World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:6, No:6, 2012

Corruption, Economic Growth, and Income Inequality: Evidence from Ten Countries in Asia

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***Abstract*—**This study utilizes the panel vector error correction model (PVECM) to examine the relationship among corruption, economic growth, and income inequality experienced within ten Asian countries over the 1995 to 2010 period. According to the empirical results, we do not support the common perception that corruption decreases economic growth. On the contrary, we found that corruption increases economic growth. Meanwhile, an increase in economic growth will cause an increase in income inequality, although the effect is insignificant. Similarly, an increase in income inequality will cause an increase in economic growth but a decrease in corruption, although the effect is also insignificant.

***Keywords*—**Corruption, economic growth, income inequality, panel vector error correction model

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I. Introduction

CORRUPTION is a global commonality. The corruption perception index (CPI) has been published annually by Transparency International (TI) since 1995 and has been widely credited with putting the issue of corruption on the international policy agenda. The CPI ranks almost 200 countries on a scale of zero to 10, with zero indicating high levels of corruption and 10 indicating low levels. The CPI generally defines corruption as "the misuse of public power for private benefit." In the 2011 CPI, Taiwan ranks 32nd with a score of 6.1; comparing to the Asian countries, behind Singapore (ranking 5th with a score of 9.2), Hong Kong (ranking 12th with a score of 8.4) and Japan (ranking 14th with a score of 8.0), but ahead of South Korea, Malaysia, China, Thailand, Indonesia, Vietnam, and Philippines.

The relationship between corruption and economic growth has been a popular topic and has been examined in several empirical studies. Jain [1] argues that three types of corruption phenomena might occur in a democratic nation. The three types of corruption are grand corruption involving corruption among high level executives in government, legislative corruption involving corruption among representatives of the general public, and bureaucratic corruption involving corruption among government officials and staff. No matter what type of corruption, corruption hurts economic development and causes resources misallocation and economic inefficiencies. Corruption might decrease a country's competitiveness, cause a decrease in economic growth, crowding out government spending in education and health, and an increase income inequality, and distort the market mechanism and resource allocation [2] , [3] .

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The author is grateful to the National Science Council, Taiwan for financial support through project no. NSC 100-2410-H-035-034.

Mauro's cross-country empirical study shows that severe corruption significantly deters investment and economic growth [4]. Brunetti et al. [5] and Brunetti and Weder [6] find that the impact of corruption on investment is negative. Monte and Papagni [7] finds that corruption in Italy municipality not only directly limits the average labor income, but also decreases private investments, which in turn, decreases the efficiency of public investment expenditures and slows down economic growth. Neeman et al. [8] suggests that corruption has a negative impact on a country's economic growth which is determined by the "openness" of the specific country. Svensson [9] re-visit of Mauro's study [4] similarly supports the finding that the impact of corruption on economic growth is negative. Gyimah-Brempong and de Camacho [10] shows that corruption has a negative impact on economic growth and there are significant countries-specific effects. Corruption's negative impact is most significant among African countries and least significant among Asian and OECD countries. Although most of the studies support that the impact of corruption on economic growth is negative, some scholars believe that the impact of corruption on economic growth is positive because corruption contributes to economic development on the grounds that bureaucratic corruption can improve the administrative efficiency of bureaucracy and reduce transaction time cost. Leff [11], Bayley [12], and Huntington [13] suggest that in some cases, bribery of certain decision-makers can reduce the incompleteness of laws and regulations and administrative rigid adverse effects to promote economic efficiency. Lui [14] suggests that corruption may simplify the administrative procedures. Klitgaard [15] and Acemoglu and Verdier [16] use the theoretical model to demonstrate that considering the cost of combating corruption, under the condition of a country's output maximization, the optimal level of corruption may be low, but it does exist. Colombatto [17] finds that in some developing countries, corruption has a positive impact on economic growth. Treisman's cross-country empirical study shows that corruption has not significant impact on economic growth [18].

As to the relationship between corruption and income inequality, Gupta et al. [19], Li et al. [20], Hendriks and Muthoo [21], Jain [1], and Johnston [22] think corruption will increase the level of income inequality. Corruption has changed the distribution of social welfare spending and will benefit the rich people [23], [24]. A large number of empirical studies have attempted to explore the relationship between income inequality and economic growth, such as Persson and Tabellini [25], Psacharopoulose et al. [26], Barror [27], Janvry and Sadoulet [28], Alfranca et al. [29], Jomo [30], Ricardo [31], Samanta and Heyse [32] etc. While most studies explore how OECD countries, European countries, Latin America, or Americas have experienced rapid economic growth accompanied with increasing economic inequality, there are few studies that focus on Asian countries. This study focuses on the Asian countries.

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Over the years of 1995 to 2010, the Asian countries/regions with the CPI score of 6 or more are only Singapore, Hong Kong and Japan. Universalism argues that increased corruption is negatively correlated with economic growth. Corruption prevents the economic development. Therefore, the countries all over the world are devoted to anti-corruption. In recent years, economic growth in Asia has rapidly increased, besides some countries have both serious corruption and rapid economic growth. Is universalism argument appropriate for the Asian countries? Does corruption hurt economic development or corruption increase the economic growth?

In this study, ASEAN+3 (excluding Brunei, Cambodia, Laos, and Myanmar) and Taiwan are selected as the main countries of interest for this empirical study. We use panel data from ten Asian countries over the period of 1995-2010 and adopt the panel vector error correction model to examine whether corruption increases income inequality and then reduces economic growth.

II. Econometric Methodology And Data

A. Panel Unit Root Tests

A variety of procedures for the analysis of unit roots in a panel context have been developed in an attempt to combine information from the time-series dimension with that of the cross-sectional dimension. Given that many interesting findings involve relatively short time-series dimensions, and that conventional unit root tests turn out low power results when applied to single time series the well-known low power of conventional unit root tests when applied to a single time series, four panel unit root tests which are Levin, Lin and Chu (LLC) test, Im, Pesaran, and Shin (IPS) test and PP-Fisher are employed in this study.

One of the popular panel unit root tests is that of Levin, Lin, and Chu [33]. Their test is based on analysis of the equation as shown below:

$$\Delta y_{i,t} = \alpha_i + \beta y_{i,t-1} + \gamma_i t + \sum_{j=1}^{k} \theta_{ij} \Delta y_{i,t-j} + \varepsilon_{i,t} \quad (1)$$

Where Δ is the first difference operator, $\varepsilon_{i,t}$ is a white noise disturbance with a variance of σ^2, t =1,2,…,T represents time periods, and i =1,2,…10 indexes cross-sectional regions. This model allows for two-way fixed effects (α and θ) and unit-specific time trends. LLC test involved the null hypothesis $H_0 : \beta_i = 0$ for all i against the alternative $H_A : \beta_i = \beta < 0$ for all i, with auxiliary assumptions under the null also required about the coefficients relating to the deterministic components.

The Im, Pesaran, and Shin [34] test extends the LLC framework to allow for heterogeneity in the value of under the alternative hypothesis. IPS relaxed the assumption of identical first-order autoregressive coefficients of the LLC test and developed a panel-based unit root test that allows β to be different across regions under the alternative hypothesis. The null and alternative hypotheses are defined as: $H_0 : \beta_i = 0 \ \ \forall i$; $H_A : \beta_i < 0$, for some i. The IPS test is based on the mean group approach. IPS demonstrated that their test has better finite sample performance than that of LLC.

The Fisher-ADF test proposed by Maddala and Wu [35] and the Fisher-PP test proposed by Choi [36] assume an individual unit root process and compute probabilities by using an asymptotic Chi-square distribution. The advantage of the Fisher test is that unlike the IPS test, it does not require a balanced panel. Additionally, the Fisher test allows the use of different lag lengths in the individual ADF regression and can also be carried out for any unit root test derived. One disadvantage of the Fisher test is that the p-values have to be derived via Monte Carlo simulation.

B. Panel Cointegration Tests

Pedroni [37], [38] developed a number of statistics based on the residuals of the Engle and Granger [39] study. Pedroni's (2004) panel cointegration procedure allows for considerable heterogeneity in the panel, since heterogeneous slope coefficients, fixed effects and individual specific deterministic trends are all permitted [40]. By so doing, Pedroni had developed seven panel cointegration statistics for varying intercepts and varying slopes. Four of the statistics, known as the pooled panel cointegration statistics, are within-dimension based statistics, while the remaining three, known as the group mean panel cointegration statistics, are between-dimension based.

Pedroni [37] argued that for cases with longer time spans (such as the number of observation is greater than 100), the sample size distortion tends to minimal, while retaining a very high testing power across all seven statistics. However, for shorter panels, alternative statistics appeared to yield conflicting evidence. Pedroni [37] showed that in terms of testing power, the group-ADF statistic has the best performance in general, followed by the panel-ADF. The panel-variance and group-ρ statistics performed poorly in comparison.

C. Panel Vector Error Correction Model

If variables in the empirical model are nonstationary and cointegrated, we can use the panel vector error correction model (PVECM) to characterize both long run equilibrium relationships and short run dynamic adjustment processes between economic growth and other variables. The PVECM is a restricted panel vector autoregression (PVAR) model with a cointegration built into its specification. The cointegration term is known as the correction term since deviations from the long-run equilibrium are corrected gradually through a series of partial short run adjustments. The PVECM is shown as follows:

$$\Delta X_{it} = C_i + \sum_{k=1}^{P} \beta_k \Delta X_{i,t-k} + \lambda_i EC_{i,t-1} + u_{i,t} \quad (2)$$

where X is the vector of variables including *GDP*, *CPI*, *Gini*, *G*, *FTD*, and *HC*; i represents the panel identity or cross-country identifier; k represents the lag length; whilst P represents the optimal lag length selected in accordance with the Schwarz Criterion (SC); *EC* represents the error correction terms; λ_i and

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u_i represent the speed of adjustment to long run equilibrium and the statistical noise, respectively. *GDP* denotes economic growth measured by the real GDP. *CPI* represents the corruption measured by the corruption perception index; the greater the CPI, the lower the corruption. *Gini* standards for income inequality measured by Gini coefficients. *G* is the real government expenditures. *FTD* denotes the degree of dependence on foreign trade. Human capital (*HC*) is measured as the secondary education enrollment rates.

D.Data

Annual data involving ten Asian countries (including China, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand and Vietnam) from 1995 to 2010 was used in the analysis. Variables *GDP* and *G* are expressed at constant 2005 prices and denominated in U.S. dollar. Data on *GDP* is obtained from the International Monetary Fund **(**IMF). *CPI* is obtained from the Transparency International. Vietnam's CPI in 1995 and 1996 is not available. We adopt SPSS procedures to handle missing data and obtain the predicted data in SPSS data transformations. Data on *Gini* is obtained from World Development Indicators (WDI) databank, the Standardize World Income Inequality Database (SWIID), Human Development Report (HDI), and each country's Bureau of Statistics. Data on *FTD* is obtained from WDI and Taiwan's Bureau of Statistics. Data on *HC* is obtained from WDI data bank, the World Economic Forum, and the Ministry of Education in Taiwan and China.

III. Empirical Results

The panel unit root tests were conducted using four techniques: LLC, IPS ADF-Fisher, and PP-Fisher. The results are reported in Table I. For variables *GDP*, *Gini*, *G* and *FTD*, we were unable to reject the null hypothesis of unit root at the 1% level of significance according to four panel unit root tests. Thus, *GDP*, *Gini*, *G* and *FTD* are nonstationary. According to the four panel unit root tests except LLC test, we were unable to reject the null hypothesis of unit root for variables *CPI* and *HC* at the 1% level of significance. It means *Gini* and *HC* are stationary according to LLC test but are nonstationary according to the other three tests. *Gini* and *HC* are treated as nonstationary variables. Thus, we observed that all variables are nonsationary. Finally, the first differences of all variables were found to be stationary, although is not reflected in the findings below.

To determine whether a cointegration relationship exists, the recently developed methodology proposed by Pedroni [38] is employed. It employs four panel statistics and three group panel statistics to test the null hypothesis of cointegration. Table II presents Pedrono's test for potential cointegration among the following variables: *GDP*, *CPI*, *Gini*, *G*, *FTD*, and *HC*. The panel cointegration results show that among the seven panel statistics, the null hypothesis of no cointegration is rejected by the panel PP, panel ADF, group PP, and group ADF test statistics at the 1% level of significance. Therefore, we think that there is a cointegration relationship among variables.

TABLE I
Panel Unit Root Test Results

Variable	LLC	IPS	ADF-Fisher	PP-Fisher
GDP	3.2936 (0.9995)	3.8184 (0.9999)	7.5482 (0.9945)	7.5387 (0.9945)
CPI	-2.6054*** (0.0046)	-1.0254 (0.1526)	25.2779 (0.1910)	33.3889** (0.0306)
Gini	-1.3719* (0.0850)	0.2053 (0.5813)	17.6754 (0.6088)	21.0966 (0.3915)
G	8.6899 (1.0000)	8.0523 (1.0000)	2.2499 (1.0000)	0.6529 (1.0000)
FTD	-1.4176 (0.0782)	0.2127 (0.5842)	17.4679 (0.6224)	14.0148 (0.8297)
HC	-2.3385*** (0.0097)	-0.7811 (0.2174)	35.7447** (0.0165)	32.7144** (0.0363)

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Numbers in parentheses are p-values.

TABLE II
Panel Cointegration Test Results (with *GDP* as dependent variable)

	Statistic	p-value
Panel v	-0.639975	0.7389
Panel ρ	2.021803	0.9784
Panel PP	-7.818703***	0.0000
Panel ADF	-5.120187***	0.0000
Group ρ	3.673895	0.9999
Group PP	-7.287739***	0.0000
Group ADF	-3.754110***	0.0001

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Due to the fact that the variables included in the model are nonstationary and cointegrated, PVECM is adopted in this study. The results of PVECM are reported in TABLE III. In this study, we focus on the relationship among corruption, economic growth, and income inequality in ten Asian countries. The interactive effects of other variables are important and computed in TABLE III. However, the focus of this study is around the impacts of economic growth (*GDP*), corruption (*CPI*), and income inequality (*Gini*).

TABLE III
PVECM Results

Indept. Variable	Dependent Variable					
	ΔGDP_t	ΔCPI_t	$\Delta Gini_t$	ΔG_t	ΔFTD_t	ΔHC_t
EC_{t-1}	0.154*** (0.001)	-0.0002 (0.102)	0.0006 (0.118)	0.062*** (0.0003)	-0.0021 (0.619)	0.0004 (0.647)

ΔGDP_{t-1}	0.1701 (0.254)	0.001** (0.031)	0.0002 (0.907)	-0.0172 (0.752)	0.0113 (0.425)	0.0002 (0.910)
ΔCPI_{t-1}	-102.8*** (0.005)	-0.1305* (0.096)	-0.3682 (0.240)	-44.4*** (0.001)	1.5174 (0.658)	0.8561 (0.109)
$\Delta Gini_{t-1}$	0.8728 (0.929)	0.0128 (0.547)	-0.1266 (0.136)	-4.0511 (0.257)	0.6755 (0.467)	-0.0455 (0.752)
ΔG_{t-1}	0.874** (0.020)	-0.0003 (0.699)	0.0039 (0.230)	0.520*** (0.0002)	-0.0413 (0.244)	0.0020 (0.716)
ΔFTD_{t-1}	-0.6606 (0.464)	0.0015 (0.447)	-0.0058 (0.453)	-0.3093 (0.347)	-0.27*** (0.002)	-0.0135 (0.307)
ΔHC_{t-1}	-7.4731 (0.179)	-0.0161 (0.178)	-0.0404 (0.399)	-1.1304 (0.576)	1.0626** (0.045)	0.278*** (0.001)
Constant	34.98*** (0.009)	0.0242 (0.396)	0.1952* (0.089)	13.22*** (0.007)	1.1187 (0.373)	0.668*** (0.001)

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The optimal lag length is 1 selected by SC. The p-values are given in parentheses.

In Table III, the error correction term has significantly positive coefficients on economic growth equation, indicating that previous disequilibrium in the economic growth will be corrected in the current period. In the economic growth equation with the dependent variable ΔGDP_t, the estimated coefficient of ΔCPI_{t-1} is significantly negative. This indicates that corruption has a significantly positive impact on economic growth because a decrease in the CPI score means an increase in corruption. In addition, the estimated coefficients of ΔG_{t-1} are significantly positive. This indicates that government expenditure has a significantly positive impact on economic growth. Thus, the ten Asian countries could use expansionary fiscal policy to increase economic growth. However, the estimated coefficients of $\Delta Gini_{t-1}$ are insignificantly positive. This indicates that an increase in income inequality will cause an increase in economic growth, although the effect is insignificant. In the corruption equation, the estimated coefficient of ΔGDP_{t-1} is significantly positive. This implies that an increase in economic growth will cause a country to improve the degree of corruption and increase the CPI score. In the income inequality equation, the estimated coefficient of ΔGDP_{t-1} is insignificantly positive and the estimated coefficient of ΔCPI_{t-1} is insignificantly negative. Thus, an increase in economic growth or corruption will cause an increase in income inequality, although the effect is also insignificant.

IV. Conclusion

In recent years, several Asian countries have experienced rapid economic growth accompanied with increasing economic inequality. While the relationship between corruption and economic growth has been a popular research topic, this study examines the relationship among corruption, economic growth, and income inequality experienced within ten Asian countries, utilizes the PVECM on data covering the period 1990 to 2008, and takes into consideration variables including economic growth, corruption, income inequality, government expenditure, foreign trade dependency, and human capital.

The empirical results show that corruption's impact on economic growth is significantly positive, indicating that corruption causes an increase in economic growth. For Asian countries, corruption may simplify the administrative procedures, improve the administrative efficiency of bureaucracy, and reduce transaction time cost. This may be the reason why the impact of corruption is positive. Thus, we do not support the common perception that corruption decreases economic growth. Additionally, the impact of government expenditure on economic growth is also significantly positive, implying that a government could use expansionary fiscal policy to increase economic growth. Meanwhile, the impacts of economic growth on corruption and income inequality are significantly negative and insignificantly positive, respectively. These relationships suggests that an increase in economic growth leads to decreased corruption, while an increase in economic growth leads to increased income inequality, although the effect is insignificant in the latter case. Furthermore, income inequality also appears to have an insignificant positive effect on economic growth and an insignificant negative effect on corruption, indicating that an increase in income inequality will lead to increased economic growth and decreased corruption, although the effects are once again insignificant.

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