Caribbean, 9 from Asia[v] and the Pacific, 8 from Africa[vi] and 2 from economies in transition[vii]. Investment (*INV*), Gross Domestic Product (*GDP*), Foreign Direct Investment (*FDI*) and Interest Rate (*INT*) are the study variables. All data currency is US dollars. *INV* represents investment to GDP ratio; *FDI* represents FDI to GDP ratio; *G* represents growth of real GDP. The data set was obtained from the World Bank, UNCTAD and IMF.

Method

For this study data set included in the dynamic processes, the dynamic panel data analysis method was used. The dynamic panel data analysis method takes into consideration the dynamic structure between the dependent and independent variables (Baltagi, 1995). In addition, use of panel data in estimating ensures control for missing or unobserved variables and relationships allow identification of country-specific effects (Arellano-Bond, 1991; Matyas and Sevestre, 1996). The dynamic panel allows dynamic effects to be introduced into the model and allows feedback from current or past shocks (Hsiao, 1986). A simple equation of dynamic panel data model is (Hsiao, 2003: 75):

$$y_{it} = \delta y_{i,t-1} + \beta x_{it} + \mu_i + u_{it} \qquad (7)$$

for i=1,2,...,N; and t=1,2,...,T. δ is a scalar, x_{it} is kx1, μ_{it} denotes the *i*th individuals effect and u_{it} is the error term of regression.

In this study, among dynamic panel data estimation methods the Generalised Method of Moments (GMM) technique was used. GMM

procedures are more efficient than other estimators (Arellano and Bond, 1991). The resulting GMM estimator is asymptotically efficient (Baltagi, 1995). GMM estimators use all possible lagged values of dependent and independent variables as instrumental variable (Arellano and Bond, 1991). There are three GMM methods; level GMM, difference GMM and system GMM. System GMM was used in this study.

The crucial point here is that variables must be endogenous in order to useGMM. For this reason, before beginning the analysis, a test of endogeneityis required. For this purpose; Durbin's score (1954) and Wu-Hausman (Wu, 1974; Hausman, 1978) tests can be used. These hypotheses would be expressed as:

H_0: Variables are exogenous

H_1: Variables are endogenous

If H_0 is rejected, variables are endogenous. In this case, using the GMM is suitable.

The Sargan test used to determine whether instrumental variables of the GMM are suitable (Greene, 2003).These hypotheses would be expressed as:

H_0: Moment conditions are valid.

H_1: Moment conditions are invalid.

The hypothesis tested with the Sargan-J statistic. This statistic will be asymptotically chi-squared (χ^2) with m-k degrees of freedom. m is the number of instrumental variables and k is the number of the parameter. If the null hypothesis is accepted, instrumental variables are suitable.

Arellano and Bond (1991) developed an autocorrelation test for GMM. The Arellano–Bond test for autocorrelation is actually valid for any GMM regression on panel data (Roodman, 2009). These hypotheses would be expressed as:

H_0: No Autocorrelation

H_1: Autocorrelation

Panel Unit Root Test

Panel unit root testing is more widely accepted for only the time dimension of time series unit root tests, since it covers the data of both time and cross-sectional size (Im, Pesaran and Shin, 1997; Maddala and Wu, 1999; Taylor and Sarno, 1998; Levin and Lin, 1992; Hadri, 2000; Choi, 2001; Levin, Lin and Chu, 2002; Breuer and Wallace, 2002; Carrion-i-Silvestre, 2005; Pesaran, 2006; Beyaert and Camacho, 2008). At the same time, the addition of the cross-sectional size of the analysis increases the variation in the data.

The first problem encountered in the panel unit root tests is whether each cross-section is independent or not. Panel unit root tests are divided into first generation and second generation tests. While Breitung (2000), Hadri (2000) and Levin, Lin and Chu (2002) based their studies on the assumption of a homogeneous model; Im, Pesaran and Shin (2003), Maddala and Wu (1999), Choi (2001) based their studies on the assumption of a heterogeneous model.

In this study; the Im, Pesaran and Shin (2003) (IPS) test will be used, since the countries aren't homogeneous. The IPS test is based on this model:

$$\Delta Y_{it} = \delta_i Y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta Y_{i,t-j} + \gamma X_{it} + \varepsilon_{it} \, for \, i = 1,2,\dots,N \, and \, t = 1,2,\dots,T \,)$$
(8)

δ_i is an error correction model. If $|\delta_i| < 1$ series is trend stationary. IPS unit root test was applied and obtained results shown in Table 3.

Table 3. IPS Unit Root Test

	Variables	Test Statistics	Prob. Values
Whole Panel	INV	-1.92**	0.02
	FDI	-2.04**	0.02
	GDP	-7.34*	0.00
	INT	-1.85**	0.03
Asia	INV	-9.31*	0.00
	FDI	-2.22**	0.01
	GDP	-5.97*	0.00
	INT	-9.16*	0.00
Latin America and the Caribbean	INV	-3.071*	0.001
	FDI	-2.976*	0.001
	GDP	-6.701*	0.000
	INT	-4.435*	0.000
Africa	INV	-1.503***	0.066
	FDI	-6.216*	0.000
	GDP	-4.551*	0.000
	INT	-2.223*	0.001

Note: In panel unit root tests Schwarz criterion is used and length was1 taken (*), (**) (***) indicating stationarity and significance levels 1%, 5%, 10% respectively.

According to the Table 3, all series are stationary in level values. This means that analysis performed in this series is reliable and equation (6) can be used.

The Endogeneity Test

In this study, the Durbin (score) (1954) and Wu (1974)-Hausman (1978) endogeneity test was used. Hypotheses of these tests are as follows:

H_o: Variables are exogenous

H_1: Variables are endogenous

Endogeneity test was applied by Stata 11 and obtained results are presented in Table 4.

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Table 4. Results of Endogeneity Test

	Durbin (score)	**Wu-Hausman**
Whole Panel	Chi2(1) = 5.21978 (0.0223)	F(1,474) = 5.2112 (0.0229)
Asia	Chi2(1) = 0.9697 (0.03248)	F(1,138) = 0.9355 (0.0335)
Latin America and the Caribbean	Chi2(1) = 0.066635 (0.01796)	F(1,170) = 0.064387 (0.018)
Africa	Chi2(1) = 1.2594 (0.02618)	F(1,122) = 1.21237 (0.0273)

Note: The values in parentheses are probabilities.

According to Table 4, H_o was rejected and concluded that the variables were endogenous. So it was decided that the GMM method should be used.

Dynamic Panel Data Analysis

Dynamic panel data analysis was made using equation (5) via GMM and long term relevant coefficient was calculated by equation (6). The results are presented in Table 5.

Table 5. Results of Dynamic Panel Data Analysis

	Coefficient (β_{LT})	**Wald Test**	**Sargan Test**	**AR(1)**	**AR(2)**
Whole Panel	0.79	Chi2(15)=2988.13 (0.00)	Chi2(163)=16.2065 (1.00)	-1.0542 (0.2918)	-1.2794 (0.2008)
Asia	4.67	Chi2(8)=138.59 (0.00)	Chi2(93)=93.84468 (0.4560)	-2.0323 (0.0421)	1.1558 (0.2478)
Latin America and the Caribbean	1.34	Chi2(10)=1456.39 (0.00)	Chi2(142)=165.362 (0.8801)	-2.5289 (0.0114)	-2.17 (0.320)
Africa	0.81	Chi2(15)=874.63 (0.00)	Chi2(118)=132.7087 (0.1677)	-1.5791 (0.01143)	1.3003 (0.01935)

Note: The values in parentheses are probabilities. The White Period method was used to correct the standard errors. Since there are few transition countries, their individual analysis was not applied.

According to Table 5; as a result of the Wald tests, it was seen the model is meaningful. According to the Sargan tests, it was decided that instruments are suitable. In autocorrelation tests, there are no second order autocorrelation problems in these models. Based on these findings, analysis results are significant and reliable.

Long term investment coefficients found for the whole panel were 0.79, for Asia 4.67, for Latin American and the Caribbean 1.34 and for Africa 0.81. These results show; in a developing country, $1of FDI increases total investments $0.79 in the home country. This value smaller than 1. Therefore, FDI has a crowding out effect in these developing countries. However, in Asian countries $1of FDI increases total investments $4.67 in the home country and FDI has crowding in effects. $1of FDI increases total investments $1.34 in Latin American and Caribbean countries and FDI has crowding in effects. However in African countries $1of FDI increases total investments $0.81 and it has a crowding out effect.

Conclusions

There are different opinions about the effects of FDI on domestic investment in economics literature. Some economists admit that FDI reduces domestic investment and it has crowding out effects. In other words, FDI increases domestic investment and it has crowding in effects. The main purpose of this study is to analyse these effects in developing countries.

For this purpose, using data from 1992-2010 for 30 developing countries, a dynamic panel data analysis was performed. According to the empirical results; FDI increases domestic investment and has crowding out effects in developing countries. $1 increase in FDI leads to an increase of $0.79 total investment for these countries. This result is similar to Chudnovsky, Lopez and Porta (1996); Agosin and Machado (2005) and Lin and Chuang (2007). In analysis carried out for country groups, different results were obtained. In Asian countries, $1 FDI increases total investments by $4.67 in the home country and FDI has crowding in effects. $1 FDI increases total investments $1.34 in Latin American and the Caribbean countries and FDI has crowding in effects. These results are compatible with Lubitz (1966); Van Loo, (1977); Borensztein, et al, (1998), Massimiliano and Massimiliano, (2003); Ang, (2009) and Gan and Gao (2010). However, in African countries $1 FDI increases total investments by $0.81 and it has a crowding out effect.

The findings of the study suggest that; differences in results among different country groups related with the FDI policies implemented, trade

openness ratio, human capital adequacy and to the extent that domestic firms are ready for international competition. For example, it is a fact that Asian countries, including China, have been providing tax advantages, easing administrative procedures for foreign investors and establishing free trade zones in order to accelerate economic development improve the capital and technology capacity and attract more FDI. Owing to such policies, foreign investments have been attracted and domestic firms have been protected.

As a result, FDI has a significant effect on the total investment level in developing countries. If a country wants to accelerate its development process it should take the necessary measures to improve factors such as taxes and social security contributions, as well as inflexibilities in the labour market to attract more FDI.

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[i]This study is a mostly renewed and developed version of the same name study,
which was presented in the 3rd International Symposium on Sustainable
Development(ISSD) at International Burch University, 31 May-2 June 2012,
Sarajevo.
[ii]Agosin and Mayer (2000); Misun and Tomsik (2002) has been followed here
and the model has been extended by the authors with interest rate.
[iii] In this study; following to Misun, and Tomsik (2002) lag was taken 3.
[iv] Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Rep., Mexico,
Panama, Peru, Uruguay, Venezuela.
[v]China, Indonesia, S. Korea, Malaysia, Qatar, Singapore, Thailand, Turkey,
Vietnam.
[vi] Algeria, Angola, Congo, Egypt, Ghana, Libyan, Morocco, Nigeria.
[vii]Russian Fed., Ukraine.