Business Integrity, Public Sector Integrity, Income, and National Competitiveness: A Cross-Country Level Analysis

Jae-Hyung Lee*

This paper's main objective is to investigate the new paradigm on combating corruption in both business and public sectors as proposed by Kang and Lee (2003). Utilising a cross-sectional data of 32 countries from the 2002 *GCR*, combined with the 2002 opacity index and the 2003 *CPI*, the empirical results are consistent with the proposition that business integrity and public sector integrity lead to economic efficiency, which in turn enhances national competitiveness. We also suggest that per capita real income, business integrity, and public sector integrity are positively inter-related. On the basis of this study, policy makers should choose an objective by comprehensive approach and develop a checks and balances system in both sectors. More specifically, business integrity has a greater effect on both per capita real income and national competitiveness than public sector integrity. It is also evident in cross-country comparisons that national competitiveness has a higher elasticity with respect to both business integrity and public sector integrity in Korea than in the other countries.

Keywords: Business integrity, Public sector integrity, The checks and balances system

JEL Classification: C31, K20, Z19

* Research Fellow, Seoul Institute for Transparency, University of Seoul, 90 Cheonnong-dong, Dongdaemun-gu, Seoul 130-743, Korea, (Fax) +82-2-2210-2858, (E-mail) jhlee2000-1@sit.re.kr. This work was supported by the Korea Research Foundation Grant (KRF-2003-005-C00025). The first draft of this paper has been presented at the 3rd Seminar on Anti-corruption, Seoul Institute for Transparency, University of Seoul, Korea, 29 January 2004. I would like to thank discussants who suggested some corrections. Addressing the points raised by paper examiners improved the paper.

[**Seoul Journal of Economics** 2005, Vol. 18, No. 2]

I. Introduction

The new paradigm on combating corruption by objective management on the basis of comprehensive approach develops only after the observation that corruption and economic development are correlated (Kang and Lee 2003). It is characterised by shifting the equilibrium point of corruption downward. On the basis of this, policy makers should choose an objective by comprehensive approach; scientific measurement enhances understanding which contributes to the control, and thus facilitates improvement. This suggests that scientific measurement or evaluation is essential. One criterion to determine the level of corruption in a country is the level of economic development indicators such as income.

A variety of studies shows an inverse relationship between corruption and economic efficiency. For example, Abed and Davoodi (2000, p. 18, 32), based on a single cross-sectional data for 25 countries from the 1999 International Monetary Fund fund staff and World Development Indicators (World Bank), present the results of ordinary least squares (OLS) regressions in which an anti-corruption index with a scale of 0 to 10 (highly corrupt=0; highly clean=10) is regressed on real per capita growth rate. They find that higher growth is significantly related to lower corruption at the 1 percent level; a one unit increase in corruption index increases the growth rate by 2.64%. Variations in initial real per capita Gross Domestic Product (GDP), initial life expectancy, the ratio of fiscal balance to GDP, and inflation are controlled for. In brief, corruption is negatively related to economic development.

On the other hand, Lipset (1960) argues that highly developed economies can more easily detect corrupt behaviours than less developed countries, because the former countries are able to provide citizens with more access to better education, greater literacy, and more impersonal relations than the latter countries. In a similar vein, there is a tendency for economically stable and developed countries to be more likely to have an institutionalised efficient political system. A more institutionalised political system would recognise the difference of public roles from private interests and would not tolerate corruption (Huntington 1968). Choi (2004) also suggests that those countries with advanced economic development have sufficient resources to tackle corruption. In sum, the

more economically developed a country is, the lower the level of corruption will be.

For example, Korea ranked 25*th* in terms of the per capita GDP converted with Purchasing Power Parity (hereafter per capita real income) across 133 countries in 2002, whereas she ranked 50th in the *Corruption Perception Index*. This suggests that Korea has a high level of corruption relative to the level of per capita real income.

External shocks such as institutional reform, education, and information technology as well as severe regulation (*e.g.*, exposure and punishment) would tend to shift the equilibrium point of corruption downward. Corruption occurs as a result of asymmetric information in the principal-agent-client relationship. Therefore, an efficient instrument for a reduction in corruption is to introduce a checks and balances system. A checks and balances system will reduce monopoly and discretion, and raise accountability and transparency, thus shifting the equilibrium point of corruption downward.

This can also apply to the private sector. An implication is that the private sectors should establish an the objective on the basis of comprehensive approach and develop a checks and balances system.

On the other hand, economic performance is one criterion of national competitiveness. For example, Porter, Sachs, and McArthur (2002, p. 17), hereafter referred to as PSM, assert that the principal factors that contribute to global competitiveness, and thereby improve living standards, will differ for economies at different levels of development. The positive effects of both private sector integrity (hereafter business integrity) and public sector integrity on national competitiveness also suggest that the benefits of combating corruption are greater than the costs.

For example, Lee (2003, p. 149) examines the linear form of the production model of national competitiveness as measured by 2002 national competitiveness score across twenty countries compiled by the International Management Development (IMD Yearbook of 2002). He presents evidence from the OLS and two-stage least squares (TSLS) estimates of the national competitiveness parameter of business integrity that a 10-point increase in business integrity increases national competitiveness by 14.86 points; by 4.26 points directly and by 10.60 points indirectly, through three indicators of

economic development (*viz.*, per capita real income, investment, and trade). The estimated results suggest that corruption reduces economic efficiency in the business sector, which in turn deteriorates national competitiveness.

In this paper, we view national competitiveness as the outcome of a production process involving national competitiveness inputs such as economic performance and the level of corruption in both the business and public sectors. This then suggests that differences in corruption are causal to differentials in national competitiveness. Given the importance of national competitiveness, lower levels of corruption in both business and public sectors may be considered jointly in policy formulation and national competitiveness outcomes.

Using unique business and public sector-level data from thirty-two countries we first examine Kang and Lee's proposition that a negative correlation between corruption and economic performance develops only after the hypothesis that economic performance yields beneficial effects on national competitiveness. This reveals that the mechanism behind the corruption-economic performance relationship may also give rise to the economic performance-national competitiveness relation.

Furthermore, we attempt to explore the possibility that causal relationships among per capita real income, business integrity, and public sector integrity potentially exist; causality running from business integrity to per capita real income as well as public sector integrity, and from per capita real income and public sector integrity to business integrity.

Thirty-two countries were selected for study due to the availability of data such as national competitiveness score, business sector corruption index, and public sector corruption index. Even though thirty-two countries do not provide sufficient observations to allow a full econometric evaluation of the causal relationships among the selected variables, the data offer accessible national competitiveness score, opacity index, and corruption perception index by country.

This paper is organised as follows. Section II develops the analytical framework that highlights the direct and indirect effects of both business integrity and public sector integrity on national competitiveness via per capita real income. Section III describes the data. Section IV presents and discusses the empirical results. More specifically, a cross-national comparison is made in this section.

Section V concludes.

II. Analytical Framework

The primary purpose of this section is to specify the proposition that the mechanism behind the corruption-economic performance relationship may also give rise to the economic performance -national competitiveness relation. Causal relationships between anti -corruption and national competitiveness, and between anti-corruption and national competitiveness via economic development indicator in describing the characteristics of the stock of individual country i can be written, in a functional form, as:

$$NC_i = f(Y_i, AOI_i, ACPI_i : X_i) \quad (1)$$

$$Y_i = g(AOI_i, ACPI_i : X_i) \quad (2)$$

$$AOI_i = h(ACPI_i, Y_i : X_i) \quad (3)$$

$$ACPI_i = k(AOI_i, Y_i : X_i) \quad (4)$$

where NC_i denotes the level of national competitiveness in the ith country. Y_i denotes per capita real income. AOI_i and $ACPI_i$ denote the level of business integrity and public sector integrity, respectively.

X_i indicates the interaction term interacted the regressor in the respective equations with a binary variable distinguishing the two groups; outlying countries-and no outlying countries of 32 countries. Outlying countries could be selected from a scatter-plot between the variables presented in appendix. We set the value of the variable to zero and the value of a binary variable, signifying that the value was missing to one. For example, O_1*AOI_i indicates an interaction variable interacted outlying observations, O_1, with AOI_i in the national competitiveness equation.

The introduction of the interaction variable allows us to estimate the differences in the coefficients of the slope between the two groups.

On an a priori basis, the coefficient of the interaction variable is positive depending on the directions of the slopes of the four equations due to the outlying country dummy. Because the dummy

has units for outlying countries, a positive sign of the coefficient of the interaction variable would mean that the slope of each function increased due to outlying countries. For example, a positive sign of $O_1{*}AOI_i$ in equation (1) indicates that national competitiveness may be strengthened at a faster rate in outlying countries as business integrity increases.

Equations (2), (3), and (4) also comply with the hypothesis that causal relationships among per capita real income, business integrity, and public sector integrity exist. The following equation in its reduced-form can be derived:

$$V_i = v(X_i) \tag{5}$$

where $V_i=(Y_i,\ AOI_i,\ ACPI_i)'$ refers to the row vector of the dependent variables and where X_i refers to the column vector of X_i in a reduced-form.

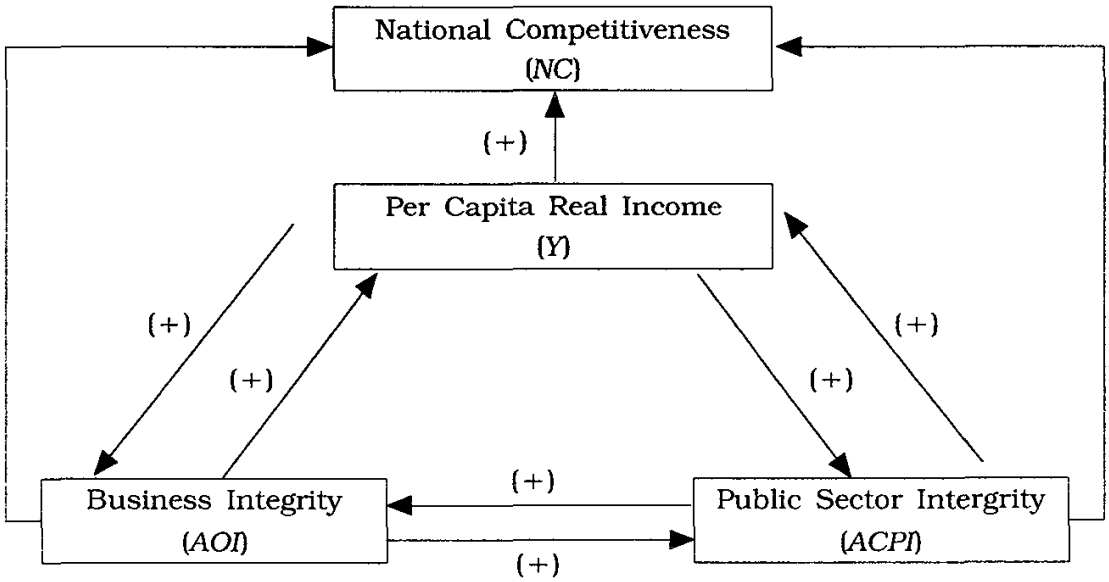
Equations (1)-(5) stand for well-behaved production functions exhibiting everywhere diminishing returns to inputs. Per capita real income, business integrity, and public sector integrity are complementary to each other and therefore business integrity and public sector integrity can be viewed as normal goods. This means that the cross effects among these variables are positive; the second cross partial derivatives are positive (*e.g.*, $\partial^2 Y/\partial AOI \cdot \partial ACPI$, $\partial^2 AOI/\partial Y \cdot \partial ACPI$, and $\partial^2 ACPI/\partial Y \cdot \partial AOI > 0$).

Equations (1)-(5) show that there are four channels through which business integrity and public sector integrity each affect national competitiveness. For example, business integrity affects national competitiveness directly and indirectly, through public sector integrity as well as per capita real income.

$$dNC/dAOI = NC_Y{*}Y_{ACPI}{*}(dACPI/dAOI) + NC_{ACPI}{*}ACPI_Y{*}(dY/dAOI)$$
$$+ NC_Y{*}(dY/dAOI) + NC_{ACPI}{*}(dACPI/dAOI) + NC_{AOI}$$

$$dNC/dACPI = NC_Y{*}Y_{AOI}{*}(dAOI/dACPI) + NC_{AOI}{*}AOI_Y{*}(dY/dACPI)$$
$$+ NC_Y{*}(dY/dACPI) + NC_{AOI}{*}(dAOI/dACPI) + NC_{ACPI}$$

A schematic view (Figure 1) presents the logical linkages among the null hypotheses given in equations (1)-(5). It depicts business



Notes: 1) Arrows relevant to the causation direction.
2) Predicted directions in parentheses

FIGURE 1
THE EFFECT OF BUSINESS INTEGRITY AND PUBLIC SECTOR INTEGRITY ON NATIONAL COMPETITIVENESS

integrity and public sector integrity affecting national competitiveness directly and indirectly, through an economic indicator (*viz.*, per capita real income).

For example, the direct effect captures the impact of a change in the business integrity on national competitiveness. The indirect effects measure the effect on national competitiveness of a change in the business integrity, due to a change in per capita real income. It also depicts two causal relationships between business integrity and public sector integrity, implying that an increase in business integrity raises public sector integrity, which in turn leads to economic performance and thereby national competitiveness.

In order to reinforce the regression results that business integrity and public sector integrity each affect national competitiveness, thirty-two countries are classified into three groups according to per capita real income. Then the structural equation on national competitiveness is defined by:

$$NC_i = \sum_{j=1}^{3} \alpha_j D_j \cdot C_i + \text{Error} \quad (6)$$

where D_1 includes countries with per capita real income greater than the mean value of U.S. $ 12,593; Singapore, U.S.A., U.K., Hong Kong, Italy, Hungary, Israel, Greece, Japan, Taiwan, and Czech Republic. D_2 includes countries with per capita real income lower than the mean value; Chile, Mexico, Uruguay, Lithuania, Peru, Colombia, South Africa, Argentina, Brazil, Venezuela, India, Poland, Guatemala, Thailand, Ecuador, Romania, Turkey, Indonesia, Russian Federation, and China. D_3 indicates Korea.

From equation (6) the elasticity of national competitiveness with respect to business integrity and public sector integrity can be obtained. A higher elasticity is associated with a stronger national competitiveness, suggesting that anti-corruption policies in both business and public sectors should be strengthened.

The coefficient on D_3 which denotes Korea is equal to the value of the constant term. Therefore, in order to avoid the problem of multicollinearity and to estimate a cross-national comparison we rely on OLS regression through the origin (Wooldridge 2000, pp. 220-1).

III. Data

The data for this investigation is from the 2002 *Global Competitiveness Report*, the 2002 *Opacity Index*, and the 2003 *Corruption Perception Index* compiled by the World Economic Forum (WEF), Price Waterhouse Coopers (PWC), and Transparency Inter- national (TI), respectively. Details of the data sources are given in Table 1. The national competitiveness variable in the above model, *NC*, implies a positive effect, so that a higher score in that variable will be associated with relatively stronger national competitiveness in a country.

The economic performance variable, *Y*, is measured as a per capita GDP converted with Purchasing Power Parity (PPP), referred to as per capita real income.

For the relative extent of business sector and public sector corruption level across thirty-two countries, we employ PWC and TI

TABLE 1
DEFINITION OF VARIABLES

	Variable	Mean (SD)	Kurtosis	Sample *t* test[5]
NC[1]	National Competitiveness Score	42.913 (7.125)	-0.439	34.069***
Y[2]	Per Capita Gross Domestic Product Converted with Purchasing Power Parity	12.593 (8.558)	-0.132	8.324***
AOI[3]	Uncorrupted Index in the Business Sector : Business Integrity	40.688 (13.475)	0.103	17.081***
ACPI[4]	Uncorrupted Index in the Public Sector : Public Sector Integrity	45.594 (20.409)	-0.194	12.638***

Notes: 1) Transformation: Value in this paper=the original WEF National Competitiveness Scores times 10.
2) In U.S./ Thousand Dollars.
3) Transformation: Value in this paper=100 minus the original PWC Opacity Index.
4) Transformation: Value in this paper=the original TI Corruption Perception Index times 10.
5) *** indicates significance at the 1% level on a two-tailed test.
1),3),4) Scale of 0 to 100.

Sources: 1),2) World Economic Forum, *The Global Competitiveness Report* 2002, 2003.
3) Price Waterhouse Coopers, *The Opacity Index*, 2002.
4) Transparency International, *CPI*, 2003.

indexes. To facilitate interpretation of the results the variables are transformed into 100 minus the original PWC index and 10 times the original TI index. Consequently, each of the two transformed values implies a positive effect, so that a higher value in each will be associated with relatively higher level of business integrity (*AOI*) as well as public sector integrity (*ACPI*).

Table 1 shows that all the variables are normally distributed. For each statement, wherever necessary, the qualification 'on average' is to be understood. A list of data used in this study is available on request.

TABLE 2

THE SPEARMAN'S RANK ORDER CORRELATION COEFFICIENTS AMONG SELECTED VARIABLES

NC-Y	*NC-AOI*	*NC-ACPI*	*Y-AOI*	*Y-ACPI*	*AOI-ACPI*
0.775***	0.588***	0.889***	0.599***	0.811***	0.782***

Note: *NC*, *Y*, *AOI*, and *ACPI* denote National Competitiveness, Per Capita Real Income, Business Integrity, and Public Sector Integrity, respectively. For more details on the definition of variables see Table 1. *** indicates significance at the 1% level on a two-tailed test.

IV. Estimation Results

In this section, we test Kang and Lee's proposition that both business integrity and public sector integrity yield beneficial effects on economic performance. Given that economic performance is positively related to national competitiveness, it turns out that national competitiveness may be strengthened by enhanced business integrity and public sector integrity directly and indirectly, through economic performance. For example, the direct effect is obtained by the partial derivative of business integrity on competitiveness. The indirect effect indicates that business integrity affects economic performance and thereby national competitiveness.

We also examine the possibility that causal relationships among per capita real income, business integrity, and public sector integrity potentially exist. Hence we further attempt to explore whether business integrity affects public sector integrity, which in turn leads to economic performance and thereby national competitiveness.

Table 2 contains the Spearman's rank order correlation coefficient among the selected variables.

Clearly, it indicates that richer countries have stronger national competitiveness, higher business integrity, and higher public sector integrity than poorer countries. It also shows that the higher a country's level of each of business integrity and public sector integrity, the more economically developed the country will be. This implies that the considerable associations among per capita real income, business integrity, and public sector integrity primarily

TABLE 3

NON-NESTED TEST OF DOUBLE LOGARITHMIC VERSUS LINEAR MODELS OF NATIONAL COMPETITIVENESS, PER CAPITA REAL INCOME, BUSINESS INTEGRITY, AND PUBLIC SECTOR INTEGRITY[1]

Equation	Box-Cox[2]		Theil[3]	
	Logarithmic model (H_1)	Linear model (H_0)	Logarithmic model (H_1)	Linear model (H_0)
NC	RSS=0.156	RSS=0.182	0.799	0.771
	Reject H_0		Reject H_0	
Y	RSS=5.487	RSS=8.169	0.626	0.616
	Reject H_0		Reject H_0	
AOI	RSS=2.311	RSS=1.421	0.440	0.617
		Accept H_0		Accept H_0
ACPI	RSS=3.133	RSS=2.764	0.440	0.617
		Accept H_0		Accept H_0

Notes: 1) By "Accept H_0" we strictly mean "cannot reject H_0".

2) The Box-Cox procedure as described by Maddala (1977, p. 317). For example, the Box-Cox procedure for the national competitiveness function (*NC*) involves dividing each NC_i by the geometric mean of the NC_i's; the exponential of the mean of the natural logarithm of *NC*. Then we estimate the two equations (double natural logarithmic and linear) and choose the one with the smaller residual sum of squares (RSS).

3) The Theil maximum adjusted multiple determination criterion as described by Maddala (1992, p.497). For example, the estimated value of Adj.R^2 for the national competitiveness function is larger in the double natural logarithmic model (Adj.R^2=0.799) than in the linear model (Adj.R^2=0.771), suggesting that the linear model can be rejected.

result from a system of multiple causations.

We restrict the estimations to a linear multiplicative functional form (or double-natural log) because this form empirically has been shown to be the most adequate in cross-country comparisons of national competitiveness. We addressed the functional form issue using the Box-Cox transformation framework and the Theil maximum adjusted multiple determination (Adj.R^2) criterion in Table 3.

The double-natural logarithmic model run by OLS is implied in the estimated regressions for national competitiveness and per capita real income, whereas the linear transformation is suitable in the estimated regressions for business integrity and public sector

TABLE 4

DIAGNOSTIC EVALUATION OF EACH EQUATION FOR NATIONAL COMPETITIVENESS, PER CAPITA REAL INCOME, BUSINESS INTEGRITY, AND PUBLIC SECTOR INTEGRITY: THE OLS ESTIMATES

Equation	Test of Functional Form Misspecification				Hetero-skedasticity
	RESET2	R^2	Durbin-Watson Statistic	*F*-Stat	
lnNC	$t=0.112$	0.906	2.556	$F(4, 27)=50.262^{***}$	$F(7, 25)=0.831$
lnY	$t=0.542$	0.695	2.251	$F(3, 28)=21.303^{***}$	$F(7, 25)=1.392$
AOI	$t=5.502^{***}$	0.687	1.313	$F(3, 28)=20.485^{***}$	$F(7, 25)=4.048^{***}$
ACPI	$t=2.612^{**}$	0.818	1.859	$F(3, 28)=41.824^{***}$	$F(7, 25)=1.516$

Note: *** and ** indicate significance at the 1% and 5% levels on a two-tailed test, respectively. For the test procedure see Dowrick (1993, p. 2), and Lewis, O'Brien, and Thampapillai (1990, p. 296 and pp. 302-7).

integrity.

As a general test for misspecification, we use Ramsey's RESET2 test. It assumes that the effect of omitted variables can be proxied by some function of the original regressors. In Table 4, the regression results of the test suggest that the null hypothesis of functional form misspecification is rejected in all the estimated OLS regressions.

On the other hand, the observed Durbin-Watson (D.W.) statistic lies between d_U and the value of 4-d_U, implying that with one exception (the AOI equation) correct specifications are implied in all three of the estimated OLS regressions. With small cross-section data sets comprised of thirty-two countries the power of the test will depend on the way in which the observations are ordered. Here the thirty-two countries are ordered as they appear in the data package of the 2002 *Opacity Index* compiled by Price Waterhouse Coopers; the external data source organisation.

The observed value of the R^2 is high and the estimated *F*-statistic is larger than the 99 per cent critical value.

TABLE 5

TESTS FOR ENDOGENEITY AMONG PER CAPITA REAL INCOME, BUSINESS INTEGRITY, AND PUBLIC SECTOR INTEGRITY

Equation	Adj.R^2	Joint F test	resid.Y	resid.*AOI*	resid.*ACPI*
Y	0.709	$F(2,24)=16.113$***	-	$t=2.746$**	$t=2.785$***
AOI	0.837	$F(2,24)=32.736$***	$t=5.247$***	-	$t=2.236$**
ACPI	0.829	$F(2,24)=31.051$***	$t=1.897$*	$t=2.483$**	-

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels on a two-tailed test, respectively. See Beggs (1988, p. 96) for the joint F test procedure and Dowrick (1993, p. 2) for the individual t test procedure.

On the basis of the RESET2 specification test and the estimated values of R^2, F and D.W., it can be suggested that all four estimated OLS regressions are correctly specified, indicating that the assumption of zero expected values of residuals is not violated.

In the reported regressions in Table 4, heteroskedasticity could not be detected. Consequently, it can be seen from the OLS regressions that the assumption that the variances of the disturbances are approximately constant for all of the thirty-two countries cannot be rejected.

In the estimated equations for per capita real income, business integrity, and public sector integrity, tests for endogeneity are carried out by augmenting the OLS regression with each of the predicted and the residual (resid) values of the suspected regressor of endogeneity from the reduced-form estimation. The joint F tests and individual t-tests are reported. It can be concluded from the tests for endogeneity in Table 5 that, *ceteris paribus*, per capita real income, business integrity, and public sector integrity are positively inter-related.

Table 6 reports the direct, indirect, and total effects for both business integrity and public sector integrity on national competitiveness from parameter estimates of equations (1)-(4).

All the equations for per capita real income, business integrity, and public sector integrity are estimated using both OLS and TSLS methods, since all the equations are identified with rows and columns whose determinants are non-zero (see, *e.g.*, Baumol (1977, pp. 237-52)). In this study, we analyse OLS results over the TSLS results in each of the three equations for the possibility of sample

TABLE 6

DIRECT, INDIRECT, AND TOTAL EFFECTS OF SECTORAL INTEGRITY ON NATIONAL COMPETITIVENESS

Explanatory Variables	Dependent Variable *NC*					
	IE				DE	TE
	IE1	IE2	IE3	IE4		
Business Integrity	0.150	2.141	0.142	0.187	0.077	2.697
Public Sector Integrity	0.071	0.416	0.240	0.038	0.300	1.065

Notes: IE1 $=NC_Y*Y_{ACPI}*(dACPI/dAOI)$ and $NC_Y*Y_{AOI}*(dAOI/dACPI)$
IE2 $=NC_{ACPI}*ACPI_Y*(dY/dAOI)$ and $NC_{AOI}*AOI_Y*(dY/dACPI)$
IE3 $=NC_Y*(dY/dAOI)$ and $NC_Y*(dY/dACPI)$
IE4 $=NC_{ACPI}*(dACPI/dAOI)$ and $NC_{AOI}*(dAOI/dACPI)$
DE $=NC_{AOI}$ and NC_{ACPI}
TE $=dNC/dAOI$ and $dNC/dACPI$ = IE1 + IE2 + IE3 + IE4 + DE
DE and IE can be obtained from the following OLS estimates:

$$lnNC_i = 2.433 + 0.046 \cdot lnY_i + 0.036 \cdot lnAOI_i + 0.282 \cdot lnACPI_i$$
$$(0.137)^{***} \quad (0.026)^{*} \quad (0.047) \quad (0.046)^{***}$$
$$- 0.045 \cdot O_1 * lnAOI_i + 0.173 \cdot O_2 * lnY_i$$
$$(0.011)^{***} \quad (0.069)^{**}$$

R^2(Adj.R^2) = 0.906(0.888), Joint F(2,26) test = 50.262***,
Chow t = 4.091***, D.W. = 2.556

$$lnY_i = -3.461 + 0.497 \cdot lnAOI_i + 1.035 \cdot lnACPI_i - 0.189 \cdot O_3 * lnAOI_i$$
$$(0.890)^{***} \quad (0.395) \quad (0.287)^{***} \quad (0.092)^{**}$$

R^2(Adj.R^2) = 0.695(0.663), Joint F(1,28) test = 21.303***,
Chow t = 2.054**, D.W. = 2.251

$$AOI_i = 16.971 + 0.498 \cdot ACPI_i + 0.015 \cdot Y_i + 1.426 \cdot O_4 * Y_i$$
$$(3.569)^{***} \quad (0.123)^{***} \quad (0.293) \quad (0.663)^{**}$$

R^2(Adj.R^2) = 0.687(0.653), Joint F(1,28) test = 20.485***,
Chow t = 2.151**, D.W. = 1.313

$$ACPI_i = 2.665 + 0.624 \cdot AOI_i + 1.348 \cdot Y_i - 1.872 \cdot O_5 * Y_i$$
$$(5.513) \quad (0.168)^{***} \quad (0.251)^{***} \quad (1.063)^{*}$$

R^2(Adj.R^2) = 0.818(0.798), Joint F(1,28) test = 41.824***,
Chow t = 1.761*, D.W. = 1.859

where values in parentheses are the estimated absolute standard errors of the regression coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels on a two-tailed test, respectively.

From the joint F test and the Chow t test for the interaction variable we reject the null hypothesis of no coefficient instability for the estimated *lnNC*, *lnY*, *AOI*, and *ACPI* equations. In order to test for stability, we perform the joint F-test and the Chow t test. The joint F-test of the significance involves augmenting the regression with the new interaction variable. The regression results confirm that the estimated equation of each of the functions coefficients is not stable between the two groups; outlying countries-and no outlying countries of 32 countries. See Beggs (1988, p.97) for the joint F test procedure and Giannaros (1985) for the Chow t test procedure.

In the double natural logarithmic equation the impact at margin can be obtained by: coefficient*$\text{DEPENDENT}_{mean}/\text{REGRESSOR}_{mean}$
where DEPENDENT_{mean} and REGRESSOR_{mean} are mean value of each of the dependent and explanatory variables.

selection bias because the sample is limited to thirty-two countries which do not generate a sufficient number of observations (Zarkin, French, Mroz, and Bray 1998, p. 65).

We further use the standard errors of the estimates (SEE) in choosing between the OLS and TSLS regressions (Maddala 1977, p. 287). The TSLS estimates of per capita real income, business integrity, and public sector integrity have higher SEE than the OLS estimates.

The OLS estimates on per capita real income and national competitiveness suggest that differences in both business integrity and public sector integrity are causal to per capita real income and national competitiveness.

It is also evident from Table 6 that two causal relationships exist; a higher level of business integrity affecting a higher level of public sector integrity, and a higher level of public sector integrity affecting a higher level of business integrity; a 10-point increase in business integrity increases public sector integrity by 6.24 points. Conversely, a 10-point increase in public sector integrity increases business integrity by 4.98 points.

Thus, an increase in business integrity raises public sector integrity, which in turn leads to economic performance as measured by per capita real income and thereby national competitiveness; a 10-point increase in business integrity increases national competitiveness by 26.97 points; by 0.70 point directly and by 26.27 points indirectly, due to increases in per capita real income and public sector integrity (see also Notes on Table 6).

On the other hand, a 10-point increase in public sector integrity increases national competitiveness by 10.65 points; by 3.00 points directly and by 7.65 point indirectly, due to increases in per capita real income and business integrity.

Given the estimations, both business integrity and public sector integrity can contribute substantially to per capita real income and national competitiveness.

Consequently, the econometric results are consistent with Kang and Lee's proposition (2003) that corruption reduces economic efficiency in the business sector as well as the public sector. Therefore, an efficient instrument for reducing corruption is to introduce a checks and balances system in both sectors. A checks and balances system will reduce monopoly and discretion, and raise accountability and transparency, thus shifting the equilibrium

TABLE 7

ESTIMATES OF THE ELASTICITY OF SECTORAL INTEGRITY ON NATIONAL COMPETITIVENESS BY COUNTRY GROUP

Sectors	Country Group[1]			D.W.[2]	$F(3,29)$[3]
	D_1	D_2	D_3		
Business Integrity (*AOI*)	0.297 (0.392)***	0.256 (0.319)***	0.346 (1.538)***	1.742	775.666***
Public Sector Integrity (*ACPI*)	0.279 (0.228)***	0.260 (0.200)***	0.303 (0.835)***	2.202	2034.489***

Notes: 1) Values in parentheses are the estimated absolute standard errors of the regression coefficients. *** indicates significance at the 1% level on a two-tailed test. In order to avoid the problem of multicollinearity we rely on OLS regression through the origin. In choosing among linear, semilogarithmic, and double natural logarithmic models, the Theil maximum adjusted multiple determination (Adj.R^2) criterion is applied. See for example, Maddala (1992, p.497). On the basis of Adj.R^2, the semilogarithmic model run by OLS is implied in the two estimated regressions. For example, the estimated value of Adj.R^2 for each of the two national competitiveness functions (*NC*) is larger in the semilogarithmic model than in the linear and double natural logarithmic models, suggesting that the semilogarithmic model cannot be rejected. A full OLS estimates are as follows:

$NC_i = 12.737D_1{*}lnAOI_i + 10.968D_2{*}lnAOI_i + 14.837D_3{*}lnAOI_i$

Adj.$R^2 = 0.986$

$NC_i = 11.976D_1{*}lnACPI_i + 11.142D_2{*}lnACPI_i + 13.001D_3{*}lnACPI_i$

Adj.$R^2 = 0.995$

From the above estimated coefficient, the elasticity of national competitiveness with respect to each of regressors at mean value can be obtained as: $\alpha_j{*}(1/\text{DEPENDENT}_{mean})$

where α_j denotes the estimated coefficient of the respective regressor and where DEPENDENT_{mean} denotes the mean value of the dependent variable, NC_i.

For example, the elasticity of national competitiveness with respect to business integrity (*AOI*) interacted with D_1 can be obtained as:

$12.737{*}(1/42.913) = 0.297$

where the mean value of *NC* (DEPENDENT_{mean}) is 42.913.

2) The estimated D.W. value lies between d_U and the value of $4\text{-}d_U$, implying that correct specifications are implied in the two estimated OLS regressions.

3) The observed joint *F*-statistic is greater than the 99 per cent critical value, suggesting that the null hypothesis of no coefficient instability is rejected.

point of corruption downward.

It can also be observed from the reported regressions in Table 6 that business integrity has greater total effects on national competitiveness than public sector integrity.

In Table 6, the significance of the constant term in each of the national competitiveness, per capita real income, and business integrity equations indicates that the unobserved factors are significant in explaining variations in business integrity, per capita real income, and national competitiveness. For example, lower level of barriers to entry in a country may be associated with higher business integrity and thereby stronger national competitiveness.

In cross-national comparisons as shown in Table 7, national competitiveness is more elastic with respect to both business integrity and public sector integrity in Korea than in the other countries. In order to raise Korea's national competitiveness, therefore, anti-corruption policies in both the business and public sectors should be strengthened.

For the estimation we classify thirty-two countries into three groups according to per capita real income. The first group, D_1, includes countries with per capita real income greater than the mean value of U.S. $ 12,593. The second group, D_2, includes countries with per capita real income lower than the mean value. The third group, D_3, indicates Korea.

Given that business integrity and public sector integrity each has a positive effect on per capita real income, this suggests that business integrity, public sector integrity, and per capita real income are positively inter-related. It turns out that they complement each other and therefore business integrity and public sector integrity can be viewed as normal goods. Consequently, the choice of policy instruments should not be based on a stability analysis of a single final target variable.

V. Concluding Remarks

This paper's main objective is to investigate the new paradigm on combating corruption in both business and public sectors as proposed by Kang and Lee (2003), and to examine the causal relationships among per capita real income, business integrity, and public sector integrity.

On the basis of this study, both the business and public sectors should establish an objective on the basis of comprehensive approach and develop a checks and balances system. For example, Korea ranked 25*th* in terms of the per capita GDP converted with PPP across 133 countries in 2002, whereas she ranked 50*th* in the *Corruption Perception Index*.

An implication of this is that Korea has a high level of corruption relative to the level of income. Therefore, the appropriate corruption rank of Korea is 25 among 133 countries.

On the other hand, economic performance is a criterion of national competitiveness (see, *e.g.*, PSM, 2002). The positive effects of both business integrity and public sector integrity on national competitiveness also suggest that the benefits of combating corruption are greater than the costs.

Given the importance of national competitiveness via economic performance, a theoretical model is developed, which allows both business integrity and public sector integrity to affect national competitiveness directly and indirectly, through economic performance as measured by per capita real income. The model is estimated using a cross-sectional data of thirty-two countries from the 2002 *Global Competitiveness Report*, combined with the 2002 *Opacity Index* and the 2003 *Corruption Perception Index*.

The overall results and analysis of the estimated models allow for the following summary remarks to be made regarding the propositions tested:

1. The regression results suggest that causal relationships among per capita real income, business integrity, and public sector integrity exist. Therefore, the choice of policy instruments should not be based on a stability analysis of a single final target variable. This implies, for example, that business integrity may be facilitated directly by enhanced competition and accounting transparency or indirectly by increased public sector integrity through regulatory reform and by higher income, and that income may be raised directly by increased levels of skill or indirectly by increased business integrity and public sector integrity through enhanced competition and accounting transparency and regulatory reform.
2. Given the estimations, both business integrity and public sector integrity can make a substantial contribution to per capita real income and national competitiveness. More

TABLE 8

THE EFFECT OF A 10-POINT INCREASE IN BUSINESS INTEGRITY AND PUBLIC SECTOR INTEGRITY ON NATIONAL COMPETITIVENESS AND PER CAPITA REAL INCOME: THE CASE OF KOREA

Explanatory Variable	Dependent Variable	
	National Competitiveness[1)]	Per Capita Real Income[2)]
Business Integrity (*AOI*)	3.65 (3.68)	2,476
Public Sector Integrity (*ACPI*)	2.85 (2.87)	1,934
Total	6.50 (6.55)	4,410

Notes: 1) Korea's national competitiveness score in 2002 is 48.9 points. Given that a 10-point increase in each of business integrity and public sector integrity her national competitiveness score becomes 55.4 points, which is approximately equal to the level of Taiwan (55.0 point in 2002). Values in parentheses indicate the elasticity of national competitiveness with respect to business integrity and public sector integrity.

2) Per capita GDP converted with PPP (unit: US $). US $4,410 indicates the difference of per capita real income between Taiwan and Korea.

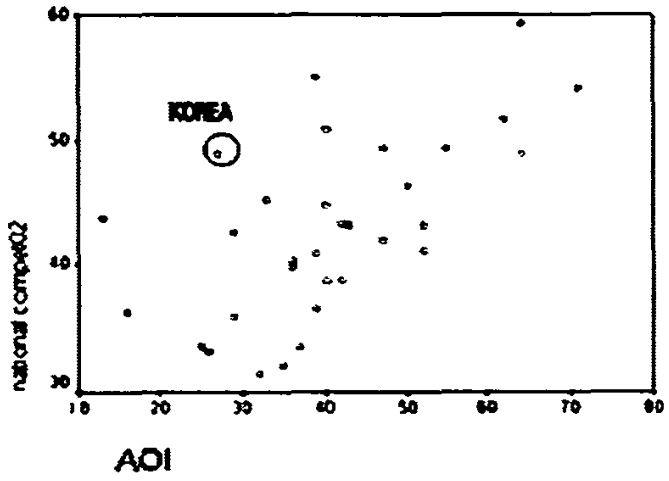
specifically, business integrity has a greater effect on per capita real income and national competitiveness than public sector integrity.

3. In cross-country comparisons, national competitiveness is more elastic with respect to business integrity as well as public sector integrity in Korea than in the other countries. Given the importance of Korea's national competitiveness via economic performance, anti-corruption policies in both business and public sectors should be strengthened.
4. Table 8 shows that, in Korea, a 10-point increase in both business integrity and public sector integrity increases national competitiveness by 6.5 points and per capita real income by U.S. $ 4,410. The estimates also suggest that a 10 percent increase in both business integrity and public sector integrity increases national competitiveness by 6.55 percent.
5. It can also be observed from Table 8 that business integrity has a greater effect on per capita real income as well as national competitiveness than public sector integrity. It is also evident that national competitiveness is more elastic with respect to business integrity than public sector integrity.

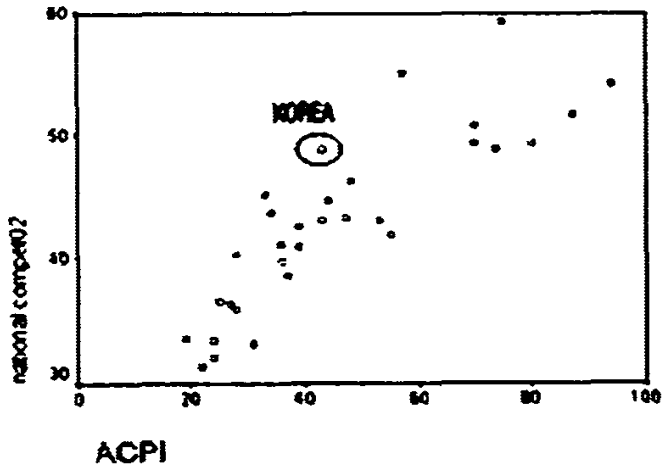
Our results are subject to a number of constraints that should be taken into account. For example, given the data limitations, the level of barriers to entry variable could not be included into the business integrity equation. In addition, thirty-two countries do not provide sufficient observations to allow a full econometric evaluation of the causal relationships among the selected variables. Hopefully, the conclusion reached here will stimulate further research and discussion in resolving these issues.

(Received 26 July 2004; Revised 18 April 2005)

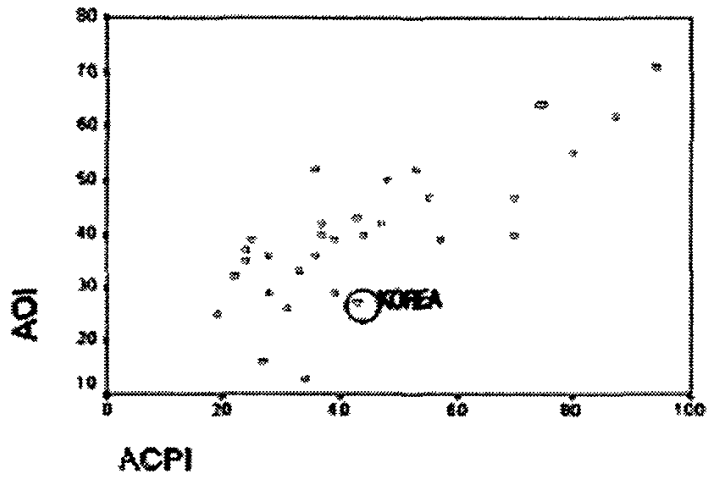
Appendix



APPENDIX FIGURE 1
NC and *AOI*



APPENDIX FIGURE 2
NC and *ACPI*



APPENDIX FIGURE 3
AOI and *ACPI*

References

Abed, George. T. and Davoodi, Hamid. R. Corruption, Structural Reforms, and Economic Performance in the Transition Economies. IMF Working Paper, No. WP/00/132, Washington, D. C., International Monetary Fund, 2000.

Baumol, William J. *Economic Theory and Operations Analysis*. Fourth Edition, New Jersey: Prentice-Hall, Inc., 1977.

Beggs, John. J. "Diagnostic Testing in Applied Econometrics." *Economic Record* 64 (June 1988): 81-101.

Choi, Wook-Jin. E-Government and Corruption: A Cross-Country Survey. Paper presented at *the 4th International Seminar on Anti-Corruption Strategies in Public and Private Sectors*. Seoul Institute for Transparency, June, 2004.

Dowrick, Steve. Estimating the Impact of Government Consumption on Growth: Growth Accounting and Optimising Models. Paper presented at *the Combined Economics Department and Associated Research Programs Seminar/Workshop Series*, University of Wollongong, New South Wales, Australia, August, 1993.

Giannaros, Demetrios S. Long-Term Real Interest Rate Forecasting and the Role of Uncertainty and Deficits. Initial Paper Presented at *Fifth International Symposium on Forecasting*, Montreal, Canada, June, 1985.

Huntington, Samuel P. *Political Order in Changing Societies*. New Haven: Yale University Press, 1968.

Kang, Chul-Kyu, and Lee, Jae-Hyung. "A New Paradigm on Strategy Against Corruption: An Objective Management by Scientific Evaluation." *Journal of Korean Economic Development* 9 (Summer 2003): 59-84.

Lee, Jae-Hyung. "Investigating a New Paradigm on Strategy against Corruption in the Private Sector." *International Area Review* 6 (Fall 2003): 137-59.

Lipset, Seymour M. *Political Man: The Social Bases of Politics*. Garden City: Anchor Books, 1960.

Lewis, Don E., O'Brien, Denis T., and Thampapillai, David. *Statistics for Business and Economics*. Sydney: Harcourt Brace Jovanovich Publishers, 1990.

Maddala, Gupta S. *Econometrics*. New York: McGraw-Hill, Inc., 1977.

_____. *Introduction to Econometrics*. Second Edition, New York: Macmillan Publishing Company, 1992.

Porter, Michael E., Sachs, Jeffrey. D., and McArthur, John. W. "Competitiveness and Stages of Economic Development." *Global Competitiveness Report* (2002): 16-25.

Price Waterhouse Coopers. *The Opacity Index*. 2002.

Transparency International. *Corruption Perception Index*. 2003.

Wooldridge, Jeffrey M. *Introductory Econometrics: A Modern Approach*. U.S.A.: South-Western College Publishing, 2000.

World Economic Forum. *The Global Competitiveness Report*. 2002, 2003.

Zarkin, Gary A., French, Michael T., Mroz, Thomas., and Bray, Jeremy W. "Alcohol Use and Wages: New Results from the National Household Survey on Drug Abuse." *Journal of Health Economics* 17 (January 1998): 53-68.