

# Economic Growth, FDI and Corruption in developed and developing economies

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# Summary

- This study of 42 developing countries and 28 developed economies used Panel Dynamics Ordinary Least Squares (PDOLS) to examine the relationship between economic growth, FDI and corruption.
- The results suggest that FDI has a significant influence on economic growth in both long and short run for both set of nations.

- Corruption is only important to economic growth in the short run for developing countries, even as lower levels of corruption enhance the impact that FDI has on economic growth.

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# Introduction

- Evidence suggest the relationships between economic growth, FDI and corruption are critically important for policy making in the real world.
- 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.

# Reason for study

- The level of institutional corruption ( $C_{\text{index}}$ ) within 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.
- There is little research on whether corrupt countries derive less benefit from the FDI that they receive.
  - To examine the relationship between corruption and the effect that FDI has on economic growth in a group of developing and developed countries..

# What approach was used

- Model:
  - The real output (Y) 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) as additions in the stock of foreign direct investment (FDI) occur within markets.

The model for the study is specified as:

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

where  $(\phi) = [\text{labour input, capital inflows, human capital and the corruption index}]$  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  $\gamma_t(1-\alpha-\beta)$  as stated by de Mello (1997), Ramirez (2000) and Akinlo (2004). The  $\gamma_t$  is a vector of deterministic variables, and the random term  $e_t$  is expected to be white noise.



- **Econometric method:**
  - This paper applies panel dynamic ordinary least square (PDOLS) to establish co-integration and derive long and short run estimates of the determinants of real output in the set of 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  $I(1)$  and  $I(0)$  variables.
    - performs well in small samples and avoids the issue of endogeneity.

- 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.
- Only statistically significant variables are retained in the models.

## • Data:

- The data utilised in this paper cover the period 1998 to 2009 for forty two (42) developing markets and twenty eight (28) developed countries 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)
  - Corruption index ( $C_{index}$ ) that represents the institutional impact on per capita GDP growth.
    - Higher values indicate worsening of index.

# What is different

- First study to examine relationship between economic growth, FDI and corruption for developing and developed countries.
  - Using PDOLS method
- Obtained both long and short run estimates.
- Determine the interaction of levels of corruption on FDI and hence impact on economic growth.

# Results and Implications

**: Long Run Coefficients of Per Capita Gross Domestic Product (developed countries)**

$\text{per\_GDP}_t = 32.16 + 89.11 \text{ Fdi\_GDP} + 3.51 L + 32.65 \text{ HK} + 10.74 \text{ Invt\_GDP}$ <p style="text-align: center;">(4.09***) (2.98***) (4.77***) (10.53***) (3.82***)</p>
<b>Diagnostic Tests</b>  $R^2 = 0.57 \quad \overline{R^2} = 0.54 \quad F = 19.42 \quad DW = 2.01 \quad \text{NORM} = 3.52$  $\text{AR} = 0.16 \quad \text{ARCH} = 0.25 \quad \text{HET} = 0.675 \quad \text{RESET} = 2.19$

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 heteroscedasticity. HET is the unconditional heteroscedasticity test based on the regression of squared residuals. Finally, RESET = Ramsey test for functional form mis-specification.

- The model for the sample of developed nations is well specified as there is no evidence of autocorrelation, heteroscedasticity or non-normal residuals.
- The determinants - foreign direct investment as a % of GDP (Fdi\_GDP), secondary school enrolment (HK), the labour force participation rate (L) and domestic investment as a % of GDP (Invt\_GDP) - 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 is the corruption index ( $C_{\text{index}}$ ) and this finding is in keeping with the results of Mo (2001).

**: Long Run Coefficients of Per Capita Gross Domestic Product (developing countries)**

$$per\_GDP_t = -2826 + 55.57 Fdi\_GDP + 0.000351 L + 158.88 HK$$

(-5.02\*\*\*)

(4.74\*\*\*)

(2.68\*\*\*)

(12.10\*\*\*)

**Diagnostic Tests**

$$R^2 = 0.4272 \quad \overline{R^2} = 0.4240 \quad F = 133.4917 \quad DW = 1.86 \quad NORM = 6.897$$

$$AR = 0.654 \quad ARCH = 0.245 \quad HET = 0.876 \quad RESET = 1.42$$

- The long run determinants of the PDOLS model for the developing countries are presented.
- Like for the set of developed nations, the residuals of this model showed no proof of autocorrelation, heteroscedasticity or non-normality. Three regressors - Fdi\_gdp, HK, and L - revealed significant impacts on per\_GDP in the long run and have the expected signs.
- Unlike the developed countries, long run per capita GDP is not affected by Invt\_GDP. However, the non-significance result of the  $C_{index}$  is similar to the result of the developed markets, and in agreement with Campos et al (2010).
- A comparison between the size of the coefficients in the two groups of nations show that except for the HK parameter the magnitude of the elasticities of the other variables are larger for developed countries in the long run.
- That the size of the coefficient of HK is smaller in developed countries may possibly be due to domestic investment contributing significantly more to economic growth in these countries (Mauro, 1998).



**Error Correcting Model of Per Capita Gross Domestic Product (developed countries)**

$\Delta \text{per\_GDP}_t = 31.90$	+	$34.90 \Delta \text{Fdi\_GDP}$	+	$2.39 \Delta L$	+	$210.56 \Delta \text{HK}$	
(3.98***)		(11.92***)		(4.32***)		(32.12***)	
+	$21.61 \Delta \text{Invt\_GDP}$	+	$2.45 \Delta \text{Invt\_GDP}_{t-1}$	+	$27.89 \Delta \text{Fdi\_GDP}_{t-1}$	-	$0.4513 \text{ECT}_{t-1}$
	(4.67***)		(2.76***)		(10.63***)		(-4.09***)
<b>Diagnostic Tests</b>							
$R^2 = 0.45$ $\overline{R^2} = 0.43$ $F = 90.5$ $DW = 1.89$ $NORM = 4.31$							
$AR = 0.78$ $ARCH = 0.12$ $HET = 0.26$ $RESET = 1.90$							

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.  $\Delta$  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 heteroscedasticity. HET is the unconditional heteroscedasticity test based on the regression of squared residuals. Finally, RESET = Ramsey test for functional form mis-specification.

- The variables  $\Delta Fdi\_GDP$ ,  $\Delta HK$ ,  $\Delta L$  and  $\Delta Invt\_GDP$  are all significant with the correct signs in the short run.
- 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 (-0.4513) suggests that it takes approximately two periods for per capita GDP to adjust to its long run equilibrium when a shock causes disequilibrium.
- The absence of the corruption index indicates that in the 28 developed markets corruption does not impact per capita GDP even in the short run.

**Error Correcting Model of Per Capita Gross Domestic Product (developing countries)**

$\Delta per\_GDP_t = -48.42$	+	$69.35 \Delta Fdi\_GDP$	+	$0.000006 \Delta L$	+	$168.04 \Delta HK$
(-0.89)		(12.93***)		(6.84***)		(27.92***)
$449.47 \Delta C_{index}$		$+ 45.66 \Delta Fdi\_GDP_{t-1}$		$- 0.169417 ECT_{t-1}$		
(2.99***)		(8.52***)		(-15.93***)		
<b>Diagnostic Tests</b>						
$R^2 = 0.337 \quad \overline{R^2} = 0.335 \quad F = 228 \quad DW = 1.96 \quad NORM = 7.864$						
$AR = 0.65 \quad ARCH = 0.15 \quad HET = 0.324 \quad RESET = 1.89$						

- The variables  $\Delta Fdi\_GDP$ ,  $\Delta HK$ ,  $\Delta L$  and  $\Delta C_{index}$  are all significant with the correct signs in the short run.
- The magnitude of the coefficient on the term (-0.1692) suggests that it takes approximately six periods for per capita GDP to adjust to its long run equilibrium when a shock causes disequilibrium, significantly slower than for the developed markets.

- The positive coefficient on the corruption index in the short run in developing countries 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, in concord with Campos et al (2010).

- 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

# Interaction Estimate

- The following model is formulated to capture the interaction effects:

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

- *Inter* is the interaction term (C\_index\*FDI\_GDP) and  $\gamma$  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.

## Interaction between Corruption and FDI

$$\Delta Y_t = -36.66 + 53.32 \Delta \text{FDI\_GDP} + 0.000002 \Delta \text{Labour\_Force} + 148.96 \Delta \text{School\_Enrolement}$$

$$(-0.71) \quad (8.91^{***}) \quad (2.79^{**}) \quad (25.69^{***})$$

$$378.09 \Delta \text{C\_index} + 8.65 \Delta \text{FDI\_GDP}_{t-1} + 53.21 \Delta \text{Inter} - 0.143 \text{ECT}_{t-1}$$

$$(8.17^{***}) \quad (12.56^{***}) \quad (18.02^{***}) \quad (13.97^{***})$$

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

$$\text{AR} = 0.74 \quad \text{ARCH} = 0.10 \quad \text{HET} = 0.421 \quad \text{RESET} = 1.65$$



- The model 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.

# Conclusion

- The results suggest that labour, capital flows and human capital are significant in the long run and have their expected positive sign.
- In the short run, the 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.