

April 29, 2006

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Institutional Variables and Economic Performance - The Case of Corruption in Korea

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* Senior Fellow, Korea Development Institute. The earlier version of this paper was published as Chapter 12 in M. Tcha (ed.) *Regulatory Reforms to Improve Business Environment* in 2005 (in Korean). The author appreciates anonymous referees for the earlier version, and Jung-Mi Kim for research assistance. The author also appreciates Nan-Hee Kim and Eun-Hee Park for editorial assistance.

I. Introduction

Corruption and regulation have very close ties. For example, a bribe may be used to evade regulations. Corruption may have a major influence on an economy via an indirect regulation by allowing some businesses to enter and operate in markets and some not. Corruption is often cited as an important institutional variable, whose relationship with economic growth has attracted wide attention. Analyzing the relationship between corruption and economic growth is further complicated by theoretical debate about whether corruption is harmful or beneficial, and, whether different types of corruption have different impacts. Since Mauro (1995), and Knack and Keefer (1995), a growing number of studies have emerged on the effect of corruption on macroeconomic variables, in an attempt to determine whether or not corruption is harmful.

As Shleifer and Vishny (1993), and Kaufmann and Wei (1999) point out, corruption harms an economy through stifling entrepreneurial flair. Corruption may do it by attracting talented workers to unproductive positions in bureaucracy, rather than in productive occupations of the private sector. In addition, corruption at the administrative level can be an enormous obstacle for those engaged in business as they must also spend more time and energy dealing with a corrupt administration. Corruption may lead to distortion through the need to maintain secrecy, and may reduce government revenues if bureaucrats pocket some revenues intended for the government by keeping inaccurate or falsified records. Furthermore, corruption can behave in a way much like a tax on firms by lowering the returns on investment. Many studies have also found that a correlation exists between high levels of corruption and reduced investment, and, in this vein, have concluded that corruption damages economic growth. (See for example, Brunetti et al (1997), Knack and Keefer (1995), Keefer and Knack (1997), Mauro (1995), Mauro (1997) and Rivera-Batiz (2000)).

In contrast to this school of thought, an alternative perspective on corruption that highlights its beneficial effects on the economy, improvements in bureaucratic and allocative efficiency has also emerged. Leff (1964) argues that corruption improves unnecessary bureaucracy by bypassing cumbersome and burdensome regulations, and Kaufmann (1997) and Rose-Ackerman (1997) state that corruption creates incentives to reduce bureaucratic inefficiency as a means of increasing the potential for bribe taking. As Kaufmann (1997) argues, allocative efficiency is improved by corruption, since under competitive bidding, the individual or company offering the highest bribe wins and only the firms with the lowest cost can afford to pay the highest bribe. On the other hand, Rose-

Ackerman (1997) indicates that the highest bidding capability is often associated with sub-standard quality, rather than low cost structures.

In addition to the positive effects that corruption may have, as discussed above, recent developments in studies on corruption suggest that 'equilibrium' is possibly associated with high levels of corruption. 'Multiple equilibrium' models developed by Andvig (1991), Ehrlich and Lui (1999) and Paldam (1999), using a variety of methodologies, all predict multiple equilibria; a high corruption-low income equilibrium, a low corruption-high income equilibrium, and an unstable equilibrium or pivot between two stable equilibria. For a country to move away from the low income-high corruption equilibrium, it must pass through the stage of unstable equilibrium located between the two stable equilibria. A move away from the high corruption-low-income equilibrium, towards the low corruption equilibrium, leads initially to an even lower income, until the pivot or point of unstable equilibrium is reached. Hence, the optimal level of corruption for countries that already have high levels of corruption is to continue to have high corruption levels. For countries with low levels of corruption, the optimal level of corruption for maximizing income is less corruption.

This study concentrates on the effect of corruption on economic growth. More specifically, this study attempts to provide how corruption affects economic growth using a theoretical model and then empirically analyzes the relationship between the two variables utilizing data for 66 countries. A correlation between corruption and GDP per capita has been reported in a number of studies recently, including Ehrlich & Lui (1999), Getz and Volkema (2001), Goldsmith (1999), Hall and Jones (1999), Husted (1999), Paldam (1999), Sandholtz and Koetzel (2000) and Treisman (2000). These studies, in general, conclude that higher levels of corruption are associated with lower GDP per capita.

Theoretical models are established in the following section. The following section, in turn, is followed by a description of the data and the methodology. After this, an empirical estimation of the relationship between corruption and growth is conducted. Finally, the paper summarizes the main findings and points out areas needing further research.

II. Theoretical Framework for Corruption and Growth

Suppose an economy produces a single consumption good by combining human capital and physical capital as

$$Y = AH^\alpha K^{1-\alpha},$$

where A measures the level of technology, H is human capital and K is physical capital. As Ethier (1982) and Borensztein et al. (1998) suppose, physical capital consists of an aggregate of different varieties of capital goods, and capital accumulation takes place through the expansion of the number of varieties. The stock of capital is then:

$$K = \left[\int_0^N x(j)^{1-\alpha} dj \right]^{1/(1-\alpha)}.$$

Total capital is a composite of a continuum of varieties of capital goods, each one being denoted by $x(j)$. A rental rate for a representative firm in this economy is determined as the marginal productivity of capital, that is

$$(1) \quad m = \frac{\partial Y}{\partial K} = A(1-\alpha)H^\alpha x^{-\alpha}.$$

For simplicity of analysis, take the assumption used by Borensztein et al. (1998) that there is a constant marginal cost of production of $x(j)$ equal to 1, and that capital goods depreciate fully. In a steady state, where the interest rate (r) is fixed, the firm's profit maximization function at t is

$$\pi_t = -F + \int_t^{\infty} [mx - x] e^{-r(s-t)} ds,$$

where F represents fixed costs.

Suppose that in order for a risk-neutral firm to operate in the market it should pay a fixed amount of money as a bribe to the authorities per unit it sells (therefore a firm which produces more products should pay a higher amount to obtain permission to operate in an economy). Then the expected cost per unit the firm should pay is $\nu (>1)$. A certain level of expected 'benefit' is promised by the authority in return to the bribe.¹ The profit function then becomes

$$(2) \quad \pi_t = -F + \int_t^{\infty} [\mu mx - \nu x] e^{-r(s-t)} ds,$$

where both μ and ν are functions of c , the level of corruption in this economy.² For further analysis, let's start with the following two assumptions about cost of and benefit from bribing.

[Assumption 1] The benefit of a firm increases as the level of corruption in the economy increases ($\frac{\partial \mu}{\partial c} > 0$), where the increasing rate decreases ($\frac{\partial^2 \mu}{\partial c^2} > 0$).

[Assumption 2] The value of the bribe that a firm has to pay initially decreases as the level of corruption in the economy increases ($\frac{\partial \nu}{\partial c} < 0$), and then increases after the level of corruption goes beyond a certain threshold ($\frac{\partial \nu}{\partial c} \geq 0$).

Figure 1 (a) sketches the relationship between μ , ν and the level of corruption, c , that satisfies these assumptions.³ If the level of corruption is too high ($> c_2$) or too

low ($< c_0$), the value of ν will exceed μ . For an economy with a low level of corruption, say, less than c_0 , the bribe per unit that a producer must pay to the authorities to be allowed to conduct business, is greater than the excess return (price surcharge) per unit.⁴ Therefore, firms will have no incentive to engage in this sort of behavior. As the level of corruption increases, however, the cost of the bribe decreases until it reaches a minimum point at c_1 . Then the amount to be paid increases as corruption increases. After a certain point, say c^* in Figure 1(a), the bribe per unit increases faster than the surcharge per unit, since more authorities are involved in corruption, and firms will compete to gain implicit permission to operate in the market by paying more bribes to more authorities.⁵

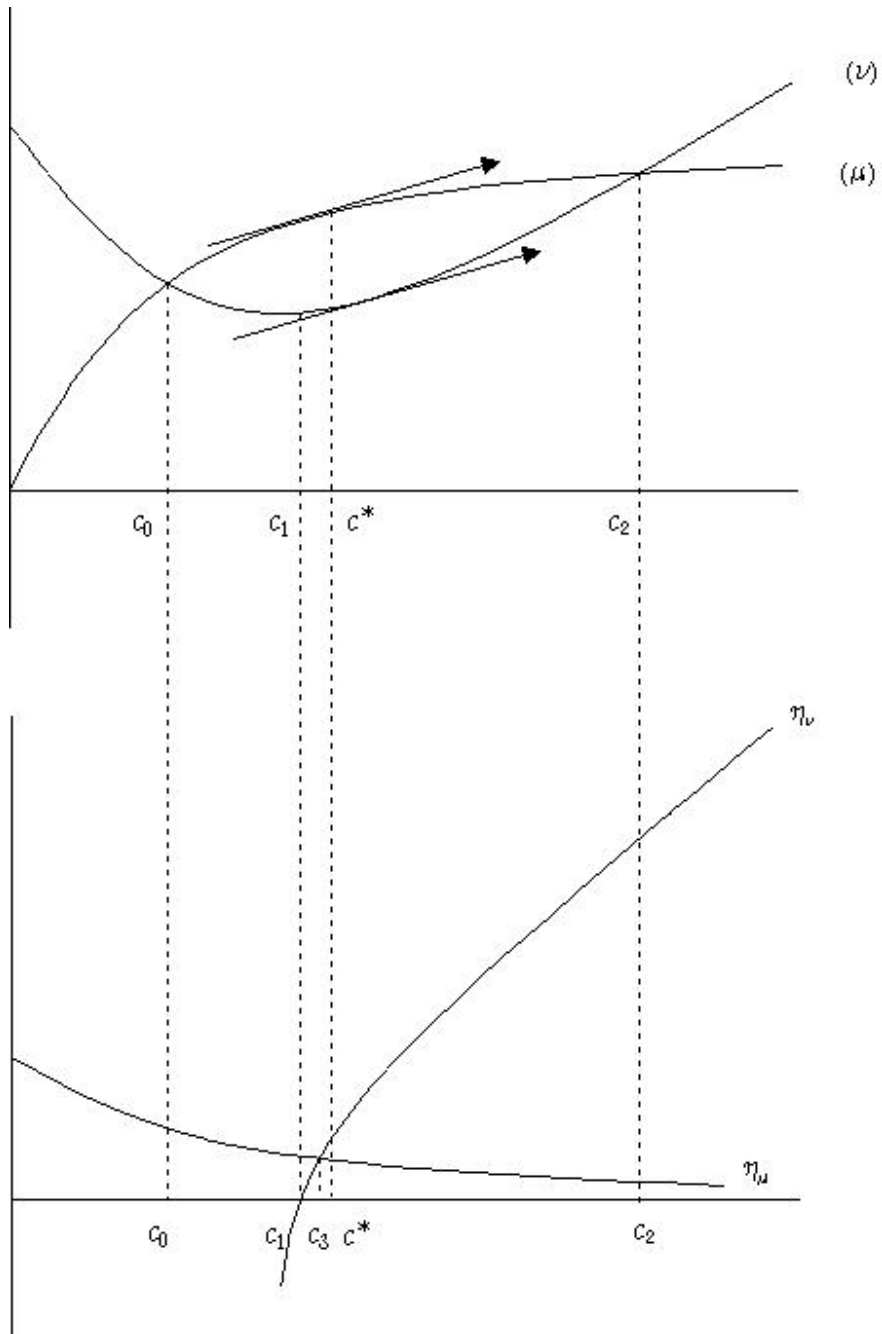
Solving the first order condition from equation (2) for the optimal amount of x gives the optimal amount of x under corruption:

$$(3) \quad x|_{corruption} = x^B = \left[\frac{\mu}{\nu} \right]^{\frac{1}{\alpha}} A^{\frac{1}{\alpha}} (1-\alpha)^{\frac{2}{\alpha}} H.$$

Substituting equation (3) into equation (1) provides the rental rate as

$$m = \frac{1}{(1-\alpha)} \frac{\nu}{\mu}.$$

Figure 1(a). Cost and Benefit of Bribe



Corruption in the economy distorts the market rental rates, which would have been $\frac{1}{1-\alpha}$ without corruption. If this firm sells constant x^B units over the period, the long run profit of this firm, π , will be derived as:

$$(4) \quad \pi^B = -F + \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{v}{r}\right)x^B \geq 0,$$

where π^B is profit under corruption. This profit should be greater than or equal to zero, otherwise the firm has no incentive to offer a bribe.

III. The Effects of Corruption on a Firm's Output and Profit

This section investigates the effect of corruption on the output of the firm that bribes authorities and receive benefit in return. Define that $\eta_{\mu c}$ is the elasticity of the benefit with respect to corruption ($= \frac{\partial \mu}{\partial c} \frac{c}{\mu}$), and η_{vc} is the elasticity of bribe cost with respect to corruption ($= \frac{\partial v}{\partial c} \frac{c}{v}$).

Using the elasticity of output with respect to corruption as shown in (3), the percentage change in output of the firm brought about by a one percent change in corruption is given as:

$$(5) \quad \eta_{xc} = \frac{\partial x}{\partial c} \frac{c}{x} = \frac{1}{\alpha} [\eta_{\mu c} - \eta_{vc}].$$

Equations (3) and (5) indicate how a firm's output level is affected as the level of

corruption in the economy increases: it depends on the relative size of the two elasticities, $\eta_{\mu c}$ and η_{vc} . The relationship between the two elasticities and the level of corruption is depicted in Figure 1(b). A firm that enters the market by paying bribe will increase its output if the corruption elasticity of benefit is larger than that of cost ($\eta_{\mu c} > \eta_{vc}$ or $0 \leq c \leq c_3$). However, once the level of corruption is higher than c_3 , the relative sizes are reverse, and the increase in corruption decreases the output of a firm.

In a traditional case where the number of producers in a market decreases, total output in the market reduces while the level of each individual's output increases. However, this analysis shows that, if the reduction in the number of producers is due to higher cost incurred by corruption, it is possible that even the level of each firm's output decreases along with the reduction in the number of firms. This of course reduces consumers' welfare even further.

The profit of the representative firm should be non-negative and may be affected by the level of corruption. Using comparative static analysis from equation (4) and rearrange the result by applying the elasticities provides equation (6) that shows how the elasticity of profit with respect to corruption is affected by those of benefit and cost.

$$(6) \quad \frac{\partial \pi^B}{\partial c} \frac{c}{\pi^B} = \left[\frac{1-\alpha}{\alpha} \right] \left[\frac{1}{1-\alpha} \eta_{\mu c} - \eta_{vc} \right]$$

Therefore the sign of $[\partial \pi^B / \partial c]$ is determined by the sign of the last bracket on the right side of equation (6). Rearranging the last bracket in equation (6) indicates that the profit of a firm, which pays bribes, may or may not increase as the level of corruption increases; it depends on the relative size of the elasticity of the benefit and the bribe. A firm's profit increases as the level of corruption increases until $[c < c_4]$. Once the level of corruption is too high (higher than c_4), then profit starts to decrease as corruption increases.

The comparison of the two results regarding output and profit levels reveals that both the output and profit of a firm increase as corruption increases, if $[\eta_{vc} < 0]$. Moreover, it indicates that when $[\eta_{vc} > 0]$, the necessary and sufficient condition to have $[\partial x / \partial c] > 0$ (which is $[\eta_{\mu c} - \eta_{vc}] > 0$ or $c < c_3$ in Figure 1(b)), is the sufficient condition for profit to increase as corruption increases ($[\partial \pi / \partial c] > 0$ or $c < c_4$ in Figure 1(b)) because $[1 - \alpha] < 1$ always. A firm may enjoy

higher profit with a lower level of production as corruption increases, depending on the size of the elasticities and α , that is $[(1-\alpha) \eta_{vc} < \eta_{\mu c} < \eta_{vc}$, or $c_3 < c < c_4$ in Figure 1(b)].

IV. Empirical Analysis

Data for 1991 – 2000 (cross-country data with decade averages) were used for estimation, as the effect of corruption on growth is believed to transmit in the mid- or long-run. The data is also divided into two sub-periods, 1991 – 1995 and 1996 – 2000, in order to examine relatively short-run relationships and to compare the results with those from the long-run.

4.1. Data

Measuring corruption is difficult as there is no direct quantitative measure. Nonetheless, the quality of various subjective measures of corruption has been tested, and has generally found a strong correlation between the different measures despite varying methodologies and definitions of corruption being used (Kaufmann and Wei 1999, Svensson, 2005). The measure of corruption used in this study is *International Country Risk Guide* (ICRG), produced by Political Risk Services Group. Although perceptions are still subjective, they form the basis for investment and planning decisions and are widely used. While the main purpose of this study is to analyze the relationship between corruption and economic growth, it also investigates the relationship between some other institutional variables and economic growth, as well. Data on the quality of the bureaucracy, democratic accountability and law and order, has also come from the ICRG.

Corruption and the other institutional indexes are measured on a scale from 0 to 6, where 0 is the highest level and 6 is the lowest level. Examples of corruption measured are *'excessive patronage, nepotism, job reservations, favor for favor, secret party funding and suspiciously close ties between politics and business.'* This study includes economic variables which are traditionally adopted in explaining growth performance. Data on GDP, foreign investment, domestic investment, population, imports and exports, exchange rates and consumer price

indices come from the *International Financial Statistics* (International Monetary Fund, various years). These variables are converted in real terms, using a base year of 1995. For a measure of human capital, the average years of schooling, as calculated by Barro and Lee (1998), is used⁶. As reported in Appendix 2, 66 countries were selected according to the availability of data.

4. 2. Estimation and Results

Corruption and Growth

Utilizing the ten years' (1991-2000) average figures, this section examines how the growth experience of the 67 countries are related to the different levels of corruption that each country experienced. It has been pointed out that the relationship between institutional variables and growth may not be linear for several reasons. Some important reasons include that (i) there is no justification that growth is linearly influenced by the institutional variables, and (ii) in most cases, institutional variables used are indexes based on surveys and they are ordinal rather than cardinal. Accordingly, quadratic and cubic, as well as linear functions are alternatively used in the following estimation:

$$g = \beta_0 + f(\text{corruption}) + \beta'X + e,$$

where g is an average annual growth rate of each country for 1991-2000, β_0 is a constant, $f(.)$ stands for a function of average corruption, β is a coefficient vector, X is a vector of relevant variables and e is an error term, which is assumed to satisfy the classical assumptions.

This study incorporates the effect of corruption into the conventional growth framework. Accordingly, variables included in vector X are growth in capital, growth in human capital, growth in openness, and the initial level of GDP per capita. A dummy variable for the Eastern European and former Soviet Union countries, which suffered transitional difficulties in the 1990s, is included with an expectation that it explains low rates of economic growth compared to other countries with the same level of corruption.

Table 1 shows the results of the regressions. Estimations (1) to (3) employ domestic and foreign direct investment separately (to accommodate the arguments that foreign direct investment contributes more to growth), while estimations (4) to (6) use total investment. As all the regressions show a significant heteroscedasticity problem when the ordinary least squares (OLS) method is used, the generalized squares (GLS) method is used to correct the problem using White's heteroscedasticity adjusted standard errors. In regression (1), where a linear relationship is used for corruption and growth, corruption is marginally significant and positive, indicating that countries with lower levels of corruption experienced higher economic growth. The coefficient explains that, all other things being equal, a country that has one level lower in corruption, experiences economic growth of 0.7 percentage points higher per annum. When a quadratic function is used as in regression (2), both average corruption and average corruption-squared are insignificant, indicating that the relationship between growth and corruption is not properly explained by a quadratic equation. In regression (3), average corruption, average corruption-squared, and average corruption-cubed are all significant, with average corruption and average corruption-cubed having negative coefficients, and average corruption-squared having a positive coefficient.⁷

To highlight the relationship between corruption and growth, we entered the coefficients for the three variables on corruption, assuming that all other variables are the same across countries, and the following relationship is derived from regression (3):

$$(7) \quad g = -0.27c^3 + 3.13c^2 - 10.3c + 9.37 + \Psi$$

where Ψ is the effect from all the other variables, which should be a constant given assumption that they are the same for all the countries.

Table 1. Corruption and Economic Growth 1991 - 2000.

Dependent variable: Economic growth 1991 - 2000.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-2.34 (-1.24)	-1.44 (-0.65)	9.37 (1.56)	-2.66 (-1.49)	-2.12 (-0.93)	6.83 (1.20)
Average corruption	0.69 (1.96)*	0.06 (0.05)	-10.3 (-1.88)*	0.70 (2.02)**	0.33 (0.28)	-8.39 (-1.61)
Average corruption squared	-	0.09 (0.56)	3.13 (2.07)**	-	0.05 (0.33)	2.63 (1.83)*
Average corruption cubed	-	-	-0.27 (-2.11)**	-	-	-0.23 (-1.89)*
Domestic investment as a percentage of GDP (A)	0.10 (1.69)*	0.10 (1.69)*	0.08 (1.38)	-	-	-
Foreign direct investment as a percentage of GDP(B)	0.21 (1.88)*	0.22 (1.98)*	0.26 (2.18)**	-	-	-
Total investment as a percentage of GDP (A + B)	-	-	-	0.13 (2.58)**	0.13 (2.53)**	0.13 (2.50)**
Growth in imports and exports	0.14 (1.56)	0.14 (1.56)	0.12 (1.40)	0.13 (1.50)	0.13 (1.50)	0.12 (1.34)
Initial GDP per capita ¹ (1990)	-0.89 (-1.98)*	-0.91 (-2.02)**	-1.08 (-2.40)**	-0.91 (-2.05)**	-0.92 (-2.06)**	-1.08 (-2.40)**
Growth in schooling level	0.24 (0.78)	0.28 (0.86)	0.43 (1.23)	0.15 (0.48)	0.17 (0.53)	0.28 (0.82)
Eastern European, former Soviet Union countries	-10.7 (-4.81)***	-10.6 (-4.65)***	-10.9 (-4.90)***	-10.8 (-4.89)***	-10.7 (-4.74)***	-11.0 (-4.96)***
F-Stat	(17.2)***	(14.9)***	(14.2)***	(20.1)***	(17.0)***	(16.0)***
Adjusted R-Squared	0.67	0.68	0.70	0.67	0.67	0.69
N	66	66	66	66	66	66

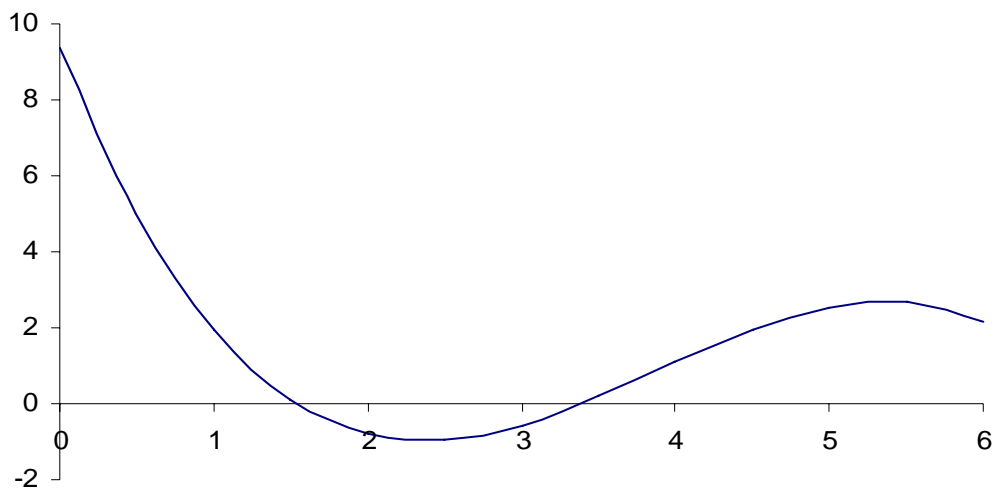
Note: The T-ratio is in brackets underneath the coefficient. * = significant at the 10% level; ** =significant at the 5% level; *** = significant at the 1% level.
1. Measured in \$US 10 000.

While the accurate shape of the relationship depends on the size of Ψ (as a shifter), Figure 2 shows the general shape of the curve for the given range of average corruption from 0 to 6, when the effect from the other variables are ignored ($\Psi = 0$). The cubic relationship has very strong implications in association with multi-equilibria models. Countries with a high level of corruption experience a decrease in growth as corruption is eliminated up to a certain level (≈ 2.4 in Figure 2), all other things being equal. After [$c \approx 2.4$], economic growth increases until the level of corruption of a country reaches approximately 5.4, and then starts to decrease slightly. This suggests that eliminating corruption is not necessarily accompanied by higher growth, especially for those who maintain high levels of corruption. Countries experience higher economic growth when they are either extremely corrupt or have low levels of corruption. Therefore, countries wishing to increase their growth levels will tend towards either extremely high or low levels of corruption. For example, if an economy has a corruption level of 1.5, it can only increase its growth rate by increasing the level of corruption or moving beyond the turning point, which is about 3.4. This suggests there are two equilibrium levels of corruption; one very low level of corruption (about $c \approx 5.4$) that guarantees a local maximum of growth, and one extremely high ($c \approx 0$) that guarantees a global maximum of growth.

However, there is reservation to argue that a high level of corruption will bring high level of growth. While Figure 2 shows the possibility of a high corruption, high growth equilibrium (when $c \approx 0$), nevertheless, a country with rating of corruption index 'zero' has never existed. When ratings are averaged over time (as in this data set) for each country in the data set, the lowest rating was 1.3. In other words, the lowest rating for a country in fact is not 0, but 1.3, where the average annual growth rate corresponding to this level of corruption is 0.6. This growth rate is far lower than that corresponding to the other equilibrium level of corruption ($g \approx 2.5$ when $c \approx 5.4$).⁸

It also suggests, that previous arguments as to the efficacy of bribery as 'grease' money oiling the machinery in some economies, or the assertion that multiple equilibria may exist, cannot be rejected completely, although this may be plausible for a small number of economies who experience a very high level of corruption, approximately lower than 1.5 (and higher than 1.3).

Figure 2. Corruption and Economic Growth



The effect of domestic investment (Domestic Investment/GDP) was positive and marginally significant for the first two regressions, consistent with the growth accounting theory. In estimation (3), it is slightly out of the 10% level of significance. Foreign investment (Foreign Investment/GDP) is positive and significant in all of the regressions, indicating that economies, which increased the ratio of inward flow of foreign investment, experienced higher economic growth. A 1% increase in foreign investment inflow ratio contributes to a 0.26 percent point increase in growth. Growth in imports and exports is insignificant in all the regressions, which is surprising given that openness is considered to contribute to economic growth by exposing an economy to competition from imports and improving access to better technology through the importation of capital goods. Growth in schooling is insignificant in the three regressions. The initial level of GDP per capita is significant and negative in line with the findings of growth studies, since high-income countries tend to grow more slowly than low income countries. The dummy variable for countries from Eastern Europe and the former Soviet Union is significant with coefficients between -10.6 and -10.9, suggesting that these countries growth rates' were lower by approximately 10.7 percentage points, compared to other countries with the same level of economic variables and a corruption index.

Regressions (4) to (6) are identical to regressions (1) to (3), with the exception that increases in domestic investment and increases in foreign investment are excluded and a variable for the increase in total investment is

included instead. An equation for the cubic relationship between corruption and growth, assuming that all the other variables are the same across countries, is derived from:

$$g = -0.26c^3 + 2.98c^2 - 9.69c + 7.71 - \Psi$$

where Ψ is the effect from all the other variables, which should be a constant given assumption that they are the same for all the countries. While the coefficients for the corruption variables are slightly different, the shape of the graph is similar to Figure 2. Therefore, the interpretation of the results is also similar. The two turning points occur at corruption levels approximately equal to 2.3 and 5.4, which are extremely close to those in Figure 2. Total investment is significant and positive in all three regressions, indicating that a 1% increases in investment ratio contribute to economic growth by approximately 0.14 percentage points.

Tables 2 and 3 show the same regressions for the two sub-periods to reconfirm the argument that the effect of institutional variables on growth is a long-run phenomenon. The cubic relationship between corruption and growth is only found in the 1996 - 2000 period, while in the 1991 - 1995 period, all the corruption variables are insignificant.

In the 1991 - 1995 period, the dummy for the Eastern European and former Soviet Union countries has a very high coefficient compared to that for the 1991 - 2000 and 1996 - 2000 periods. This is to be expected, as the impact on growth of being an Eastern European or former Soviet Union country is clearly declining over time. The regressions for the two sub-periods are also notably different to each other in that for 1991 - 1995, the measures of investment and initial GDP per capita are all positive and significant, while in 1996 - 2000 none is significant. Growth in imports and exports is significant and positive in 1996 - 2000, but insignificant in 1991 - 1995. Growth in schooling is significant only in the cubic regressions for 1996 - 2000.

Table 2. Corruption and Economic Growth 1991 - 1995.

Dependent variable: Economic growth 1991 - 1995.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-4.00 (-1.84)*	-1.50 (-0.50)	1.76 (0.28)	-5.58 (-2.43)**	-3.55 (-1.28)	-0.98 (-0.17)
Average corruption	0.82 (1.53)	-0.94 (-0.51)	-4.27 (-0.70)	0.96 (1.71)*	-0.49 (-0.29)	-3.15 (-0.54)
Average corruption squared	-	0.25 (1.00)	1.28 (0.75)	-	0.20 (0.91)	1.03 (0.61)
Average corruption cubed	-	-	-0.09 (-0.64)	-	-	-0.08 (-0.52)
Domestic investment as a percentage of GDP (A)	0.22 (3.03)***	0.24 (2.96)***	0.23 (2.92)***	-	-	-
Foreign direct investment as a percentage of GDP(B)	0.90 (2.71)***	0.94 (2.76)***	0.94 (2.77)***	-	-	-
Total investment as a percentage of GDP (A + B)	-	-	-	0.30 (4.32)***	0.32 (2.77)***	0.32 (3.92)***
Growth in imports and exports	0.02 (0.18)	0.01 (0.05)	0.00 (0.02)	0.04 (0.34)	0.03 (0.24)	0.02 (0.22)
Initial GDP per capita ¹ (1990)	-1.84 (-2.81)***	-2.07 (-2.84)**	-2.12 (-2.89)***	-1.96 (-2.72)***	-2.15 (-2.77)***	-2.19 (-2.75)***
Growth in schooling level	-0.33 (-1.40)	-0.31 (-1.36)	-0.32 (-1.39)	-0.25 (-1.07)	-0.23 (-1.01)	-0.23 (-1.00)
Eastern European, former Soviet Union countries	-20.1 (-4.41)***	-19.9 (-4.39)***	-20.3 (-4.41)***	-19.6 (-4.03)***	-19.5 (-4.00)***	-19.7 (-4.03)***
F-Stat	(20.5)***	(18.1)***	(15.9)***	(21.7)***	(18.5)***	(16.0)***
Adjusted R-Squared	0.72	0.72	0.72	0.69	0.67	0.70
n	65	65	65	65	65	65

Note: The T-ratio is in brackets underneath the coefficient.

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level.

1. Measured in \$US 10 000.

Table 3. Corruption and Economic Growth 1996 – 2000.

Dependent variable: Economic growth 1996 - 2000.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-1.35 (-0.79)	-0.07 (-0.02)	17.5 (2.01)**	-0.66 (-0.38)	0.16 (0.05)	15.5 (1.87)
Average corruption	0.53 (1.49)	-0.30 (-0.19)	-16.5 (-2.14)**	0.50 (1.39)	-0.03 (-0.02)	-14.5 (1.94)*
Average corruption squared		0.10 (0.53)	4.62 (2.18)**		0.07 (0.34)	4.09 (2.00)**
Average corruption cubed			-0.39 (-2.14)**			-0.34 (-1.98)*
Domestic investment as a percentage of GDP (A)	0.07 (1.27)	0.07 (1.33)	0.06 (1.11)			
Foreign direct investment as a percentage of GDP(B)	0.06 (0.76)	0.07 (0.83)	0.12 (1.46)			
Total investment as a percentage of GDP (A + B)				0.04 (0.83)	0.04 (0.87)	0.05 (1.07)
Growth in imports and exports	0.20 (3.19)***	0.20 (3.20)***	0.20 (3.26)***	0.19 (3.13)***	0.20 (3.13)***	0.19 (3.18)***
Initial GDP per capita1 (1995)	-0.07 (-0.18)	-0.07 (-0.18)	-0.15 (-0.40)	-0.00 (-0.01)	-0.00 (-0.01)	-0.00 (-0.19)
Growth in schooling level	0.43 (1.12)	0.47 (1.19)	0.83 (1.98)***	0.43 (-1.12)	-0.46 (-1.16)	0.74 (-1.80)*
Eastern European, former Soviet Union countries	-2.60 (-2.24)**	-2.45 (-2.04)**	-2.60 (-2.23)**	-2.55 (-2.19)**	-2.45 (-2.03)**	-2.59 (-2.19)**
F-Stat	(2.96)***	(2.60)**	(2.96)***	(3.14)***	(2.67)**	(2.94)***
Adjusted R-Squared	0.26	0.27	0.32	0.24	0.24	0.29
n	66	66	66	66	66	66

Note: The T-ratio is in brackets underneath the coefficient.

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level.

1. Measured in \$US 10 000.

Other Institutional Variables and Growth

This study also experimentally analyzes the relationship between other institutional variables and growth, as well as examining the relationship between corruption and a variety of economic variables. First of all, the relationships between corruption and other institutional variables (quality of bureaucracy, democratic accountability, law and order) are considered. *Bureaucracy quality* is measured by *the strength and expertise to govern without drastic changes in policy or interruption in government services*. Where corruption is high, the quality of bureaucracy is typically low. *Democratic accountability* measures *how responsive a government is to its people* on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society. *Law and order* is an assessment of *the strength and unbiasedness of the legal system and the popular observance of the law*. Table 4 shows the correlation between corruption and three other institutional variables, which are presumed to be highly related to corruption.⁹ The correlation between the institutional variables is high, indicating that all three institutional variables, in general, move in the same direction.

Table 4. Correlation Matrix for Institutional Variables

	Average corruption	Average quality of the bureaucracy	Average law and order	Average democracy
Average corruption	1			
Average quality of the bureaucracy	0.81	1		
Average law and order	0.82	0.80	1	
Average democracy	0.80	0.74	0.65	1

Table 5 summarizes the regression of economic growth on each of these institutional variables and other relevant variables as shown in Table 1.¹⁰ While the institutional variables have a high correlation with one another, it is noteworthy that the effects of these other institutional variables on growth are surprisingly different from those of corruption.

The average quality of the bureaucracy is significant only in the first regression with a linear function. This indicates that better quality bureaucracy is associated with higher economic growth. In contrast to the

regressions using corruption, domestic investment and foreign investment are insignificant in all three regressions.

Average law and order is significant and positive, and a better quality of law and order is associated with higher economic growth. The average law and order variables are, however, insignificant when quadratic and cubic relationships are explored. This indicates that the relationship between the quality of law and order and economic growth is best approximated by a linear rather than a quadratic or cubic relationship.

Consistent with Rodrick's (2000) findings, average democracy is insignificant in regression (7) suggesting that a linear relationship between democracy and economic growth does not exist. However, in regression (8), where a quadratic relationship is explored, the coefficients for both average democracy and average democracy squared are significant, where the former is negative and the latter is positive. In regression (9), the democracy variables are all insignificant. These results indicate that the relationship between democracy and economic growth might be quadratic. The curve predicts that growth will only occur when there is little democratic accountability (i.e. under a dictatorship), or in an extremely democratic economy, while the lowest growth rate is expected when the democracy index is about 3.6.

4.3 Corruption and Economic Growth - Implications for Korea

The corruption index for Korea has been approximately 5 until the mid 1990s, which indicates that the nation was perceived to have maintained a low level of corruption. However, the level of corruption for Korea increased afterwards, recording 3 in 2000, and hitting 2 in 2002 in the index but then changed its direction and began to increase since 2002. Considering that the analysis in this study supports the relationship between corruption and growth, it is implied that the fall of the index from 5 since the mid 1990s incurred loss of growth that Korea could have achieved otherwise.

Table 5. Institutional Variables and Economic Growth

Dependent variable: Economic growth 1991 - 2000.

	Average bureaucracy			Average Law and Order			Average democracy		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-1.94 (-1.16)	-1.45 (-0.85)	-1.97 (-1.37)	-2.59 (-1.50)	-0.07 (-0.14)	1.53 (0.33)	-0.21 (-0.10)	3.97 (1.62)	3.89 (1.55)
Institutional variable	1.13 (2.61)**	0.40 (0.29)	-1.42 (-0.62)	0.90 (2.73)***	-0.89 (-0.56)	-2.18 (-0.49)	-0.10 (-0.31)	-3.82 (-2.87)***	-3.31 (-1.15)
Institutional variable squared		0.17 (0.53)	-0.40 (-0.29)		0.24 (1.07)	-0.60 (-0.49)		0.53 (2.74)***	-0.39 (-0.39)
Institutional variable cubed			0.09 (0.38)			-0.03 (-0.30)			-0.01 (-0.14)
F-Stat	(18.6)***	(16.1)***	(14.1)***	(18.2)***	(16.1)***	(14.1)***	(15.8)***	(16.2)***	(14.1)***
Adj R-Squared	0.69	0.69	0.69	0.69	0.69	0.69	0.66	0.69	0.69
n	66	66	66	66	66	66	66	66	66

Note: The T-ratio is in brackets underneath the coefficient.

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level.

All regressions calculated using White's heteroscedasticity adjusted standard errors. Results for the other variables included in the regressions are similar to those in Table 2 and are available on request from the authors.

However, it should be pointed out that the move in the index is not consistent with intuition. It is generally accepted that the democracy in Korea has progressed significantly since the late 1980s, and authoritarian leadership and bureaucracy faced substantial challenges. In particular, campaigns to fight corruption and promote transparency in the public sector achieved considerable success since the mid 1990s. While these changes in Korea enabled what had been thought impossible previously, such as investigation and indictment of people with close ties to the former presidents if wrongdoing is detected, these might have influenced the perception and hence the level of corruption in Korea. The corruption index, in particular for Korea, therefore has a limitation and always leaves a room for measurement errors. Nevertheless, this study accepts the indexes for Korea as ICRG reports, and utilizes them to find how much loss Korea endured due to corruption compared to the average corruption level for OECD countries.

Table 6 summarizes the growth gap due to corruption based on estimation equations (3) and (6) in Table 1. The numbers tell how much additional growth would have been available had Korea maintained the average corruption level of OECD for given periods. For example, during the 1990s, the average corruption level of Korea was 4.22 while that of OECD was 4.80. With all other variables being equal, these two different corruption indexes explain 0.83%p of growth gap when estimation (3) was used. Table 6 provides the results for the four periods since 1991. It is calculated that the growth loss was about 0.72-0.83%p for ten years since 1991, and ranged from 1.22 to 1.37%p for 13 years since 1991.

As discussed earlier, it is questionable that the corruption index for Korea continuously declined during the early 2000s, and the calculation based on this information may distort the real figures. It may be more reasonable to assume that corruption in Korea did not worsen during the late 1990s. The numbers in parentheses in Table 6 are computed under the assumption that Korea in the 2000s maintained the same level of corruption as it was throughout the 1990s. In this case, the loss of growth reduces substantially. For example, the loss for 1991-2003 ranges from 0.66-0.73%p, compared to 1.22-1.37%p for the case using ICRG indexes directly.

Table 6. Corruption and the Loss of Growth - Korea

Period	1991~2000	1991~2001	1991~2002	1991~2003
<u>Average corruption index</u>				
Korea	4.22	4.11	3.95	3.85
OECD	4.80	4.75	4.70	4.71
Growth loss of Korea*		0.97	1.19	1.37
(% point)	0.83	(0.78)	(0.72)	(0.73)
Growth loss of Korea**		0.85	1.05	1.22
(% point)	0.72	(0.70)	(0.65)	(0.66)

NOTE: * Results using estimation (3). **Results using estimation (6). The numbers in parentheses are the results under the assumption that the level of corruption of Korea maintained 4.22 in the 2000s.

V. Conclusion

The effect of institutional variables on economic growth has attracted the attention of researchers from a variety of fields. While the empirical findings are inconclusive due to different models, variables and data sets used, some studies have departed from embracing a 'linear' relationship between these variables and economic growth. For example, Rodrik (2000) investigated the relationship between democracy and 'standard deviation' of growth, and Tavares and Wacziarg (2001) explored the effect of democracy on growth through 'channel' variables. Nevertheless, no consensus has been reached regarding the mechanics of how corruption may contribute to eroding economic growth. This paper has attempted to lay the theoretical foundation for the effect of corruption on economic growth, and then pursued an empirical investigation of the nature of their relationship. Our finding indicates that a very corrupt economy may experience a decrease in growth temporarily as it undertakes to eliminate corruption. In addition, while corruption has a very high correlation with other institutional variables, such as bureaucracy, democracy, and law and order, its effect on growth is substantially different from theirs.

The possibility that economic growth in a corrupt economy is retarded

as corruption is eliminated may be viewed to support those who advocate corruption as “greasy and lubricating oil” necessary for an economy to operate. However, this study shows that sustained and high growth only goes along with low level of corruption. Further, it was shown that Korea could have achieved a substantially higher rate of growth once it had maintained a low level of corruption as the average of OECD. Therefore, even when Korea faces a certain extent of resistance and difficulty as it reforms its system, including explicit regulations and institutional environment, it has to tolerate the difficult period as a part of the transition progress. Otherwise, the cost from the delay of regulatory reform will be too large.

Appendix 1: Corruption and Consumption

The effect of corruption on the consumption of the representative consumer is investigated using the standard inter-temporal utility function of the representative consumer with a constant relative risk aversion utility function:

$$(A1) \quad U = \int_t^{\infty} \frac{C_s^{1-\sigma}}{1-\sigma} e^{-\rho(s-t)} ds,$$

where C is consumption, σ is a measure of relative risk aversion and ρ is the time discount factor. The optimal consumption path for this representative consumer is given by the standard condition as discussed in Barro and Sala-I-Martin (1995), and Borensztein et al. (1998). Using the Euler equation, the optimal consumption path over time is derived as:

$$(A2) \quad g = \frac{\dot{C}_t}{C_t} = \frac{1}{\sigma} (r - \rho).$$

From equations (A1) and (A2), the interest rate of the economy, r , is expressed as

$$(A3) \quad r = A^{1/\alpha} a(1-\alpha)^{(2-\alpha)/\alpha} H [(\mu/\nu)^{(\alpha-1)/\alpha} - (1-\alpha)(\mu/\nu)^{1/\alpha}] (F + \pi)^{-1} \\ = \Phi \mu^{1/\alpha} \nu^{(\alpha-1)/\alpha} H (F + \pi)^{-1}.$$

Therefore, substituting the interest rate in equation (A3) for the above equation (A2) gives

$$(A4), \quad g = \frac{1}{\sigma} \{ \Phi H (F + \pi)^{-1} (\mu/\nu)^{1/\alpha} [(\mu/\nu) - (1-\alpha)] - \rho \},$$

where $\Phi = A^{1/\alpha} (1 - \alpha)^{(2-\alpha)/\alpha}$. Equation (A4) shows that the growth rate of consumption can be affected by the level of corruption as reflected by μ and ν , as well as many other stylized factors, as the degree of corruption affects growth through (i) the price surcharge (μ), and the value of the bribe (ν), and (ii) the long run profit of the firm (π).

While equation A(4) is complex, the effect of corruption on the dynamic path of consumption can be conjectured. The changing rate of consumption over time is more likely to be negative as initial investment is large or profit, which reflects imperfect market, is large. The equation also shows that the increasing rate of consumption decreases or may be negative as the ratio between the cost and benefit of corruption approaches $(1 - \alpha)$, the capital elasticity of output (or the capital share). It is known that the capital share of product in general increase as an economy grows. That is, all other things being equal, including the level of corruption, the cost-benefit ratio of developed countries will be closer to the capital share, which implies more changes in consumption path. Developed countries therefore face more serious distortion in consumption pattern due to corruption.

This finding suggests that as the Korean economy matures, the cost that the economy should pay due to corruption becomes larger. This is another reason why the Korean government and the entire economy should exert strenuous efforts to fight against corruption.

Appendix 2: List of Countries Included

Australia	Austria	Bahrain	Bangladesh
Belgium	Bolivia	Botswana	Bulgaria
Canada	Chile	Colombia	Costa Rica
Cyprus	Denmark	Dominican, Republic	
Egypt	El Salvador	Finland	France
Germany	Ghana	Guatemala	Haiti
Honduras	Hungary	Iceland	India
Indonesia	Ireland	Israel	Italy
Jamaica	Japan	Jordan	Kenya
Malaysia	Malta	Mexico	Myanmar
Netherlands	New Zealand	Norway	Pakistan
Panama	Papua New Guinea	Paraguay	Philippines
Poland	Portugal	Romania	Senegal
Singapore	Slovenia	South Africa	Spain
Sri Lanka	Sweden	Switzerland	Thailand
Trinidad & Tobago	Tunisia	Turkey	United Kingdom
United States	Uruguay	Venezuela	

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Endnotes

¹ This benefit may be achieved through a variety of different means. It may be realized by a restriction on the number of firms operating in the economy. Alternatively, the authorities may provide subsidies for the firms that pay bribes.

² It is obvious from the notations that $(\nu - I)$ is bribe per unit and $(\mu - I)$ is the rate of benefit. However, for simplicity, we label μ and ν as ‘benefit’ (profit) and ‘bribe’ (cost) respectively.

³ The benefit μ is not necessarily concave. Nor, is the accurate functional form, or the sign of higher order derivatives, needed from this study to obtain the results.

⁴ If an economy has a very low level of corruption, it indicates that the opportunity cost of being involved in corruption for the authorities is very high. Therefore it is reasonable to assume that a firm which attempts to corrupt the authorities has to pay a very large amount of bribe.

⁵ With assumptions 1 and 2, there will be only one level of corruption where the slopes of ν and μ are identical, and it will be in $[c_0, c_2]$ as in Figure 1.

⁶ Therefore, the average years of schooling is computed from the eight years’ data for 1991-1998.

⁷ The F-statistics from the redundant variables tests for corruption-squared and corruption-cubed also indicate that these two variables do not have zero coefficients, and consequently should not be deleted from the equation. More detail information is available from the authors.

⁸ Nevertheless, we are reserved to argue that the low corruption equilibrium brings higher growth than the high corruption equilibrium, as Figure 2 simplifies the model by ignoring initial GDP per capita as well as all the other variables. For example, according to (3) in Table 1, *ceteris paribus*, about \$10,000 difference in the initial level of GDP per capita results in about 1 percent point difference in annual growth. As countries with low corruption are in general associated with a considerably higher GDP per capita, the growth rate for the low

corruption equilibrium will be substantially lower than 2.5, once this difference in GDP per capita is taken into account, even when all the other variables are the same.

⁹ All of these variables are taken from ICRG. While bureaucracy is measured by 4 point scale, all the other variables are measured by 6 point scale.

¹⁰ To avoid excessive complexity, only the results for the institutional variables are reported in Table 5. The estimation results for other variables are available on request.