Corruption and Economic Growth: The African Experience

Emmanuel Anoruo and Habtu Braha

Abstract

This paper empirically investigates the effect of corruption on economic growth for 18 African countries using panel unit root and the Phillips-Hansen fully modified OLS procedures. The results from the IPS panel unit root tests indicate that corruption, economic growth, investment, and population growth have zero order of integration [i.e. I(o)]. The results from the Phillips-Hansen fully modified OLS procedure reveal that corruption retards economic growth directly by lowering productivity, and indirectly by restricting investment. From a policy perspective, efforts should be made to discourage corruption.

Keywords: Corruption, economic growth, investment, Transparency International, Africa

Introduction

Corruption has received significant attention among economists and international financial institutions during the last few decades, given its implications for economic growth. There are two schools of thought relative to corruption-economic growth nexus. One school of thought holds that corruption has beneficial effect on economic growth. The supporters of this view argue that corruption (i.e. payment of bribery to bureaucrats in many forms) acts like oil that greases and facilitates the engine of economic growth as it helps government officials to make the process of project approval more efficient. Hence, the proponents of this view including Leff (1964), Huntington (1968), Summers (1977), and Acemoglu and Verdier (1998) suggest that corruption introduces efficiency in the economy and affects economic growth positively.

The second school of thought maintains that corruption negates economic growth as it adds to the cost of business and introduces significant uncertainty in the decision making process. The proponents of this view including Murphy et al, (1993), Gould and Amaro-Reyes (1983), United Nations (1990), Mauro (1995), Mo (2001), and Monte & Papagni (2001) suggest that corruption is disadvantageous to businesses and innovators, especially those that lack the necessary cash flows and established lobbying power to either bribe or lobby the bureaucrats.

Cultural differences make it difficult to find consistent global definition of corruption. Some cultures think of bribery as corruption while others consider it as gifts. Nevertheless, corruption has been defined as an act whereby government officials extract from individuals and businesses for services provided in addition to their salaries and beyond the taxes that businesses are required to pay to the government. In this respect, Murphy *et. al*., (1993) suggest that corruption can be viewed as an additional tax on business transactions. Wei (2001) provides lengthy discussion on the various types and ratings of corruption across countries. Wei's corruption ratings are based on expert opinions and surveys of firms or citizens.

A number of studies have shown that corruption affects economic growth through both domestic and foreign investments. Shleifer and Vishny (1993) and Bardhan (1997) suggest that corruption has some sort of distributional effects, as it promotes redistribution of resources. Businesses derive benefits from corrupt state machinery by forging patron-client relationships. Leff (1964) and Huntington (1968) suggest that corruption increases economic growth for a number of reasons including helping entrepreneurs to avoid bureaucratic delay by bribing officials. Lui (1965) suggest corruption minimizes waiting costs thus reducing inefficiency in economic activity. Beck and Maher (1986) and Lien (1986) maintain that allocative efficiency can exist even where corrupt officials grant bids to the highest bidder.

Santhanam Committee on prevention of corruption in India (1964) and Myrdal (1968) found that corrupt officials cause unnecessary delay in the bureaucracy increase the transaction cost of doing business. The corrupt officials, instead of speeding up slow down the process seeking more bribes. These studies conclude that corruption leads to inefficiency. Andvig (1991) and Barro (1991) investigated the relationship between economic growth and investment. They found that corruption negates economic growth through investment. Mauro (1995) using econometrics analysis found significant negative relationship between economic growth and corruption over the period 1960-1985. Mauro (1997) concludes that corruption reduces expenditures on health and education. Similarly, Tanzi and Davoodi (1997) examined the effects of corruption on public finances and found that corruption increases public investment at the expense of private investment. Wei (1997) maintains that corruption, acting like a tax, negates foreign direct investment. Gupta *et al* (1998) find that corruption leads to inequality and poverty it through its negative influence on economic growth. In addition, other factors such as biased tax system (which favors the rich and influential), low social spending, unequal access to education, interest groups, and lobbying also contribute to income inequality and poverty for the sample countries.

Ali and Isse (2003) examine the determinants of corruption. They investigate the extent to which education, political regimes, and the type of the state, ethnicity, judicial efficiency; political freedom and the size of government explain differences in corruption across countries. They contend that knowledge of the determinants of corruption would help authorities to design and implement measures to curb and control its harmful effects.

Rahman *et al* (1999) examined the effects of corruption on economic growth and gross domestic investment for Bangladesh. This study extended the earlier studies by Baro (1991). Unlike the previous studies, the authors modified Mauro's model by including two regional dummy variables. They find that corruption is significantly and negatively associated with cross-country differences in economic growth and gross domestic investment. In addition, they suggest that corruption retards economic growth by reducing foreign direct investment. They caution that endogeneity must be looked at more seriously in investing the relationship between corruption and economic growth.

It is clear from the earlier studies in the extant literature that there is no consensus relative to the effect of corruption on economic growth. There are claims on both sides of the aisle regarding the usefulness or harmfulness of corruption. Studies, which claim that corruption is harmful to economic growth, tend to focus attention on the implications of corruption for efficiency. Yet, other studies advocate that corruption greases the wheels of business and commerce and thus, facilitates economic growth and investment. Further, the previous studies have mainly focused attention on the effect of corruption on economic growth in the context of OECD countries. Only a handful of studies including Gyimah-Brempong (2002) and Tanzi and Davoodi (1997) have examined this issue for Africa. It is therefore fair to argue that African countries have not received adequate attention on this subject even though most of the corrupt nations in the world are located in this continent. In addition, most of the previous studies, did not apply the unit root tests to ascertain the time series properties of the variable in the system. The omission of these important tests could lead to spurious regression as suggested by Engle and Granger (1987). In light of these drawbacks, this study uses panel unit framework proposed by Im *et al.* (1997) (henceforth, IPS) and the Phillips-Hansen (1990) fully modified OLS (FM-OLS) to investigate the relationship between corruption and economic growth for a sample of 18 African countries including Angola, Burkina Faso, Cameroon, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Ghana, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Niger, Mozambique, Sierra Leone, Togo, Uganda, and Zambia. The FM-OLS is particularly suitable for the present study because it enables us to simultaneously correct for the effect of serial correlation in the error term and the endogeneity of the regressors.

The sample countries present an excellent avenue to investigate the relationship between corruption and economic growth given the fact that corruption is prevalent in the African continent. For example, the average corruption index for the sample countries is roughly 2.37, which is at the high end of the corruption scale. Economic growth on the other hand, averaged about 2.07 percent among the sample countries for the period under consideration. It is therefore obvious from these figures that corruption is rampant, while growth is anemic among the sample countries.

The organization of the paper is as follows. Section 2 presents the data and summary statistics. Section 3 discusses the methodology. Section 4 furnishes the empirical results. Section 5 presents the conclusions and policy implications of the study.

Methodology

The IPS panel unit root procedure is used to determine the time series properties of corruption, economic growth, population growth, initial output, and investment ratio of GDP. The standard ADF procedure is based on the following equation:

$$\Delta X_t = \alpha_0 + \beta_1 X_{t-1} + \delta t + \sum_{i=1}^{\rho} \theta_i \Delta X_{t-1} + \varepsilon_t \tag{1}$$

where Δ is first-difference operator, t represents time trend, and ε stands for stationary random error, and ρ is the optimal lag length. The null and alternative hypotheses under ADF unit root test are that $\beta = 0$ and $\beta \neq 1$, respectively. The IPS panel unit root procedure is derived by using the average of the individual ADF *t-statistics* from independent cross-sections. The average ADF is based on the following:

$$\Psi_t = \frac{\sqrt{N}(\bar{t}_{N,T} - E[\bar{t}N, T(\rho,0)])}{\sqrt{Var(\bar{t}N, T)}} \Rightarrow N(0,1), \tag{2}$$

where $\Rightarrow$ represents convergence in distribution, $\bar{t}_{N,T}$ = (1/N) $\sum_{t=1}^{N} ti$, is the *t*-statistic for the OLS estimate of ρ in equation (1) for the i^{th} unit of the cross-section, and $E[\bar{t}N, T(\rho,0)]$ is taken under the hypothesis ρi, = 0 for all i and with the choice $\rho = (\rho_1, \rho_2, \rho N)$ for each cross-section. The computed value of ψ_t is compared to critical values for one-sided N (0, 1) distribution.

We next employ the Phillips and Hansen (1990) fully modified OLS (FM-OLS) procedure to obtain the long run estimates for the variables. The model specification for the FM- OLS procedure utilized by the study is as follows:

$$EG_t = \alpha_0 + \alpha_1 COR_t + \alpha_2 K_t + \alpha_3 PG_t + \alpha_4 Y_0 + \varepsilon_t \tag{3}$$

$$K_t = \alpha_0 + \alpha_1 COR_t + \alpha_2 EG_t + \alpha_3 PG_t + \varepsilon_t \tag{4}$$

$$PG_t = \alpha_0 + \alpha_1 COR_t + \alpha_2 EG_t + \alpha_3 K_t + \varepsilon_t \tag{5}$$

Where EG represents growth rate of GDP, COR is the corruption index, K stands for capital (proxied by investment percent of GDP), PG represents population growth rate (proxy for labor), Y_o represents initial output, and ε_t is the error term. In equation (3), capital (K) and population growth (PG) are expected to have positive effect on economic growth (EG) (i.e. $\alpha_2 > 0$ and $\alpha_3 > 0$). On the other hand, initial output (Y_o) is expected to negatively influence economic growth (i.e. $\alpha_4 < 0$). However, corruption could either have positive or negative effect on the economic growth (i.e. $\alpha_1 >< 0$).

Corruption has been shown to effect economic growth both directly and indirectly. Directly, corruption reduces economic growth by discouraging productive utilization of capital and encouraging resource misallocation. Indirectly, corruption reduces economic growth by lowering investment in both physical and human capital. With these arguments in mind, we formulate equation (3) to account for the direct effect of corruption on economic growth. To assess the indirect effect of corruption on economic growth through investment and human capital, formulate equations (4) and (5), respectively. We estimate equation (4) to gauge the effect of corruption on investment. In equation (4), population growth (PG) is expected to have negative effect on capital (K) ($\alpha_3 < 0$).

Data And Summary Statistics

The data used in this study consist of annual observations on corruption index, economic growth, capital (proxied by investment as percentage of GDP), labor (proxied by population growth), and initial output (proxied by GDP per capita lagged by one period) for 18 African countries. The data on economic growth, capital, labor, and initial output were collected from the World Bank's *Development Indicators* CD-ROM data disk, 2003. The data cover the period 1984 through 2000 for each country. The data on corruption index were taken the *Transparency International.* Corruption index ranges from 0 to 10. An index of 0 indicates a highly corrupt country. On the other hand, an index of 10 indicates a highly clean country. In other words, the lower the index, the more corrupt a country is. Similarly, the higher the index, the least corrupt a country is. The sample countries include Angola, Burkina Faso, Cameroon, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Ghana, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Niger, Mozambique, Sierra Leone, Togo, Uganda, and Zambia.

Table 1 presents the descriptive statistics for corruption index (COR), economic growth (EG), capital (K), population growth (PG), and initial output (proxied by lagged value of GPD per capita) (Y_o) for the full sample. As can be seen from Table 1, the mean values of EG, COR, K, PG, and Y_o are 2.07, 2.57, 16.60, 2.74%, and \$373.30. The maximum and minimum values indicate cross-country variability among the variables used in the study. The standard deviations reveal that real disposable income (6.023) fluctuated the most. In contrast, RGC with a standard deviation of .855 fluctuated the least.

Table 2 displays the Pearson's correlation coefficients respectively corruption index, economic growth, capital, population growth, and initial output. The results reveal that economic growth and capital are positively correlated with corruption. In contrast, population growth and corruption are negatively correlated. However, the analysis of short-run correlation relationships may be spurious. As a result, a more rigorous analysis must be undertaken to underpin the effects of corruption on economic growth.

Empirical Results

This section presents the data and the empirical results of the study. Table 3 presents the IPS panel unit root results. The results suggest that corruption; economic growth, capital, labor, and initial output are level stationary. The null hypothesis of non-stationarity is rejected at the 5 percent level for with and without time trend. In each case, the test statistic exceeds the critical value at the 5 percent level of significance. In all, the results from the IPS panel unit root suggest that the series have zero order of integration [I (0)].

Having ascertained the order of integration for the series, we next implement the FM- OLS to obtain the long run estimates for the various variables. Prior to interpreting the results, it is important to point out that high corruption index implies low corruption, while low corruption index indicates high corruption. Table 4 displays the results for economic growth [i.e. equation (4)]. The results reveal that the effect of corruption on economic growth is sensitive to the inclusion of the transmission channels including capital and labor. From column 2 of Table 4, we observe that the regression coefficient on corruption is 0.961. It exceeds 1 in columns 3 and 4 where the transmission channels were included separately. However, when both channels were included as in column 5, it decreases to 0.757. In all of the cases, the regression coefficient on corruption is statistically significant at least at the 5 percent level. The fact that the regression coefficient on corruption fluctuated with the inclusion of the transmission channels suggests that in addition to direct effect, corruption can also influence economic growth through capital and labor. The results in Table 4 show that low corruption is associated with high economic growth. For example, using column 5 of Table 4, we infer that one standard deviation decrease in corruption translates to about 0.83 percent (found by 1.1x 0.757) increase in economic growth. The results suggest that improvement in corruption engenders economic growth. To assess the robustness of the results obtained from the FM-OLS, we re-estimate equation (3) using the generalized instrumental variable method (GIVM). The results from the GIVM corroborate those obtained from the FM-OLS relative to the effect of corruption on economic growth. The results from the GIVM are presented in column 3 of Table 3. The results again show that the regression coefficient on corruption positively significant at the 5 percent level. These results suggest that improvement in corruption engenders economic growth for the sample countries.

We next examine the effects of capital and population growth on economic growth. The results indicate that capital has positively significant impact on economic growth. This is consistent with economic theory, which stipulates that capital stock is an essential ingredient for economic growth. Turning to the effect of population growth on economic growth, we observe that increases in population negate economic performance, as the regression coefficient on PG is negative and statistically significant at the 1 percent level. This finding contradicts the conventional wisdom, which stipulates that labor is an important input in the process of economic growth. This anomaly could be attributed to the quality of data. It could also be blamed on the abundance of unskilled labor in most African countries. Estimation method could also be the culprit given that the regression coefficient on PG is significantly positive at the 5 percent level under the generalized instrumental variable method.

Table 5 presents the results from the two transmission channels including investment percent of GDP and population growth. From column 2 of Table 5 we observe that corruption has positively significant effect on investment percent of GDP at the 1 percent level. From the result we infer that a one-unit improvement in corruption increases investment percent of GDP by about 4.69 percent (found by 1.10 x 4.262). This indicates that low corruption is associated with high investment. This finding is consistent with Tanzi and Davoodi (1997). The results reveal that both economic and population growth have significant effect on investment. These results indicate both economic and population growth rates are important determinants of investment.

Column 3 of Table 5 displays the indirect effect of corruption on economic growth through population growth. The results suggest that corruption has negative influence on population growth, as the regression coefficient on COR is negative and statistically significant at the 5 percent level. Economic growth has negative significant impact on population growth at the 1 percent level. This finding corroborates the notion that corruption misallocates talents. Given that in the presence of corruption, rent seeking tends to be more lucrative than productive work. Ehrlich and Lui (1999) suggest that corruption encourages officials to engage in rent seeking and in the process accumulate political capital, which is socially unproductive. Finally, reveal that investment percent of GDP has positive significant influence on population growth at the 5 percent level. This result implies that as investment increases, population growth rises.

Conclusion And Policy Implications

This paper has used the FM-OLS procedure to investigate the long-run dynamics between economic growth and corruption for panel of 18 African countries. Specifically, the study utilized the IPS panel unit root procedure to determine the time series properties for economic growth, corruption, investment percent of GDP, and population growth. The FM-OLS is estimated to ascertain the long-run dynamics between economic growth and corruption.

The results from the IPS panel unit root test indicate that the series have zero order of integration [i.e. I (0)]. The results from the FM-OLS suggest that corruption has both direct and indirect implications for economic growth. The study makes several important findings. First, the results reveal that a one-unit increase in corruption retards economic growth by roughly 0.87 percent for the period under consideration. The finding that corruption has negative influence on economic growth is consistent with Gyimah-Brempong (2002). Second, corruption negates investment share of GDP. A one-unit increase in corruption translates to about 4.69 percent decrease in investment share of GDP. Third, corruption has implications for population growth. Taken together, these results suggest that corruption directly negates economic growth by lowering productivity, and indirectly by hampering investment. Our findings support the conventional wisdom, which stipulates that corruption is detrimental to economic growth and development.

Based on the findings of this study it is obvious that efforts should be made to curtail corruption at all levels among the sample countries. Laws aimed at the reduction of corruption should be vigorously pursued and enforced. Institutions should be established to enforce corruption laws.

References

Acemoglu, D. and Verdier, T. (1998), “Property Rights, Corruption and the Allocation of Talent: A General Equilibrium Approach,” *Economic Journal*, 108, 450: 1381-1403

Ades, A. and Di Tella R. (1997), “ The causes and Consequences of Corruption: A Review of Recent Empirical Contributions”, *Institute of Development Studies Bulletin*, 27: 6-12.

Andvig, J. C. (1991), The Economics of Corruption: A Survey," *Studi Economici,* 43, 57-94.

Ali, A.M. and Hodan, S. I., (2003), "Determinants of Economic Corruption: A Cross-Country Comparison", Cato *Journal*, Washington, 22, 3, 449-469.

Bardhan, P. (1997) “ Corruption and Development: A Review of the Issues.” *Journal of Economic Literature*, 35: 1320-46.

Barro, Robert, (1991)."Economic Growth in a Cross-Section of Countries," *Quarterly Journal of Economics*, 106,2, 407-443.

Barro, Robert . (1996), "Determinants of Economic Growth: A Cross-Country Empirical Study," *NBER Working Paper*, No. 5698.

Beck, P.J. and Maher, M.W.(1986). "A comparison of Bribery and Bidding in Thin Markets," *Economics Letters*, 20, 1-5

Bhagwati, J.N. (1982) "Directly Unproductive Profit-Seeking (DUP) Activities." *Journal of Political Economy,* 90: 988-1002.

Buchanan, J.M. Tullock G and Tollison, R. .Eds. (1980), Toward a Theory of the Rent-Seeking Society, College Station, Texas A & M University Press.

Campos, J. E. Lien, D. and Pradhan, S. (1999) "The Impact of Corruption on Investment: Predictability Matters." *World Development,* 27 (6): 1059-67.

Ehrlich, Isaac and Francis T. Lui (1999). "Bureaucratic Corruption and Endogenous Economic Growth," Journal of Political Economy, 107, 270-293.

Engle, R.F. and C.W.J. Granger (1987), "Cointegration and Error Correction: Representation, Estimation, and Testing," *Econometrica*, 55, 251-276.

Gould, David J., and Amaro-Reyes, Jose A. (1983), "The Effects of Corruption on Administrative Performance", *World Bank Staff Working Paper No. 580*, Washington, DC.

Gupta, S.H. Davoodi, and R. Alonso Terme. (1998). "Does Corruption Affect Income Inequality and Poverty?" *IMF Working Paper 98/76*. International Monetary Fund, Washington D.C.

Gyimah-Brempong, K. (2002), "Corruption, Economic Growth, and Income Inequality in Africa," *Economics of Governance*, 3, 183-209.

Huntington, S. P. (1968), Political Order in Changing Societies, New Heaven: Yale University Press.

Im, K., Pesaran, H. and Shin, Y. (1995), "Testing for Stationarity in Heterogeneous Panels", *Manuscript*, University of Cambridge.

International Monetary Fund. (1998), Roads to Nowhere: "How Corruption in Public Investment Hurts Growth." Washington D.C.

Krueger, A.O. (1974) "The Political Economy of the Rent-Seeking Society." *American Economic Review,* 137(2): 333-38

Leff, N.H. (1964). “Economic Development through Bureaucratic Corruption.” *American Behavioral Scientist,* 8(3):8-14.

Lien, D.H.D. (1986). "A Note on Competitive Bribery Games." Economic Letters. 22. pp337-41.

Lui F.T. (1996). “Three Aspects of Corruption.” *Contemporary Economic Policy,* 14(3) 26-29.

Mauro, P. (1995), “Corruption and Growth.” *Quarterly Journal of Economics*, 109, 681-712.

_____________, (1997), “Why Worry About Corruption,” International Monetary Fund, Washington D.C.

_____________, (1997) “The Effects of Corruption on Growth, Investment and Government Expenditure: A Cross-Country Analysis.” In Kimberly Ann Elliot eds., Corruption and the Global Economy, Institute for International Economics. Washington, D.C. pp.83-108

_____________, (1998) “Corruption: causes, Consequences and Agenda for further research. “ Finance and Development, 35, 11-14.

_____________, (1998) “Corruption and the Composition of Government Expenditure. *Journal of Public Economics*, 69, 263-279.

Meagher, Patrick (1997), “Combating Corruption in Africa: Institutional Challenges and Response,” Paper Presented at the IMF Seminar on Combating Corruption in Economic and Financial Management, Lisbon, May 19-21.

Mo, Pak Hung. (2001). “Corruption and Economic Growth” *Journal of Comparative Economics*, 29, 66-79.

Monte, Alfredo Del and Erasmo Papagni. (2001) “Public Expenditure, Corruption, and Economic Growth: The Case of Italy.” *European Journal of Political Economy*, 17, 1, 1-16.

Murphy, Kevin M. et al, (1993). ""Why is Rent-Seeking So Costly to Growth?" American Economic Review. 83,2:409-414

Ng, S. and P. Perron (2002) “PPP May not hold After All: A Further Investigation,”

Annals of Economics and Finance, 3, 41-19.

_____________, (2001) “Lag Length Selection and the Construction of Unit Root

Tests with Good Size and Power,” *Econometrica*, 69, 1519-1554.

Pellegrini, L. (2003), “Corruption, Economic Development and Environmental Policy.” *Political Economy of the Environment*, Institute for Environmental Studies, IVM, The Netherlands.

Phillips, P.C.B. and Hansen, B.E. (1990), "Statistical Inference in Instrumental Variables Regression with me (1) Processes", *Review of Economic Studies*, 57, 99-125.

Rahman, Aminur, Gregory Kisunko and Kapil Kapoor (1999). “The Effects of Corruption Implications for Bangladesh, *Policy Research Working Papers,* WPS2479, World Bank, Washington D.C.

Shleifer, A. and Vishny R. (1993), “Corruption”, *Quarterly Journal of Economics,* 108(3): 599-617

Summers (1977), Speech to the Summit of Eight, Denver.

Tanzi, Vito and Hamid Davoodi (1997), ”Corruption, Public Investment and Growth.” *IMF Working Paper,* WP/97/139.

United Nations (1990). Corruption in Government. New YOrk: United Nations.

Wei, S. J. (1977), "How Taxing is Corruption on International Investors?," *NBER Working Paper 6030*.

Wei, S. J. (2001), “Corruption in Economic Development: Grease or Sand?,” *Economic Survey of Europe*, Geneva: United Nations Economic Commission for Europe.

World Bank (2003), *World Development Indicators*, Washington D.C.

Table 1: Summary Statistics

	EG(%)	COR	K(%)	PG(%)	Y_0(US$)
Mean	2.07	2.57	16.60	2.74	373.30
Maximum	16.73	4.00	48.40	4.36	1029.00
Minimum	-28.10	0.00	1.76	0.61	94.93
Std. Dev.	5.66	1.10	7.49	0.59	230.06
COV	2.74	0.43	0.45	0.21	0.62
Observations	306	306	306	306	306

EG = GDP growth rate, COR = corruption index, K = investment percent of GDP (proxy for capital), PG = population growth (Proxy for labor), Y_0 = initial output (GDP per capita lagged by one period).

Table 2: Pearson Correlation Matrix

	COR	EG	K	PG	Y_0
COR	1.000				
EG	.2001	1.000			
K	.034	.172	1.000		
PG	-.041	-.028	-.110	1.000	
Y_0	.058	-.081	.070	.256	1.000

EG = GDP growth rate, COR = corruption index, K = investment percent of GDP (proxy for capital), PG = population growth (Proxy for labor), Y_0 = initial output (GDP per capita lagged by one period).

Table 3: Unit Root Tests for Heterogeneous Panel

		Without Trend		With Trend	
Series	Test	Level	Difference	Level	Difference
COR	IPS ADF-stat	-2.84^{**}	—	-2.33^{**}	—
EG	IPS ADF-stat	-5.05^{**}	—	-4.79^{**}	—
K	IPS ADF-stat	-3.43^{**}	—	-3.27^{**}	—
PG	IPS ADF-stat	-4.66^{**}	—	-4.37^{**}	—
Y_O	IPS ADF-stat	-2.17^{**}	—	-1.81^{**}	—

** indicates the rejection of the null hypothesis of non-stationarity at the 5% level. The 5% critical value for IPS is -1.645. The null hypothesis of non-stationarity is rejected if the test statistic is less than the critical value (-1.645). EG = GDP growth rate, COR = corruption index, K = investment percent of GDP (proxy for capital), PG = population growth (Proxy for labor), Y_0 = initial output (GDP per capita lagged by one period).

Table 4: Long-Run Estimates

Dependent Variable: Economic Growth (EG)					
	Estimation Methods				
	FM-OLS	FM-OLS	FM-OLS	FM-OLS	Instrumental Variables
Regressors	(1)	(2)	(3)	(4)	(5)
Constant	0.857	-4.504***	-0.405	4.200**	7.844**
	(0.92)	(3.97)	(0.26)	(2.02)	(2.50)
COR	0.961***	1.213***	1.701***	0.757**	1.211**
	(3.35)	(4.21)	(6.34)	(2.41)	(3.40)
K	—	0.308***	—	0.154***	0.155**
	—	(7.28)	—	(3.32)	(2.53)
PG	—	—	-0.625	-2.421***	2.136**
	—	—	(1.21)	(4.11)	(2.05)
Y_0	-0.003**	-0.01***	-0.516	-0.11***	-0.04**
	(2.48)	(3.24)	(0.39)	(2.98)	(2.54)

Notes: Absolute value of t -statistics are in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. EG = GDP growth rate, COR = corruption index, K = investment percent of GDP (proxy for capital), PG = population growth (Proxy for labor), Y_0 = initial output (GDP per capita lagged by one period). Sixteen lags for the non-parametric correction and equal weights window were used for the equation with all transmission channels. One period lag of COR; K, PG, Yo and the constant are used as instruments for the instrumental variable method.

Table 5: Estimation for Transmission Channels based on Fully Modified OLS

	Dependent Variable	
Independent Variables	Investment (K)	Population Growth (PG)
Constant	-49.430***	2.894***
	(7.32)	(12.05)
COR	4.262***	-0.168**
	(3.66)	(2.53)
EG	0.368*	-076***
	(1.63)	(5.82)
K	—	0.026**
		(2.73)
PG	19.796***	—
	(9.31)	

Notes: Absolute value of t -statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. EG = GDP growth rate, COR = corruption index, K = investment percent of GDP (proxy for capital), PG = population growth (Proxy for labor), Y_0 = initial output (GDP per capita lagged by one period). Fifteen lags for the non-parametric correction and equal weights window were used.