FOREIGN DIRECT INVESTMENT, ECONOMIC GROWTH AND CORRUPTION IN DEVELOPING ECONOMIES

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August 2010

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Abstract
This study of forty two developing countries uses Panel Dynamic Ordinary Least Squares – PDOLS - to examine the relationship between foreign direct investment, corruption and economic growth. The results suggest that corruption has a significant influence on per capita GDP in the short run but is not significant in the long run. It was also found that lower levels of corruption enhance the impact of foreign direct investment on economic growth. This has important implications for policymakers.

Keywords: Panel Co-integration, Foreign Direct Investment, Corruption and Economic Growth

JEL Number: C33, E22, D73 and D92

Introduction

The impact of foreign direct investment (FDI) on economic growth is of concern to both academic researchers and policymakers, as it is a significant promoter of economic growth and development. Some studies suggest that its' effects on growth is dependent on conditions in the host country. Important influences on the impact that FDI has on economic growth include the supply of human capital (Borenzstein et. al, 1998), the trade regime (Zhang, 2001) and the level of financial development (Hermes and Lensink, 2003). It is now recognized that other institutional factors including the prevalence of corruption increase the costs of firms and reduce productivity (World Bank, 2005). This implies that corruption can affect the impact that FDI has on economic growth. Recent studies of the relationship between FDI and corruption have found that corruption reduces FDI inflows (Al Sadig, 2009, Egger and Winner, 2006). However, there is little research on whether corrupt countries derive less benefit from the FDI that they receive.

The objective of this study is to examine the relationship between corruption and the effect that FDI has on economic growth in a group of developing countries, using panel dynamic ordinary least squares on 42 developing countries covering the period 1998 to 2008.The paper is organized as follows: section two provides a brief review of the theoretical literature on FDI and economic growth. The model and the data are discussed in section three. Estimation results are presented in section four. Finally, section five makes some conclusions.

2. FDI and Economic Growth: A Select Literature Review

The literature identifies several channels through which FDI contributes to economic growth. From the viewpoint of neoclassical growth theory FDI inflows increase the stock of capital in host countries thereby allowing higher rates of growth than would be possible from reliance on domestic savings. Endogenous growth theory postulates that technological advancement stimulates economic growth by creating externalities that compensate for diminishing returns to capital (Romer, 1990; Mankiw, Romer and Weil, 1992). FDI can therefore enhance growth by allowing host countries access to advanced technologies not available domestically. It has also been argued that FDI leads to increased competition in the domestic market which can cause greater efficiency of domestic firms (UNCTAD, 1999). In addition, improved managerial practices may be transmitted to domestic firms that attempt to imitate foreign firms. In cases where FDI involves training of domestic labor, the strengthening of human capital will generate positive externalities that could raise economic growth. Moreover, FDI has the potential to expand access to export markets. For those developing countries with limited industrial bases, increased export earnings facilitate imports of capital goods that can lead to higher levels of economic growth.

The trade regime of the host country has been identified as an important factor influencing the impact that FDI can have on economic growth. It has been found that the effect of FDI on growth is positive in the case of countries with export promotion policies but negative in countries pursuing import substitution policies (Balasubramanyam et.al., 1996).

Recent empirical studies suggest that FDI may not promote economic growth in developing countries that lack the necessary absorptive capacity (Borensztein et.al., 1998; Hermes and Lensink, 2003). Absorptive capacity is determined by factors such as the quality of human capital, the level of development of the financial sector, technological development and quality of infrastructure (UNCTAD, 2001; Hermes and Lensink, 2003). Low levels of development of human capital reduce the spillovers from the advanced technology introduced by FDI as domestic firms will not be able to absorb the new technology. Similarly, underdeveloped financial markets limit the ability of domestic firms to access financial resources to undertake investment in new technologies. In the case of infrastructure, adequate infrastructure is required to support new technologies as well as to facilitate linkages between FDI and domestic firms.

Empirical research on the impact that FDI has on economic growth has produced mixed results. Li and Liu (2005) used panel data to examine the relationship between FDI and growth in 84 countries over the period 1970-99. They found that FDI promoted economic growth both directly and indirectly. This finding was not supported by Carkovic and Levine (2005) who studied 72 countries during the period 1960-1995. The authors controlled for simultaneity bias and concluded that FDI does not have an independent influence on economic growth. Ram and Zhang (2002) utilised data for the period 1990-97 to assess the effect of FDI on growth in a sample of 85 countries. They found that the association between FDI and economic growth in the host country was "generally positive" during the 1990s, contradicting the result of an earlier cross country study undertaken by Dutt (1997) which indicated that FDI had a negative impact on economic growth. Borensztein et. al. (1998) reported on the influence that FDI has on economic growth in a sample of 69 developing countries and concluded that FDI promotes economic growth only when the host country has sufficient human capital. Similarly, Hermes and Lensink (2003), in a study of 67 developing countries, found that the development of the financial sector is necessary in order for FDI to have a positive effect on economic growth.

3. The Model, Econometric Method and Data

3.1 The Model

The real output (Y_t) model relies on an integrated approach based on a production function maximization procedure. It employs the three leading factors of production, namely L as raw labour input, K as capital inflows and H as human capital (Akinlo, 2004). These variables (L, K, H) will increase output (Y_t) as additions in the stock of foreign direct investment (FDI) occur within markets.

For developing countries, the understanding of the determination of real output, depends not only on the production factors (L, K and H) but on other institutional factors like the prevalence of corruption, which is the focus of this paper. The level of institutional corruption (C_{index}) within developing economies can have an adverse effect on real output growth, as scarce resources are deprived from essential sectors and investors find it increasingly difficult to conduct business ventures.

The model for the study is specified as:

$$\Delta(\phi) = \prod \phi_{t-1} + \sum_{i=1}^{k-1} \alpha \Delta \phi_{t-1} + \delta \gamma_t + e \qquad (1)$$

where (ϕ) = [labour input, capital inflows, human capital and the corruption index] is a data vector explaining the real output relationship. It determines the elasticities of real output with respect to raw labour, capital, human capital and the corruption index by the factor $\gamma_t(1\text{-}\alpha - \beta)$ as stated by de Mello (1997), Ramirez (2000) and Akinlo (2004). The γ_t is a vector of deterministic variables, and the random term e_t is expected to be white noise.

3.2 The Econometric Method: Panel Dynamic Ordinary Least Squares

This paper applies panel dynamic ordinary least square (PDOLS) – see Kao and Chiang (2000) and Mark and Sul (2003) - to establish co-integration and derive long and short run estimates of the determinants of real output in the set of developing economies examined here. . PDOLS is based on the single equation DOLS procedure pioneered by Saikkonen (1991) and generalized by Stock and Watson (1993) and has the following similar features: it allows for the direct estimation of a mixture of I(I) and I(0) variables, performs well in small samples and avoids the issue of endogeneity. Further, statistical inference on the parameters of the co-integrating vector is facilitated by the fact that the t-statistics of the estimated coefficients have an asymptotic normal distribution, even with endogenous regressors (Stock and Watson, 1993).

The application of PDOLS involves three steps. First, panel unit root tests are employed to check the stochastic nature of the variables. The procedures used are due to Levin, Lin and Chu (LLC) (2002), and Breitung (2002) [which have a common unit root process as their null hypothesis], Im, Pesaran and Shin (IPS) (2002), the Augmented Dickey Fuller - Fisher Chi-square (ADF) [which have individual unit root processes] and the Hadri z-statistic which has a null hypothesis of no unit root.

If the variables are non-stationary, the next step is to test for co-integration. The methods employed are the residual based panel and group statistics tests of Pedroni (1999). Finally, the Panel Dynamic Ordinary Least Squares (PDOLS) procedure proposed by Kao and Chiang (2000) and adopted by Mark and Sul (2003) are used to determine the short run and long run factors influencing real output. In this paper, the models begins with five leads and lags on the first difference of the variables and as is customary the general to specific methodology is executed in order to obtain a parsimonious representation of the regression equations. Therefore, only statistically significant variables are retained in the models.

The estimation of the long –run relationship for Equation (1) is based on the following regression:

$$Y_t = \alpha_0 + \beta X_t + \sum_{i=-k}^{k} \phi X_{t-1}^{1} + e \qquad (2)$$

where X is a vector of all explanatory variables, X^1 is a subset of I(1) variables of X, β is a vector of long –run coefficients and e is a well behaved error term. The leads and lags of the first differenced I (1) regressors are included to deal with the problems of endogeneity and autocorrelation.

To investigate the short run dynamics, the estimates from Equation (2) are used to derive a general error correction model of the form:

$$\Delta Y_t = \beta_o + \sum_{1=1}^{m} \beta_{1_t} \Delta Y_{t-1} + \sum_{1=0}^{m} \beta_2 \Delta X_{t-1}^{1} + \sum_{1=0}^{m} \beta_3 Z_{t-1} + \sum_{i=1}^{m} \varphi (Y_{t-1} - \beta X_{t-1}) + \mu \qquad (3)$$

Changes in per capita GDP are a function of its past, lagged first difference non-stationary variables (X^1), lagged stationary variables (Z) and the lagged error correction term. The short run effects are captured by $\beta_1, \beta_2 and \beta_3$ while the rate at which per capita GDP readjusts to steady state after disequilibrium have occurred is given by φ.

3.3 Data

The data utilised in this paper cover the period 1998 to 2008 for forty two developing markets and were obtained from the International Monetary Fund's International Financial Statistics and the World Bank's Statistics Database. The dependent variable is per capita gross domestic product (Per_GDP) and the independent variables are as follows: Foreign direct investment as a percentage of GDP (Fdi_GDP), domestic investment as a percentage of GDP (Invt_GDP), secondary school enrolment as a proxy for human capital (HK), labour force participation rate (L) and a corruption index (C_{index}) that represents the institutional impact on per capita GDP growth. The descriptive statistics of the series are shown in Table 1.

Table 1: Descriptive Statistics

	C_INDEX	FDI_GDP	INVT_GDP	LABOUR_F	PER_GDP	SCHOOL_E
Mean	3.708894	30.04380	22.70426	41840332	4423.759	73.53781
Median	3.500000	23.04417	21.65664	7974689.	2539.913	78.03834
Maximum	7.600000	129.7320	44.54532	7.77E+08	54260.08	160.3465
Minimum	1.400000	3.295922	11.02170	558371.2	231.6199	9.579883
Std. Dev.	1.368126	22.52831	6.076702	1.27E+08	6618.427	24.63061
Skewness	0.807838	1.548333	1.170195	4.614338	4.124950	-0.327683
Kurtosis	3.120974	5.591122	4.584315	24.15015	23.36813	3.610846
Jarque-Bera	50.42267	313.1584	153.4263	10228.38	9276.119	15.41730
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000449
Sum	1709.800	13850.19	10466.67	1.93E+10	2039353.	33900.93
Sum Sq. Dev.	861.0135	233461.5	16986.10	7.48E+18	2.01E+10	279066.8
Observations	461	461	461	461	461	461

4. Estimation Results

The results of the panel unit root tests mentioned above revealed that all the variables are integrated of order 1 [I(1)], that is, they need to be differenced once to become stationary (see Table 2).

Table 2: Unit Roots Tests

	LLC	Breitung	IPS	ADF	PP	Hadri
Variable						
Y	-41.83***	-20.556***	-25.21***	212.15**	220.688**	-0.99*
FDI_GDP	-41.70***	-21.490**	-25.99***	215.82***	218.39***	-1.12*
Invt_GDP	-41.04667***	-21.81271***	-25.80***	212.37***	219.4159***	-0.95*
School_Enrolement	-38.7401***	-20.6493***	-24.63**	208.902***	209.050***	-1.17*
Labour_Force	-21.6502***	-9.79493***	-13.2626**	119.529**	212.124**	-1.29*
C_index	-45.755***	-21.0305***	-28.7066**	220.164**	185.966***	0.64*

Note: ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively

Moving on to the panel and group statistics for co-integrating vectors among the variables, the residual based tests of Pedroni (1999) indicate the null hypothesis of no co-integrating vector cannot be accepted (see Table 3).

Table 3: Pedroni Residual Co-integration Test

Common AR Coefficients within dimension			Indiviual AR Coefficients between dimension		
	Statistic	P Value		Statistic	P Value
Panel v Statistic	3.63***	0.0001	Group rho Statistic	-16.07***	0.0000
Panel rho Statistic	-15.41***	0.0000	Group PP Statistic	-11.80***	0.0000
Panel PP Statistic	-10.39***	0.0000	GroupADF Statistic	-11.12***	0.0000
Panel ADF Statistic	-9.82***	0.0000			

The long run determinants of the PDOLS model are presented in Table 4. The model is well specified as there is no evidence of autocorrelation, heteroscedasticity or non-normal residuals. Three variables - foreign direct investment as a % of GDP (FDI_GDP), secondary school enrolment (School_Enrolement), and the labour force participation rate (Labour_Force) - are shown to significantly influence per capita GDP in the long run and have the a priori signs. These results suggest that these variables are critical towards developing a sustainable economy, and should be promoted carefully by national entities and policy makers. Not influencing long run per capita GDP are domestic investment as a % of GDP (Invt_GDP) and the corruption index (C_index).

Table 4: Long Run Coefficients of Per Capita Gross Domestic Product

Y_t = - 2826 + 55.57 FDI_GDP + 0.000351 Labour_Force + 158.88 School_Enrolement (-5.02***) (4.74***) (2.68***) (12.10***)
Diagnostic Tests R^2 = 0.4272 $\overline{R^2}$ = 0.4240 F = 133.4917 DW = 1.86 NORM = 6.897 AR = 0.654 ARCH = 0.245 HET = 0.876 RESET = 1.42

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics. AR is the Lagrange multiplier test for residual autocorrelation and ARCH is the autoregressive conditional heterscedasticity. HET is the unconditional heteroscedasticity test based on the regression of squared residuals. Finally, RESET = Ramsey test for functional form mis-specification.

The results of the PDOLS error correcting model are reported in Table 5. All the diagnostics are satisfied indicating that the model is an adequate representation of the data generation process. The sign and statistical significance of the lagged error correction term (ECT) supports the Pedroni (1999) results that there exists long run equilibrium among the variables. The magnitude of the coefficient on the term (-0.1692) suggesting that it takes approximately six periods for Y_t (per capita gdp) to adjust to its long run equilibrium when a shock causes disequilibrium.

Table 5: Error Correcting Model of Per Capita Gross Domestic Product

$$\Delta Y_t = -48.42 + 69.35\,\Delta\,\text{FDI\_GDP} + 0.000006\,\Delta\,\text{Labour\_Force} + 168.04\,\Delta\,\text{School\_Enrolement}$$

(-0.89) (12.93***) (6.84***) (27.92***)

$$449.47\,\Delta\,\text{C\_Index} + 45.66\,\Delta\,\text{FDI\_GDP}_{t-1} - 0.169417\,\text{ECT}_{t-1}$$

(2.99***) (8.52***) (-15.93***)

Diagnostic Tests

$R^2 = 0.337$ $\overline{R^2} = 0.335$ F = 228 DW = 1.96 NORM = 7.864

AR = 0.65 ARCH = 0.15 HET = 0.324 RESET = 1.89

Note: t- statistics of regressors are shown in parentheses.. ***, ** and * indicates significance at the 1, 5 and 10% level of testing, respectively. However, all diagnostics tests are performed at the 5% level of testing. Δ is the first difference operator. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, F is the F- Statistic for the joint significance of the explanatory variables. DW is the Durbin Watson statistic and the NORM is the test for normality of the residuals based on the Jarque- Bera test statistics. AR is the Lagrange multiplier test for residual autocorrelation and ARCH is the autoregressive conditional heterscedasticity. HET is the unconditional heteroscedasticity test based on the regression of squared residuals. Finally, RESET = Ramsey test for functional form mis-specification.

The variables Δ(FDI_GDP), Δ(School_Enrolement), Δ(Labour_Force) and Δ (C_INDEX) are all significant with the correct signs in the short run. The positive coefficient on the corruption index suggests that improvements in the levels of anti-corruption and transparency of institutional entities will lead generally to higher levels of per capita gross domestic product. These results bring into question whether corruption influences growth via the other significant determinants; foreign direct investment, school enrolment and labour force participation. From observation, some foreign investment is affected directly or indirectly through the level of perceived corruption within institutional entities in developing markets (Prasad et. al, 2003; Tao, 2003). Therefore the issue of the existence of interaction between corruption and foreign direct investment is investigated next.

4.1 Interaction between Corruption and Foreign Direct Investment

The following model is formulated to capture the interaction effects:

$$Y_t = \alpha_0 + \beta X_t + \sum_{i=-k}^{k} \phi X_{t-1}^{1} + \gamma Inter + e \qquad (4)$$

$Inter$ is the interaction term (C_index*FDI_GDP) and γ is the coefficient of this term, the significance of which will be checked using a chi –squared test of joint hypothesis of the interaction term and the C_index indicator, all other variables are standard as employed in Equation 1.

The model (see Table 6 below) is well specified and shows that there is a long run relationship among the variables judging by the size, significance and sign of the ECT term. With respect to the interaction term, the result reveals that it has a positive impact on per capita gross domestic product. Without the impact of corruption index, the direct effect of foreign direct investment on per capita GDP is approximately 70 points.

Table 6: Interaction between Corruption and FDI

$\Delta Y_t =$ -36.66 + 53.32 Δ FDI_GDP + 0.000002 Δ Labour_Force + 148.96 Δ School_Enrolement

(-0.71) (8.91***) (2.79**) (25.69***)

378.09 Δ C_index + 8.65 Δ FDI_GDP $_{t-1}$ + 53.21 Δ Inter - 0.143 ECT $_{t-1}$

(8.17***) (12.56***) (18.02***) (13.97***) (5)

χ^2= *24.86*** R^2 = 0.399 $\overline{R^2}$ = 0.397 F = 261 DW = 2.02 NORM = 5.431

AR = 0.74 ARCH = 0.10 HET = 0.421 RESET = 1.65

Note: See Table 5

Conclusions

This paper utilises the panel dynamic ordinary least squares methodology to arrive at strong and well specified long and error correcting models for real output. The results suggest that labour, capital flows and human capital are significance in the long run and have their expected positive sign. In the short run, the above variables are also correctly signed and significant, along with the corruption indicator. In interacting corruption and foreign direct investment the results revealed that a one point change in the interaction term led to an increase of 53 points on per capita GDP, suggesting that the direct impact of foreign direct investment is about 70 points change on GDP when the influence of corruption is controlled. That there is no significant impact of corruption in the long run may imply that investors are usually driven by prospects of profitability, government directed incentives, and local institutional and human capital effectiveness.

In essence, given the discovery of the significant long run coefficients for real activity are foreign investment as a percentage of gross domestic product, secondary school enrolment as a proxy of human capital and the labour force, these variables are critical towards developing a sustainable economy, and should be promoted carefully by national entities and policy makers.

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