Corruption, Investment and Economic Growth: Theory and International Evidence

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Abstract

This paper analyzes the real effects of corruption on a firm's production function. Using an augmented-Solow Growth model, with multifactor productivity as a function of corruption, a closed-form solution is derived for real GDP per capita, economic growth and physical capital per capita, at steady-state. With the a priori assumption of a negative relationship between corruption and multifactor productivity, it is shown that corruption negates a society's standard of living, economic growth and investment level. OLS results of the closed-form solutions not only support this theoretical finding for a full cross-section of countries, but they also reveal that corruption may have a positive concave effect on economic variables for the OECD sample. Nonlinear least squares estimates of the elasticities of physical and human capital, with the inclusion of the corruption index, confirm that the productivity of inputs is impacted.

1. Introduction

During the past decade, corruption and its impact on the economy have received a great deal of attention**.** The resurgence of this topic is a consequence of a couple of factors. First, there is an increase in the number of corruption indexes. Researchers can now empirically examine the effects of corruption on output and other factors. Second, and more importantly, corruption has become more prevalent in the global economy (Tanzi, 1998).

With few exceptions [(Leff, 1964) and Huntington, (1968)], the effects of corruption on the economy have been shown to be negative [(Mauro, 1995 and 1996), Leite and Weidmann, 1999), (Tanzi, 1998) and (Tanzi and Davoodi, 1997)]. For the most part, these authors have focused on the linear relationship between corruption and economic growth. In these models, bribery is taken in the same context as taxation with little emphasis placed on its impact on factors of production. Therefore, the effects of corruption on the production function have not been fully investigated.

It is with this objective in mind that this author departs from the conventional view of corruption. This paper argues that the effect of corruption goes *beyond* the pricing system. In this framework, corruption is treated as an exogenous factor that deteriorates the productivity of inputs of a representative firm's production function. The deterioration may take various forms, ranging from the effects of externalities or diminished quality of inputs. The firm who pays a bribe to a bureaucrat to avoid fines not only reduces its level of investment, but it may also impose externalities onto other firms. When a high government official makes an attempt to provide public goods by doing business with his unqualified cronies, this comes at the cost of reduced productivity in the private sector (Vito and Tanzi, 1997.

2. The Model

The model begins with an economy that produces only one good. Output is produced with a well-behaved neoclassical production function with positive and strictly diminishing marginal products of human and physical

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capital. The Inada conditions assure that the marginal products of both capital and labor approach infinity as their values approach zero and approach zero as their values go to infinity. The functional form of the production function is Cobb-Douglas[1]

$$Y_t = K_t^{\alpha} H_t^{\beta} [A_t(\rho) L_t]^{1-\alpha-\beta}; \tag{1}$$

where Y_t is the aggregate level of real income, K_t is the level of physical capital, H_t is the level of human capital, L_t is the amount of labor employed, A_t is the level of multifactor productivity and ρ is the level of corruption in a country; where $A'(\rho) < 0$.

Let $0 < \alpha < 1$, $0 < \beta < 1$ and $\alpha + \beta < 1$. These ensure that the production function exhibits constant returns to scale and diminishing return to each input. The state equations are:

$$\frac{dK}{dt} = s_K Y_t - \delta_K K_t \tag{2}$$

$$\frac{dH}{dt} = s_H Y_t - \delta_H H_t; \tag{3}$$

where s_H, s_K, δ_H and δ_K are exogenous parameters that represent, respectively, shares of income that are allocated to human capital investment, physical investment, and depreciation rates of human and physical capital. Population is exogenously determined and defined as $L_t = L_o e^{nt}$ so that population growth is constant over time, $(dL/dt)/L_t = n$.[2]

Let A_t describe the economy's multifactor productivity;

$$A_t(\rho) = \tilde{A}_t e^{-\gamma\rho}, \text{ where } 0 \le \rho \le 1 \text{ and} \tag{4}$$

$$\tilde{A}_t = A_o e^{gt}. \tag{5}$$

The corruption parameters, ρ and γ, together determine the magnitude of the effect of corruption on multifactor productivity. The parameter, ρ, is a measure of the economy's overall level of corruption while γ captures the sensitivity of corruption to the production function. Conventional multifactor productivity, $\tilde{A}_t$, is exogenous and grows at rate g. We assume that $dA_t/d\rho < 0$ and $d^2A_t/d\rho^2 > 0$. If there is no corruption ($\rho = 0$), then $\tilde{A}_t = A_t$ and equation (6) reverts to the traditional Solow growth model (MRW, 1992). The sign and value of γ are instrumental in modeling the net effect of corruption on multifactor productivity. Since ρ is a nonnegative real number bounded by 0 and 1, a positive (negative) value of γ causes corruption to reduce (improve) multifactor productivity.

2.1. Steady State Level Equation

The steady state levels of physical and human capital per effective worker and output per effective worker are as follows:

$$k^*_t = \left[\frac{s_k}{n+\delta_k+g}\right]^{(1-\beta)/(1-\alpha-\beta)} \left[\frac{s_h}{n+\delta_h+g}\right]^{(\beta)/(1-\alpha-\beta)} e^{-\gamma\rho} \tag{6}$$

$$h^*_t = \left[\frac{s_k}{n+\delta_k+g}\right]^{(\alpha)/(1-\alpha-\beta)} \left[\frac{s_h}{n+\delta_h+g}\right]^{(1-\alpha)/(1-\alpha-\beta)} e^{-\gamma\rho} \tag{7}$$

$$y^*_t = e^{-\gamma\rho} k^{*\alpha}_t h^{*\beta}_t \tag{8}$$

where $k^*_t = K_t/(\tilde{A}_t L_t)$, $h^*_t = H_t/(\tilde{A}_t L_t)$ and $y^*_t = Y_t/(\tilde{A}_t L_t)$.

It is further assumed that physical and human capital depreciate at the same rate so that $\delta_H = \delta_K = \delta$. From these equations, logarithmic steady state expressions for real output and physical investment per worker are as follows:

$$\ln\left(\frac{Y_t}{L_t}\right) = \ln(A_o) + gt + \frac{\beta}{1-\alpha-\beta}\ln(s_h) + \frac{\alpha}{1-\alpha-\beta}\ln(s_k) - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+\delta+g) - \gamma\rho. \tag{9}$$

$$\ln\left(\frac{K_t}{L_t}\right) - \ln\left(\frac{K_o}{L_o}\right) = \frac{\beta}{1-\alpha-\beta}\ln(s_h) + \frac{1-\beta}{1-\alpha-\beta}\ln(s_k) - \frac{1}{1-\alpha-\beta}\ln(n+\delta+g) - \ln\left(\frac{K_o}{L_o}\right) - \gamma\rho \tag{10}$$

where $\frac{K_o}{L_o}$ is the initial level of physical capital per worker **.**

With the exception of the corruption term, the equations for steady state output per worker and physical investment per worker are consistent with the standard neoclassical growth model. Conditional convergence in physical capital, the hallmark of the neoclassical growth model, is also expressed in equation (14). The effect of corruption on the two endogenous variables remains ambiguous, as it depends on the sign of γ. However, a priori, corruption has a negative impact on capital accumulation and thus implies that γ is a positive-valued parameter. Hence, higher levels of corruption will reduce average investment per worker.[3]

2.2. Convergence To Steady State

An expression for the speed of convergence at steady state is expressed as the first order linear differential equation:

$$d\ln y_t/dt = \lambda(\ln y^{ss} - \ln y_t) \tag{12}$$

where λ is a parameter for the speed of convergence. A solution to equation (12) is written as:

$$\ln y_t - \ln y_0 = (1 - e^{-\lambda t})\left[\ln(A_o) + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+\delta+g) + \frac{\alpha}{1-\alpha-\beta}\ln(s_K) + \frac{\beta}{1-\alpha-\beta}\ln(s_H) - \gamma\rho - \ln y_0\right]. \tag{13}$$

Since the speed of convergence, λ, is a constant, equation (13) states that economic growth is a function of the initial level of multifactor productivity and its growth rate, population growth rate, physical and human capital investment rates, the level of corruption and initial level of output. Again, conditional convergence is captured with the negative relationship between initial level of output and the level of economic growth.

A priori, the sign of γ is assumed positive. Therefore, it can easily be shown from equation (13) that corruption reduces economic growth by acting as an opposing force to efficiencies obtained through improvements in multifactor productivity. Corruption reduces the effectiveness of physical and human capital, which consequently results in lower levels of output per worker and subsequently lower levels of output, since investment rates (s_k and s_H) are fixed.

3. The Corruption Data

The corruption data are extracted from the IRIS Time Series of the International Country Risk Guide (1997), developed by the IRIS Center (University of Maryland) [4]. As the author has alluded to in the introduction, there have been a number of indices of corruption that have become available to researchers in recent years (Transparency International, 2001). To a great extent, these measures are highly correlated and share some similar characteristics that contribute to their overall validity. For all of the data sets, the data points are highly persistent over time for OECD countries. This fact is not completely true for non-OECD countries. For these samples, there are measurable changes in corruption over time for a variety of countries. However, there are reasons why the author selects the ICRG data set to proxy corruption.

First, various authors have used the data set (Mauro (1995,1997), Vito and Tanzi (1997) and Keefer and Knack (1995), to name a few). Second, to avoid measurement errors that may arise from using only a few years or less as data points for corruption, the ICRG data set contains data for 13 consecutive years from 1982-1995. Moreover, this series best coincides with the national accounts data that ends in 1992.

The corruption index is an estimator of the degree of political corruption in a political system. It is a subjective measure of corruption for over 128 countries that ranges from 0 to 6, with 6 being the least corrupt. Each year's estimate is an average of perceived corruption for two months of that year. As measured, it is a measure of the degree of corruption in the form of "…special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection or loans." The estimate also takes into account " …excess patronage, nepotism, job reservations, favor-for-favors, secret party funding, and suspiciously close ties between politics and business" (ICRG, pg. 6). In their assessment, ICRG looks first at how long a government has been in continuous power. This data is then rectified to account for other political variables such as rule of law, accountability, etc.

Recall that the index of corruption bureaucratic agents in equation (1) is expressed as ρ. As its proxy, the function

$$CORRUPT(\varsigma_t) = (1 - \varsigma_t/6) \tag{14}$$

is used for two reasons. First, for ease of interpretation, CORRUPT(ς) transforms the raw corruption index so that higher values of CORRUPT correspond to higher levels of corruption. Second, since ς_t is bounded by 0 and 6, therefore, CORRUPT(ς) is bounded by 0 and 1. Rescaling makes CORRUPT more consistent with ρ, the percentage of corrupt agents. To capture any nonlinear effects of corruption, the corruption function will enter the production function both linearly and non-linearly. Therefore, ρ will take on two specific forms:

$$CORRPUPT = (1 - \varsigma_t/6), \text{ and} \tag{15}$$
$$CORRUPTSQ = (1 - \varsigma_t/6)^2. \tag{16}$$

4. The Results

Table 3 reports the results of the model of real GDP level in 1989 with and without corruption as an explanatory variable. The results of the base-line model (equations 1B, 1B and 1C) are consistent with that of MRW (1992). In an effort to estimate the elasticities of output with respect to physical and human capital (α and β), the restricted OLS models are also estimated. Their estimates are .31 and .23, for physical and human capital elasticities, respectively and are highly statistically significant. The author attributes any differences in the base–line results in Table 3 from that of MRW to three factors: differences in the time period (1960-1989), sample size and sample selection.[5]

The estimation of the model of real steady state GDP (equation (9)), is provided by specifications 2A, 2B, and 2C. With the exception of the log of investment, all of the coefficients of the variables enter the model statistically significant in the NON-Oil sample. The inclusion of the corruption variable increases the explanatory power of the specifications. There is an increase from 76% to 83% in explanatory power in the Non-Oil sample and from 61%

to 71% in the Non-OECD sample, as the standard error of the estimate falls from .51 to .43 and .55 to .48 for the two samples, respectively. In each specification, the coefficient of the corruption variable is negative and statistically significant. There is observed interaction between the investment and corruption variables. With the inclusion of the corruption variable in the regression, the level of the investment coefficient is greatly reduced and is no longer statistically significant. These phenomena give rise to the notion that the base-line equation, as that of MRW (1992) is mis-specified and suffers from a missing variable bias. Additionally, the level of the coefficient of the corruption variable is fairly stable over sample size, ranging from only -1.32 in the NON-OIL sample to -1.33 for the OECD sample. When output elasticity of corruption is taken at the mean, this implies that if corruption in Algeria were to improve to that of Italy, the standard of living of the average Algerian would improve to approximately that of the average Argentinean. Moreover, independent of the initial level of output per person and holding both forms of capital and population growth constant, an increase in corruption reduces the steady-state level of output per worker.

As a formal test of parabolic convexity, a Theil (1971) t-statistic is calculated for the corruption variable in each of the specifications listed above. Their values indicate that convexity is not a concern in Non-Oil and Non-OED samples. However, the same conclusion cannot be reached in the OECD sample. The Theil (1971) t-statistic detects a strong possibility of convexity in the BLUS[6] residuals when the data is sorted by the corruption variable. This is a convincing argument for the inclusion of a squared corruption term (CORRUPTSQ) in the regression equation (specification 2D). In the presence of high multicollinearity of CORRUPT and CORRUPTSQ, the coefficients of the CORRUPTSQ variable remain statistically significant in the OECD sample.[7] The Adj. R-Square of the OECD sample is increased from 29% to 50% with the inclusion of the corruption variable and to 62% with the corruption variable and its squared term. Similarly, the standard error of the estimates falls from .24 to .21 in specification 2D, providing more evidence to its superiority. The coefficient of the CORRUPTSQ coefficient is –6.33, suggesting a strong negative nonlinear relationship between corruption and output per worker for the OECD countries. Moreover, a continued increase in corruption of an OECD country decreases its standard of living, but at a decreasing rate. The output elasticity of corruption calculated at the mean value of corruption for an OECD country is .82.

Table 4 contains base growth models as an explanatory. Conditional convergence is a major finding as represented by a negative and statistically significant coefficient of ln(GDP60). An increase in the physical capital and human capital saving rates has a positive effect on convergence to steady state output. This is represented by positive and statistically significant coefficients of the investment and schooling variables. Moreover, the estimates of α, β and λ are statistically significant at the 1% level for the NON-Oil sample, but not for the non-OECD sample. The convergence rate of .015 for the non-OIL sample implies that a representative economy would take 46.2 years to be halfway from arrival to its steady-state output value. The OECD model explains 85% of the variation in growth rates of OECD member countries.

Specification 2A, 2B and 2C are the results of estimating equation (13). The signs and level of the coefficients for the non-OIL and non-OECD samples support the neoclassical model of economic growth. The coefficients of the corruption variable are statistically significantly, with observed interaction between the corruption variable and the other right-hand side variables. Corruption increases the magnitude and significance of the coefficient schooling and also reduces the level of the coefficient of the investment variable. Again, as in the level equation (specification 2B of Table 3) there is evidence of misspecification in the MRW (1992) growth. This fact is further corroborated with a reduction in the output elasticity of physical capital from .35 to .18 and an increase the output elasticity of human capital from .27 to .34, while these estimates remain highly statistically significant. Conditional convergence is preserved in the presence of the corruption variable in the model.

The Theil (1971) t-statistics reveals no caution for parabolic convexity in the economic growth model for the NON-OIL and NON-OECD specifications. Once again, however, the same is not true for the OECD sample. A t-statistic of –2.40 provides strong evidence of parabolic convexity in the corruption variable. Even more interesting is the surprising sign reversal of the corruption coefficient. This finding suggests that an initial increase in corruption has a positive effect on a developed country's convergence to its steady state output. When the square corruption term enters the model, the sign of its coefficient is negative and statistically significant. This unexpected finding suggests that initial increases in corruption enhance convergence to steady state output, albeit, at a decreasing rate. Furthermore, concavity of the corruption function suggests an "optimal" corruption.. The results for the OECD sample are striking and to run counter to what has been previously described. Rose-Ackerman (1999) offers one possible explanation for this phenomenon. She maintains that the optimal corruption level in any economy is not *zero*. She posits that detection and prevention of corruption utilizes scarce resources that would otherwise be used to produce goods and services. Rose-Ackerman firmly writes, "The optimal amount of corruption is not zero even if one gives no value to the benefits received by bribers. Once one takes the costs of prevention into account, the level of deterrence expenditures should be set where the marginal benefits equal the marginal costs" (Rose-Ackerman, pg 52).

OECD economic growth is plotted against each country's corruption index, in Appendix 1. This data coupled with the regression results above suggest that a preponderance of OECD countries behave sub-optimally. If firms had the ability of detecting and controlling the level of corruption that they face, they would. It stands to reason that corruption must be exogenous to a firm's production function, but politicians and government bureaucrats endogenously determine its level.

Table 1
Data Description

Variable name	Source	Description
ς	International Country Risk Guide (ICRG) – Compiled by Political Risk Services –	Average corruption from 1982-1989 for each country. Corruption Survey data ranging from "0" to "6". A score of "0" relates to a country with relatively the most corruption. A ranking of "6" relates to a country that is least corrupt.
CORRUPT	Derived using raw corruption variable, ς.	CORRUPT = (1 - ς/6). Converts raw corruption data to an index ranging from "0" to "1". The higher the index, the higher the average corruption.
CORRUPTSQ	Derived using raw corruption variable, ς.	CORRUPTSQ=CORRUPT*CORRUPT
GDP60	Penn World Table (Mark 5.6a)	Real GDP per worker (1985 International Prices) in year 1960.
GDP89	Penn World Table (Mark 5.6a), 1995	Real GDP per worker (1985 International Prices) in year 1969.
INV/GDP	Penn World Table (Mark 5.6a)	Average (1960-1989) real investment share of GDP (%) [1985 international prices]
POPGR	Penn World Table (Mark 5.6a)	Average population growth from years 1960-1989
SCHOOL	MRW, "A contribution to the empirics of Economic Growth", QJE, 1992.	Percentage of the working age population of ages 15-21 with a secondary education. (Average from 1960-1985).

Table 2A
Simple Correlation (of means) Matrix –83 countries

	POPGR	INV/GDP	GDP60	GDP89	SCHOOL	CORRUPT	CORRUPTSQ
POPGR	1.00						
INV/GDP	-.61	1.00					
GDP60	-.59	.57	1.00				
GDP89	-.76	.77	.88	1.00			
SCHOOL	-.60	.70	.62	.70	1.00		
CORRUPT	.59	-.67	-.66	.78	-.47	1.00	
CORRUPTSQ	.48	-.60	-.55	.66	-.39	.95	1.00

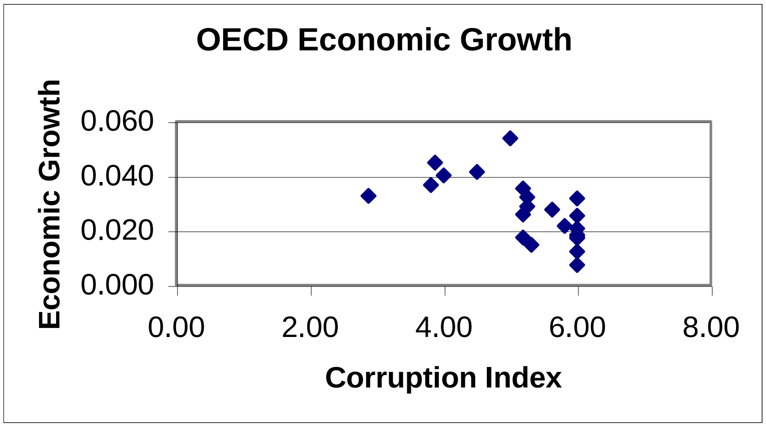
Source: Corruption data extracted from International Country Risk Guide (ICRG) – Complied by Political Risk Services. National accounts data taken from Penn World Table (Mark 5.6a), 1995.

Table 2B
Quantitative Data Description – Means, Standard Deviations, etc.

	NON-OIL SAMPLE (83 OBS)				NON-OECD SAMPLE (61 OBS)				OECD SAMPLE (22 OBS)			
	Mean	**Min**	**Max**	**S.D.**	**Mean**	**Min**	**Max**	**S.D**	**Mean**	**Min**	**Max**	**S.D**
POPGR	.02	.003	.04	.01	.02	.01	.04	.01	.01	.003	.02	.01
INV/GDP	17.53	1.48	34.84	8.095	14.47	1.48	30.78	6.93	26.02	18.12	34.84	4.01
GDP60	6849	579	24906	6074	4431	579	20445	3795	13554	3194	24906	6230
GDP89	12805	1043	36859	10464	7854	1043	25628	6340	26532	7867	36859	6643
SCHOOL	6.26	.50	11.90	3.379	5.25	.50	11.71	3.18	9.09	4.80	11.90	2.08
CORUPT	.43	.00	1.00	.28	.54	.00	1.00	.23	.13	.00	.52	.15

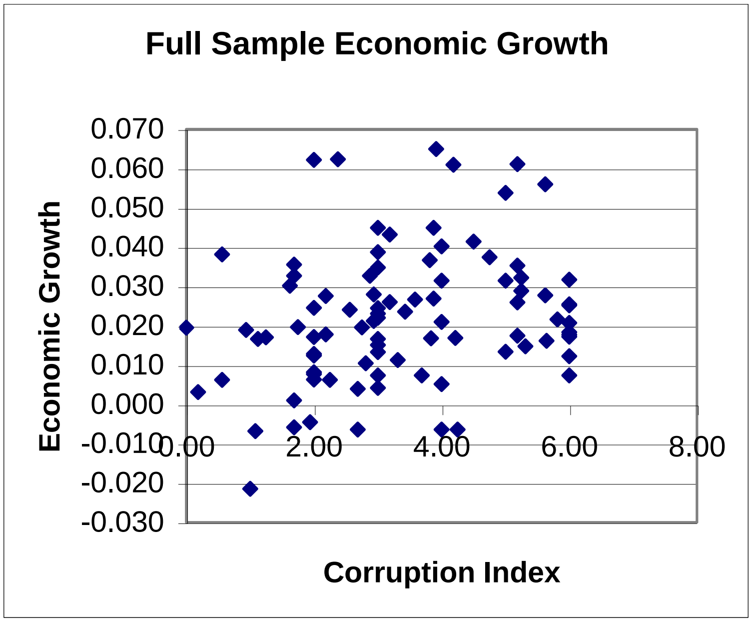
Source: Corruption data extracted from International Country Risk Guide (ICRG) – Complied by Political Risk Services. National accounts data taken from Penn World Table (Mark 5.6a), 1995.

Figure 1
Economic Growth
OECD Countries



Source: Corruption data extracted from International Country Risk Guide (ICRG) – Complied by Political Risk Services.
Economic growth taken from Penn World Table (Mark 5.6a), 1995.

Figure 2
Economic Growth
Full Countries



Source: Corruption data extracted from International Country Risk Guide (ICRG) – Complied by Political Risk Services.
Economic growth taken from Penn World Table (Mark 5.6a), 1995.

Table 3
Regression of GDP level – Eq. (9)

Dependent Variable: Log of GDP per working-age person in 1989

SAMPLE	**NON-OIL**	**NON-OIL**	**NON-OECD**	**NON-OECD**	**OECD**	**OECD**	**OECD**
N	**83**	**83**	**61**	**61**	**22**	**22**	**22**
EQUATION #	**(1A)**	**(2A)[D]**	**(1B)**	**(2B) [D]**	**(1C)**	**(2C) [D]**	**(2D)**
CONSTANT	.83	5.17	4.4	6.54	2.89	6.83	10.91
	(.85)	(4.09)	*(2.34)*	(3.04)	*(.59)*	(2.40)	(3.71)
Ln (INV/GDP)	.42	.16	.34	.11	.38	.26	.07
	(3.54)	(1.53)	*(2.62)*	(1.01)	*(.99)*	(.84)	(.23)
Ln (SCHOOL)	.60	.69	.64	.73	.58	.17	-.10
	(6.55)	(8.64)	*(7.14)*	(8.82)	*(1.67)*	(.85)	(-.68)
CORRUPT	---	-1.32	---	-1.33	---	-1.33	.87
	---	(-4.89)	---	(-4.68)	---	(-3.10)	(1.47)
	---	[T](.12)	---	[T](-.16)	---	[T](-2.30)	---
CORRUPTSQ	---	---	---	---	---	---	-6.33
	---	---	---	---	---	---	(-3.47)
Ln (.05 + POPGR)	-2.29	-1.08	-.1.58	-.57	-1.815	-.80	.23
	(-5.77)	(-2.54)	*(-1.06)*	(-.74)	*(-1.75)*	(-1.04)	(.32)
Adj. R^2	.76	.83	.61	.71	.29	.50	.62
S.E.E.	.51	.43	.55	.48	.28	.24	.21
Restricted Regression:							
CONSTANT	3.43	5.72	4.32	5.88	3.98	7.39	---
	(6.98)	(10.65)	*(7.80)*	(10.67)	*(1.31)*	(3.04)	---
{ln(INV/gdp) -	.497	.16	.342	.12	.505	.33	---
ln(.05 +POPGR)}	*(3.89)*	(1.54)	*(2.63)*	(1.05)	*(1.14)*	(.94)	---
{ln(SCHOOL) –	.684	.70	.638	.72	.612	.18	---
ln(.05 + POPGR)}	*(7.56)*	(9.23)	*(7.07)*	(9.31)	*(1.72)*	(.89)	---
CORRUPT	---	-1.36	---	-1.32	---	-1.36	---
	---	(-5.59)	---	(-4.71)	---	(-3.14)	---
Adj. R^2	.75	.83	.62	.71	.31	.52	---
S.E.E.	.52	.43	.55	.48	.28	.23	---
Test of Restrictions:							
Implied α	.23	.09	.17	.06	.24	.22	---
	(4.7)	(1.58)	*(2.78)*	(.93)	*(1.70)*	(1.31)	---
Implied β	.31	.38	.32	.39	.29	.12	---
	(7.1)	(8.51)	*(6.11)*	(7.39)	*(2.75)*	(.83)	---
Implied γ	---	1.36	---	1.32	---	1.37	---
	---	(6.27)	---	(4.40)	---	(3.10)	---

All variables are fully described in Chapter 4.
Estimated heteroskedasticity-consistent (White, 1980) t-statistics are in parentheses.
[T]Denotes the Theil (1971) t-statistics – test for parabolic convexity.
[D]direct test of equation (9).

Table 4
Regression of GDP Growth - Eq. (13)

Dependent Variable: Log Difference Of GDP Per Working-Age Person From 1960-1989							
SAMPLE	***NON-OIL***	***NON-OIL***	***NON-OECD***	***NON-OECD***	***OECD***	***OECD***	***OECD***
N	***83***	***83***	***61***	***61***	***22***	***22***	***22***
EQUATION #	***(1A)***	***(2A)*** [D]	***(1B)***	***(2B)*** [D]	***(1C)***	***(2C)*** [D]	***(2D)***
CONSTANT	.11	2.65	2.00	3.77	.65	-1.97	*.96*
	(.155)	*(2.06)*	*(1.11)*	*(1.94)*	*(.62)*	*(-1.90)*	*(.66)*
ln(INV/GDP)	.31	.19	.260	.12	.51	.61	*.48*
	(3.49)	*(1.97)*	*(2.61)*	*(1.18)*	*(4.21)*	*(4.91)*	*(4.23)*
ln(SCHOOL)	.24	.36	.27	.38	.14	.24	*.10*
	(2.57)	*(4.13)*	*(2.87)*	*(4.17)*	*(1.81)*	*(2.87)*	*(1.20)*
CORRUPT	---	-.73	---	-.87	---	.71	*1.64*
	---	*(-2.59)*	---	*(-2.96)*	---	*(3.74)*	*(4.58)*
	---	[T]*(-1.10)*	---	[T]*(.28)*	---	[T]*(-2.40)*	---
CORRUPTSQ	---	---	---	---	---	---	-3.24
	---	---	---	---	---	---	(-3.23)
Ln(.05 + POPGR)	-.90	-.49	-.12	-.01	-1.09	-1.37	-*.79*
	(-3.00)	*(-1.29)*	*(-.16)*	*(-.02)*	*(-3.88)*	*(-5.80)*	*(-2.75)*
ln(GDP60)	-.37	-*.49*	-.35	-.45	-.53	-.40	-*.46*
	(-4.95)	*(-6.62)*	*(-3.87)*	*(-5.23)*	*(-15.00)*	*(-7.50)*	*(-8.16)*
Adj. R^2	.33	.41	.23	.35	.85	.88	.91
S.E.E.	.37	.35	.42	.39	.12	.11	.09
Restricted Regression:							
CONSTANT	.74	2.53	1.04	2.60	1.21	-1.10	---
	(1.94)	*(3.53)*	*(2.00)*	*(3.56)*	*(1.06)*	*(-.81)*	---
ln(INV/gdp)- ln(.05 +POPGR)	.33	.19	.26	.13	.60	.71	---
	(3.77)	*(1.94)*	*(2.67)*	*(1.23)*	*(3.90)*	*(4.53)*	---
ln(SCHOOL) - ln(.05 +POPGR)	.25	.353	.25	.36	.157	.25	---
	(2.66)	*(4.22)*	*(2.48)*	*(3.99)*	*(2.00)*	*(2.98)*	---
CORRUPT	---	-.73	---	-.86	---	*.65*	---
	---	*(-2.84)*	---	*(-2.94)*	---	*(3.15)*	---
ln(GDP60)	-.36	-.49	-.35	-.46	-.52	-.41	---
	(-4.70)	*(-6.52)*	*(-4.05)*	*(-5.31)*	*(-15.10)*	*(-7.93)*	---
Adj. R^2	.33	.42	.24	.35	.85	.87	---
S.E.E.	.37	.35	.42	.39	.12	.11	---
Test of Restrictions:							
Implied α	.35	.18	.30	.13	.47	.52	---
	(4.17)	*(2.21)*	*(2.67)*	*(1.27)*	*(5.00)*	*(6.15)*	---
Implied β	.27	.34	.29	.38	.12	.18	---
	(3.63)	*(5.27)*	*(3.07)*	*(4.62)*	*(1.49)*	*(2.43)*	---
Implied λ	.015	.023	.015	.021	.026	.018	---
	(3.86)	*(4.41)*	*(2.78)*	*(3.78)*	*(6.67)*	*(3.97)*	---
Implied γ	---	1.48	---	1.89	---	-1.598	---
	---	*(4.11)*	---	*(3.27)*	---	*(-1.47)*	---

All variables are fully described in Chapter 4.
Estimated heteroskedasticity-consistent (White, 1980) t-statistics are in parentheses.
[T]Denotes the Theil (1971) t-statistics – test for parabolic convexity
[D]direct test of equation (13).

5. Conclusion

Corruption has recently found its way back in the mainstream of the economics literature. Most recent contributions to the body of literature have focused on its distortionary effects on a market economy. To a large extent, most of these works have provided support of a negative effect of corruption on investment and economic growth. As an attempt to look beyond the pricing system, this paper has presented a theoretical model showing corruption negating investment, standard of living and economic growth.

The empirical findings suggest that increased levels of corruption reduce a country's standard of living. Since this finding is linear, an increase in the amount of corruption has a proportional decrease in a country's level of investment – regardless of the size of the country. The results for standard of living are not so uniform. Increases in the level of corruption retards standard of living proportionally for developing countries, but it does so in a decreasing, convex way for the OECD. An analysis of the effects of corruption on economic growth produces similar results. Corruption has a negative linear effect on developing countries. However, the results are rather surprising for OECD countries. A reduction in corruption has a positive concave effect on economic growth. OECD countries can improve their economic growth by becoming more corrupt. Hence, there is a n "optimal" level of corruption for OECD. One potential explanation for these results is that the eradication of corruption carries an opportunity cost. Ceteris paribus, as a developing country deploys its resources from productive activities to the detection and prevention of corrupt ones, there are positive, but diminishing returns.

These findings have a strong effect on policy formulation. A prescription for the ills of one country should not be used for the cure of another. In that notion, the author proposes a few recommendations for policy makers. 1) Since political corruption is endogenously determined in a country's polity, the reduction of corruption should be balanced with other national agenda items. 2) Give proper accounting rigor to activities or systems in place to fighting of corruption. 🕮

Appendix

Cross-Country Data

COUNTRY	POPGR	I/GDP	CORRUPT	GDP_{60}	GDP_{89}	SCHOOL
BANGLADESH	0.025	4.28	0.00	2768	4758	3.2
ZAIRE	0.029	4.09	0.19	1024	1118	3.6
HAITI	0.017	5.16	0.56	1673	1990	1.9
INDONESIA	0.022	16.15	0.56	1638	4677	4.1
PARAGUAY	0.029	13.16	0.94	3575	6045	4.4
GUYANA	0.014	24.14	1.00	5608	3055	11.7
MALI	0.024	6.05	1.08	1506	1243	1.0
PHILIPPINES	0.027	15.21	1.13	2971	4718	10.6
BOLIVIA	0.025	16.90	1.25	3322	5336	4.9
PAKISTAN	0.030	10.65	1.63	2027	4663	3.0
EGYPT	0.024	4.61	1.69	2796	6888	7.0
SUDAN	0.029	13.51	1.69	2420	2491	2.0
SYRIA	0.033	14.94	1.69	5690	15141	8.8
ZAMBIA	0.032	22.23	1.69	2662	2260	2.4
UGANDA	0.031	2.45	1.75	1206	2079	1.1
GHANA	0.026	6.19	1.94	2044	1799	4.7
EL SALVADOR	0.024	8.36	2.00	4371	5489	3.9
GUATEMALA	0.029	9.14	2.00	5292	7483	2.4
HONDURAS	0.033	13.86	2.00	3268	4671	3.7
JAMAICA	0.013	21.95	2.00	4338	5178	11.2
SIERRA	0.020	1.48	2.00	2035	2521	1.7
TOGO	0.029	15.96	2.00	792	1562	2.9
CAMEROON	0.026	8.54	2.19	1348	2890	3.4
PANAMA	0.025	20.42	2.19	4739	7771	11.6
TRINIDAD&TOBAGO	0.016	12.46	2.25	16901	20130	8.8
KOREA	0.019	22.75	2.38	2703	14697	10.2
TANZANIA	0.030	10.72	2.56	579	1126	0.5
PERU	0.026	17.72	2.69	6309	7050	8.0
VENEZUELA	0.033	18.08	2.69	20445	17083	7.0
MEXICO	0.026	16.56	2.75	9517	16373	6.6
KENYA	0.037	15.66	2.81	1451	1944	2.4
TURKEY	0.024	21.12	2.88	3194	7867	5.5
INDIA	0.023	13.70	2.94	1761	3167	5.1
TUNISIA	0.022	14.78	2.94	3931	8508	4.3
COLOMBIA	0.024	15.87	3.00	5485	10104	6.1
CONGO	0.029	10.45	3.00	2494	4912	3.8
CYPRUS	0.007	27.39	3.00	4967	16999	8.2
DOMINICAN REPUBLIC	0.026	15.07	3.00	4130	7819	5.8
GAMBIA	0.029	4.85	3.00	1142	1739	1.5
JORDAN	0.023	14.03	3.00	4488	12998	10.8
PAPUA	0.023	15.50	3.00	2270	3290	1.5
SENEGAL	0.025	5.16	3.00	2164	2431	1.7
SRILANKA	0.018	9.04	3.00	3508	5578	8.3
URUGUAY	0.007	12.90	3.00	9784	12022	7.0
ECUADOR	0.028	22.25	3.19	4459	9154	7.2
THAILAND	0.026	17.07	3.19	1884	6157	4.4

Cross-Country Data (Cont'd)

COUNTRY	POPGR	I/GDP	CORRUPT	GDP_{60}	GDP_{89}	SCHOOL
CHILE	0.018	19.41	3.31	8756	11986	7.7
ALGERIA	0.028	21.49	3.43	6517	12530	4.5
ARGENTINA	0.015	16.66	3.69	11339	13938	5.0
ITALY	0.005	28.10	3.81	11063	30321	7.1
BRAZIL	0.025	19.46	3.88	5549	11668	4.7
GREECE	0.006	24.93	3.88	5151	17625	7.9
BOTSWANA	0.033	18.93	3.92	1224	7123	2.9
MOZAMBIQUE	0.025	1.85	4.00	1905	1593	0.7
NIGER	0.029	8.65	4.00	902	1043	0.5
PORTUGAL	0.004	22.92	4.00	4853	14642	5.8
MALAWI	0.030	9.94	4.21	765	1223	0.6
NICARAGUA	0.029	11.54	4.25	5124	4278	5.8
SPAIN	0.008	25.19	4.50	8186	25518	8.0
MALAYSIA	0.026	22.68	4.75	4110	11498	7.3
COSTARICA	0.030	16.07	5.00	6830	9905	7.0
ISRAEL	0.027	26.30	5.00	9685	23063	9.5
JAPAN	0.009	34.06	5.00	4998	21691	10.9
AUSTRALIA	0.017	28.76	5.19	19261	31271	9.8
GERMANY	0.004	27.99	5.19	13919	28505	8.4
HONG KONG	0.022	19.96	5.19	4172	21962	7.2
IRELAND	0.007	24.75	5.19	8391	22186	11.4
AUSTRIA	0.003	25.70	5.25	10713	26004	8.0
FRANCE	0.007	27.24	5.25	13478	29879	8.9
U.S.A.	0.011	21.49	5.31	24433	36859	11.9
BELGIUM	0.003	23.75	5.63	14310	30765	9.3
SINGAPORE	0.017	30.78	5.63	5008	23030	9.0
SOUTH AFRICA	0.025	18.57	5.64	6306	9891	3.0
U.K.	0.003	18.12	5.81	14754	26858	8.9
CANADA	0.011	24.15	6.00	24906	35069	10.6
DENMARK	0.004	25.93	6.00	14807	24647	10.7
FINLAND	0.009	34.84	6.00	11577	27740	11.5
ICELAND	0.012	28.80	6.00	12585	25268	10.2
NETHERLANDS	0.009	24.74	6.00	17117	30384	10.7
NEW ZEALAND	0.012	24.57	6.00	21285	26121	11.9
NORWAY	0.006	31.37	6.00	14291	28913	10.0
SWEDEN	0.004	23.49	6.00	17352	28370	7.9
SWITZERLAND	0.007	29.19	6.00	20149	32480	4.8

Endnotes

1. The Cobb-Douglas function provides a reasonable description of actual economies (Barro and Sala-I-Martin, 1995). For the effects of corruption on a production function with no structural form, see Appendix A.
2. Since full employment is assumed, the labor force is equal to the employed. This also implies that the labor force growth rate is also given by n.
3. Doing the same for equation (10) yields a similar expression for the growth of human capital per worker at steady state.
4. This variable has been used in various papers including Tanzi and Davoodi (1997), Keefer and Knack (1995), Leite and Weidmann (1999) and others.
5. This is most obvious when a comparison is made of the non-OECD and intermediate samples. The striking differences in sample size and selection yield very dissimilar results, with the MRW specification outperforming that of the author.
6. Best Linear Unbiased Scalar. Refer to Stokes (1999).
7. Even though the coefficient of CORRUPT is statistically insignificant, jointly CORRUPT and CORRUPTSQ better explain differences in real GDP per worker for the OECD sample.

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Notes

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