

Fiscal Policy, Institutions, and Economic Growth in Asian Countries: Evidence from Pedroni's Cointegration Approach

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ABSTRACT

This paper investigates the relationship between fiscal policy, institutions, and economic growth and also the role of the institution in Asian economies between 1982 and 2001 through the application of Pedroni's Cointegration approach. It examined two different channels through which fiscal policy and institutions can affect long-run economic growth in Asian economies. The first channel is when aggregate of government expenditure, aggregate of other fiscal variables, and the institution affect the real per capita Gross Domestic Production (GDP) and the second channel is to determine the role of institutions on the real per capita GDP. The Pedroni Cointegration result established a long-run relationship between fiscal policy, institution, and economic growth. We found a positive and statistically significant impact of aggregate of government expenditure and aggregate of other fiscal variables and institution on real per capita GDP. We also found that there is a role of institutions on the real per capita GDP.

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ABSTRAK

Kertas ini menyoiasat hubungan antara dasar fiskal, institusi dan pertumbuhan ekonomi dan juga peranan institusi di dalam ekonomi Asia antara 1982 dan 2001 melalui aplikasi pendekatan ko-integrasi Pedroni. Ianya memeriksa dua saluran yang berbeza iaitu melalui dasar fiskal dan institusi yang mana dijangka boleh memberi kesan jangka panjang pertumbuhan ekonomi di dalam ekonomi Asia. Saluran pertama adalah apabila agregat perbelanjaan kerajaan, agregat pembolehubah fiskal lain dan institusi dapat memberi kesan pada Keluaran Dalam Negara Kasar (KDNK) benar per kapita. dan saluran kedua adalah untuk menentukan peranan institusi ke atas KDNK benar per kapita. Hasil keputusan ko-integrasi Pedroni ini menunjukkan wujudnya hubungan jangka panjang antara dasar fiskal, institusi dan pertumbuhan ekonomi. Kami dapati bahawa terdapat impak yang signifikan dan positif agregat perbelanjaan kerajaan dan agregat pembolehubah fiskal lain dan institusi ke atas KDNK benar per kapita. Kami juga dapati bahawa adanya peranan institusi ke atas KDNK benar per kapita.

INTRODUCTION

In Asian countries, efficiency of the role of institutions is sadly lacking, and there are numerous deficiencies in the functioning of the role of institutions. Institutions mostly thrive on informal networks of political and family connections. There is a certain lack of transparency and accountability in the operation of governmental role of institutions in Asian countries. This type of institutional operation has not only resulted in large transactional costs, but has also created political and economic uncertainty in the region.

The framework of institutions comprises the legal rules and norms that constrain the behaviour of policy-makers. Legal rules and norms should also guarantee that government actions do not undermine but rather support the functioning of economic growth. Government actions should be limited and well constrained by appropriate institutions. Rules and norms can enhance the efficiency of fiscal policies and reduce the scope for rent seeking. Institutions can also secure the stability of fiscal policies by preventing erratic changes in deficit, tax laws, and expenditure programmes. Generally, we concluded that there is evidence which suggests that institutions are important determinants of economic growth. Government policies and institutions seem to play an important role, policies and institutions that minimise rent seeking and attract investment are correlated with higher growth.

Fiscal policies have a benign role for economic growth in the region, namely to provide a stable macro-environment for investment. The changed environment of liquidity constraints on external borrowing and slowdown in output growth has led to new attention being directed toward the role and contribution of fiscal policy to reviving growth in the region (Gangopadhyay & Chatterji, 2005). In the debate on economic policy, fiscal policy is predominantly viewed as an instrument to mitigate short-run fluctuations of output and employment. By a variation in government spending or taxation, fiscal policy aims at altering aggregate demand in order to move the economy closer to potential output.

There are many non-economic factors which interact with the economic growth process,

e.g. institutional economics in North and Thomas (1973), and North (1990) who examined the link between economic development and institutions, while there is a tradition in political science revealed in Lipset (1959) who explained political institutions, and democracy in terms of economic development.

Economic agents may interact in many different ways. Certain agents may only be able to trade with certain others; some agents may try to make inferences from the activities of others. Agents may change their expectations as a function of the expectations of others with whom they are in contact with. A first approach to analysing this sort of problem is to stay within the standard framework and to define a suitable sort of static equilibrium, which takes account of interaction. The latter may be local or global, that is, in the first case, agents will be limited as to whom they have contact with, in the second, agents may meet any other agent.

The objective of this study was to determine the long-run relationship fiscal policy, institutions, and economic growth, and determine the role of institutions on economic growth and whether institutions require complimentary factors to influence economic growth through interaction term effects. Thus, this study aimed at filling a gap in research devoted solely to achieving the objectives using newly developed methods of panel cointegration by Pedroni (2004, 2001) and panel FMOLS estimator (Pedroni, 1996; Pedroni, 2000).

This paper is organised as follows. Section 2 contains a brief literature review, while in section 3, the model is applied to the 13 Asian economies. Section 4 presents empirical results and conclusion is in the final section.

REVIEW OF RELATED LITERATURE

The most recent empirical literature, mainly based on panel data regressions, showed that economic growth is significantly affected by fiscal policies, although there remains some lack of agreement on the sign of these effects. On

the other hand, Caselli, Esquivel, and Lefort, (1996) found robust positive contribution of the government expenditure ratio (net of defence and educational expenditure) to growth. In a similar way, Kneller, Bleaney, and Kneller, (1999) found that public expenditure and taxation only affected growth if they were productive and distortionary, productive government expenditure was found to positively affect growth, whereas distortionary taxation was found to be harmful for growth. With this distinction, they argued that both sides of the government budget should be considered in estimating the impact of fiscal policy on growth, as their financing offsets the growth-enhancing effects of productive expenditure. Gerson (1998) surveyed the theoretical and empirical literature on the effect of fiscal policy variables (government expenditure programmes and taxes) on economic growth. He concluded that educational attainment and public health status had significant, positive effects on per capita output growth; economies that were open to international trade grew faster than those that were closed, therefore fiscal policies that encouraged openness should encourage growth.

Zagler and Dürnecker (2003) surveyed the literature on fiscal policy and economic growth. They presented a unifying framework for the analysis of long-run growth implications of government expenditures and revenues. They found that the level of education expenditure and the growth rate of public infrastructure investment both exhibited a positive impact on the growth rate of the economy. Tanzi and Zee (1997) examined systematically the various ways that main fiscal instruments (tax policy, public expenditure policy, and budget policy) influenced economic growth through their impact on the determinants of growth.

The question of how institutions fit into a theory of economic growth depends not only on what one means by institutions, but also on the other aspects of that theory. Rodrick, Subramaniam, and Trebbi, (2002) concluded that institutions ruled over other potential determinants of growth and, in particular, geographic variables had a strong impact on institutions but little or no effect on growth beyond the institutional linkage. That means quality of institutions overrides geography and integration (international trade) in

explaining cross-country income levels. Rodrick (1997) found that an index of institutional quality [drawn from work by Knack and Keefer (1995) and Easterly and Levine (1997) did exceptionally well in rank-ordering East Asian countries according to their growth performance.

North (1990) had argued that it was a country's institutions that determined its long-run economic performance, by defining the way its political/economic system operated. North identified the government's enforcement of property rights, and the regulations it imposed as the most important determinants of economic performance. These institutions clearly could have a significant effect on the Total Factor Productivity (TFP) of a country's economic system.

Leblang (1996) had found that there was a positive correlation between economic and political freedom on the one hand and economic growth on the other. Goldsmith (1995) also found that both economic and political freedom were correlated with economic growth. Przeworski and Limongi (1997) found little evidence that political systems affected growth, but did not examine economic institutions. Gwartney, Lawson, and Block, (1996) had developed a measure of economic freedom that was independent of political freedom, and their analysis indicated that there was a simple correlation between economic freedom and growth. Barro (1996) concluded that after adjusting for various economic factors, democracy had, if anything, a negative impact on economic growth.

Rodrik *et al.* (2002) followed this analysis in treating current institutions as a stock that had been created by a past flow of good or bad policies, that was, by the operation of past institutions. Results thus rely upon current measures of rule of law. Sala-i-Martin and Subramanian (2003) found that once the effect of resource flowing on institutions (with an emphasis on rule of law) was accounted for, resources had no effect or a small positive effect on growth rates of per capita GDP. Law and Demetriades (2006) examined whether the institution was an important determinant of financial development by using dynamic panel data techniques. They found that the institution variable was a statistically significant determinant of financial development in all models.

Chen and Gupta (2006) examined the structural factors that may have an effect on economic growth. They worked with panel data where observations were pooled on a cross-section over a period of time. They began with a linear growth regression specification and then extended it to account for interaction terms. The interaction terms were between a variable to measure for openness and the various structural factors such as education, financial depth, public expenditure on education and health, and the inflation rate. They found that the interaction term between openness and government expenditure on health and education, and openness and financial depth have positive coefficients. This implied that economies where the government spends more on education and health and is relatively financially developed; openness will have a positive effect on growth.

Law and Demetriades (2006) found that the coefficient on the models containing the interaction term demonstrates that interaction between capital inflows and import duties are positive and has a highly significant influence on financial development. Borensztein, De Gregorio, and Lee, (1998) detected a positive and significant interaction between the stock of human capital and FDI. Eller, Haiss, and Steiner, (2006) implemented a second improvement interaction term between the stock of FSFDI and the stock of human and physical capital. They found that the interaction of the FSFDI stock with the index of employee education has a positive impact on economic growth; the interaction of the FSFDI stock with the stock of physical capital is associated negatively to growth. They also considered the positive human capital-related interaction term – they detected complementary effects between FSFDI and human capital on economic growth, and FSFDI seemed to spur economic growth depending on a higher human capital stock.

Benos (2005) used the following interaction terms: $SY=SSY*Y$, $EY=EDY*Y$, $HEY=HY*Y$, where SSY is social spending as fraction of GDP, Y is GDP per capita and EDY , HY stands for government spending on education, and health respectively as a proportion of GDP. The inclusion of these terms tests the hypotheses that the impact of expenditures on social security-social assistance, education and health varies with

the GDP per capita of the countries. This way, he allowed for heterogeneity of the coefficients of government spending on education, health, and social services across countries. He also found that the interaction term SY was negative and statistically significant in three out of six estimations implying that the influence of social spending on growth might weaken the higher the level of development of a country. The effect of health expenditure seems to be stronger the richer a country is, although the relevant variable, HEY , is not statistically significant most of the time. This sort of impact suggests the possibility of positive externalities of better nutrition, housing, and social infrastructure in wealthier countries, on health spending.

Building on this prior work, this paper seeks to identify more precisely the characteristics conducive to economic growth and the key institutional and policy factors that contribute to differences in growth rates across countries.

EMPIRICAL MODEL

As follow Hoeffler (2002), in the Solow's model growth in output per worker depends on initial output per worker [$y(0)$], the initial level of technology [$A(0)$], the rate of technological progress (g), the savings rate (s), the growth rate of the labour force (n), the depreciation rate (δ), and the share of capital in output (α). Thus, the model predicts that a high saving rate will affect growth in output per worker positively, whereas high labour force growth (corrected by the rate of technological progress and the rate of depreciation) will have a negative effect on growth in output per worker. The basic Solow model can be transformed in the following form:

$$\ln y(t) - \ln y(0) = \ln A(t) + gt + \frac{\alpha}{1-\alpha} \ln(s) - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \quad (1)$$

where $y(t)$ denotes the logarithm of output per worker in period t .

In the augmented version of the Solow model investment, human capital is an additional determinant of growth in output per worker

$$\ln y(t) - \ln y(0) = \ln y(0) + \ln A(0) + gt + \frac{\alpha}{1-\alpha-\beta} \ln(s_k) + \frac{\beta}{1-\alpha-\beta} \ln(s_h) - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \quad (2)$$

where s_k and s_h denote the proportion of output invested in physical and human capital, respectively.

Equations (1) and (2) had been used as a framework for empirical analysis by Mankiw, Romer, and Weil, (1992), Islam (1995), and Caselli et al. (1996). In this section, a simple model is set out and provides an organising framework for thinking about the ways in which the aggregate of government expenditure, aggregate of other fiscal variables, and institutions affect growth. Therefore, we adopted the framework introduced by Mankiw *et al.* (1992), Demetriades and Law (2006), Ghura and Hadjimichael (1996), Hoeffler (2002), and Knight, Looyza, and Villanueva, (1993). This study provides a growth model from the conventional growth accounting framework and the production function below takes the standard neoclassical form with a minor modification which includes human capital in the Cobb-Douglas production function:

$$Y(t) = K(t)^\alpha H(t)^\beta [A(t)L(t)]^{1-\alpha-\beta}, 0 < \alpha < 1. \quad (3)$$

where Y is real output at time t , K and L are the stocks of physical capital and labour, respectively, at time t , H is the stock of human capital, A is a similar measure for physical capital, and α and β the share of capital and human capital on output. A is a labour-augmenting factor reflecting the level of technological development and efficiency in the economy and the subscript t indicates time. This equation states merely that at any moment, the total output of the economy depends on the quantity and quality of physical capital employed, the quantity of labour employed, and the average level of skills of the labour force. Output can only increase if K , L , A , or H also increases, and perpetual increases in output per worker can only occur if the stock of capital per worker or the average quality of labour or of capital also increases perpetually.

We assumed that $\alpha + \beta < 1$ which implies that there are decreasing returns to all capital raw labour and labour-augmenting

technologies, which are assumed to grow according to the following functions:

$$L(t) = L(0)e^{nt} \quad (4)$$

$$A(t) = A(0)e^{gt+P\theta} \quad (5)$$

where n is the exogenous rate of growth of the labour force, g is the exogenous rate of technological progress, P is the variable vectors of government expenditure and fiscal policy that can affect the level of technology and efficiency in the economy, and θ is a vector of coefficient related to these variables.

Demetriades and Law (2006) stated that variable A depends on exogenous technological improvements and the level of other variables. Variable A in this study differed from A used by Mankiw *et al.* (1992). This modification is more likely to be particularly relevant to the empirical cases of the link between government expenditure, fiscal policy, and economic growth. The technological improvements are encouraged by development in public investment spending and fiscal policy, which tend to contribute to economic growth (Ramirez & Nazmi, 2003).

In a steady state (denoted as a * in the equation), output per worker grows at the constant rate g , which is the exogenous component of the growth rate of the efficiency variable A (Demetriades & Law, 2006). Hence, this output can be obtained directly from the definition of output per effective worker as follows:

$$\frac{Y(t)}{A(t)L(t)} = [k(t)]^\alpha [h(t)]^\beta$$

$$\frac{Y(t)}{L(t)} = A(t)[k(t)]^\alpha [h(t)]^\beta \quad (6)$$

$$\text{Let } y_t^* = \left(\frac{Y(t)}{L(t)} \right)^*$$

Taking logs both of Equation (6) and log income per worker at a given time; time 0 for simplicity is

$$\ln\left(\frac{Y}{L}\right)^* = \ln A + \alpha \ln k^* + \ln \beta \ln h^* \quad (7)$$

where $A(t) = A(0)e^{gt+P\theta}$

The main equation of this model used for estimation purposes in equation (8) below:

$$\ln\left(\frac{Y}{L}\right)^* = \ln A_0 + gt + \theta \ln P + \frac{\alpha}{1-\alpha-\beta} \ln s_k + \frac{\beta}{1-\alpha-\beta} \ln s_h - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) \quad (8)$$

Equations (8) indicates a steady state output per worker or labour productivity where a vector of government expenditure and fiscal policy proxies exist, while s_k is the savings in physical capital, s_h is the savings in human capital, and δ is the rate of depreciation.

Before we proceed to estimate the model, it is necessary to write equation (8) in terms of per capita output. Note again that for Mankiw *et al.* (1992) as bellow:

$$\ln A(0) = a + \varepsilon \quad (9)$$

On the other hand, for Islam (1995) and Caselli *et al.* (1996) as below:

$$\ln A(t) = \ln A(0) + gt \quad (10)$$

Our model differed from Caselli *et al.* (1996) and Islam (1995) where we assumed that s_h and gt do not vary over time but s_k and n can be assumed to vary over time. This means that, $\ln A_0$, gt , and s_h can be considered as a constant term A_0 . Therefore, the steady-state output per worker or labour productivity (y^*) grows according to the following equation:

$$\ln\left(\frac{Y}{L}\right)^* = A_0 + \theta \ln P + \frac{\alpha}{1-\alpha-\beta} \ln s_k + \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) \quad (11)$$

The above equation introduced a set of variables (P) which was assumed as exogenous that could affect economic growth in the long

run. With the introduction of endogenous growth theory, P was no longer assumed as exogenous. The endogenous treatment of P allowed us to suggest a possible set of explanatory variables. This model differed from neoclassical production functions in two important categories of variables namely technology related variables and policy related variables. The key assumption about productivity growth here was that a typical developing country purchases technology knowledge abroad from various suppliers. What technology purchased depends on the price of foreign technology as well as trade and exchanged rate policies that impact the final cost of the imported technology (Ramirez & Nazmi, 2003). In our model, we concentrated on policy related variables and we introduced government expenditure and fiscal policy, which were included as a proxy for policy related variables.

Then proposed Basic Model was given as:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln GOVPOL_{it} + \beta_2 \ln S_{kit} - \beta_3 \ln(n+g+\delta)_{it} + \varepsilon_{it} \quad (12)$$

where Y_{it} is real GDP per capita, $GOVPOL_{it}$ is a control variable of fiscal policy and institutions, S_{kit} is the savings in physical capital, $(n+g+\delta)$: n is the rate of labour growth, g is the rate of technology growth or technological progress, and δ is the rate of depreciation. The addition of g and δ was assumed to be constant across countries and over time, following Islam (1995), Mankiw *et al.* (1992), and Caselli *et al.* (1996), technological progress and the depreciation rate were assumed to be constant across countries and that they sum up to 0.05. The natural logarithm of the sum of population growth was 0.05 and was calculated for $(n+g+\delta)$. The β_0 is a constant term and β_1 , β_2 , and β_3 are estimated parameters in the model, while ε_{it} is an error term.

In order to examine the aggregate of government expenditure, aggregate of fiscal policy, institutions, and the interaction effects between aggregate of government expenditure variables, and institutions, and aggregate of fiscal policy variables, and institutions on economic growth, Equation (12) was extended to include the institutions and an interaction term, as follows:

Model 1

$$\ln Y_{it} = \beta_0 + \beta_1 \ln GE_{it} + \beta_2 \ln OFV_{it} + \beta_3 \ln INS_{it} + \beta_4 \ln(GE_{it} * INS_{it}) + \beta_5 \ln S_{kit} - \beta_6 \ln(n+g+\delta)_{it} + \varepsilon_{it} \quad (13)$$

Model 2

$$\ln Y_{it} = \beta_0 + \beta_1 \ln GE_{it} + \beta_2 \ln OFV_{it} + \beta_3 \ln INS_{it} + \beta_4 \ln(FPV_{it} * INS_{it}) + \beta_5 \ln S_{kit} - \beta_6 \ln(n+g+\delta)_{it} + \varepsilon_{it} \quad (14)$$

where Y_{it} is a real GDP per capita, GE_{it} is an aggregate of government expenditure variables as a share of GDP (obtained by summing up the government expenditure on health, education, and defense), OFV_{it} is an aggregate of independent fiscal policy variables as a share of GDP (obtained by summing up public sector wages and salaries, expenditure on other goods and services, transfers and subsidies, interest payment on government debt, capital expenditure (minus government expenditure on health, education and defense), tax revenue, non-tax revenue, and grant). S_{kit} and $(n+g+\delta)$ are as defined earlier in equation (12). In addition, INS_{it} is an institutions indicator which is obtained by summing up the five indicators (corruption, bureaucratic quality, rule of law, government repudiation of contracts, and risk of expropriation), $(GE*INS)$ and $(OFV*INS)$ are interactions between the aggregate of government expenditure variables and institutions, and the aggregate of other fiscal variables and institutions, i is a cross-section data for countries referred to, and t is a time series data, while ε_{it} is an error term. The constant is denoted as β_0 while β_1 - β_6 are the coefficients showing how much a one unit increase in each individual variable will affect the growth rate in economic growth.

Panel Unit Root Tests Estimation Procedure

In order to investigate the possibility of panel cointegration, it is first necessary to determine whether real per capita GDP (as dependent variable) and the independent variables evolve as unit root processes. There are several unit root tests specifically for panel data which have been introduced in past decades. Each panel unit root test data has its own benefits and limitations and for this study we have chosen the Levin, Lin, and Chu (denoted as LLC; 2002), Im, Pesaran and

Shin (denoted as IPS; 1997), and Maddala and Wu (denoted as MW; 1999), which were based on the well-known Dickey-Fuller procedure.

We started with LLC which found that the main hypothesis of panel unit root is as follows:

$$\Delta y_{it} = \Phi_i y_{i,t-1} + \sum_{L=1}^{p_i} \rho_{i,L} \Delta y_{i,t-L} + \varepsilon_{i,t} \quad m=1,2,\dots \quad (15)$$

where $y_{i,t}$ refers to variable $\ln rgdpc_{it}$, $\ln GE_{it}$, $\ln OFV_{it}$, $\ln S_{kit}$, $\ln(n+g+\delta)_{it}$ and Δ refers to the first difference. The hypothesis test is $H_0 : \Phi_i = 0$ for existence of unit root whereas $H_a : \Phi_i < 0$ for all i for non-existence of unit root. As p_i is unknown, LLC suggested a three-step procedure in the test. In the first step; obtain the Augmented Dickey-fuller (ADF) regression which has been separated for each individual in the panel, generate two orthogonalised residuals. The second step requires an estimation of the ratio of long-run to short-run innovation standard deviation for each individual. The last step requires us to compute the pooled t -statistics.

IPS proposed a test for the presence of unit roots in panels that combines information from the time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power. Since the IPS test has been found to have superior test power by researchers in economics to analyse long-run relationships in panel data, we also employed this procedure in this study. IPS begins by specifying a separate ADF regression for each cross-section with individual effects and no time trend as follows:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad (16)$$

where $i = 1, \dots, N$ and $t = 1, \dots, T$

IPS used separate unit root tests for the N cross-section units. Their test was based on the ADF statistics averaged across groups. After estimating the separate ADF regressions, the average of

the t -statistics for p_1 from the individual ADF regressions, $t_{if_i}(p_i)$ was:

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^N t_{i,T}(p_i, \beta_i) \quad (17)$$

The t -bar was then standardised and it was shown that the standardised t -bar statistic converges to the standard normal distribution as N and $T \rightarrow \infty$.

Finally, MW developed a test based in the probability values of all root unit individual tests. An alternative approach to panel unit root tests uses Fisher's (1932) results to derive tests that combine the p -values from individual unit root tests. The statistic is given by:

$$-2 \sum_{i=1}^N \log(\pi_i) \rightarrow \chi^2_{2N} \quad (18)$$

where π_i is the p -value of the test statistic in unit i , and is distributed as a $\chi^2(2N)$ under the usual assumption of cross-sectional independence. When the Fisher test is based on ADF test statistics, we must specify the number of lags used in each cross-section ADF regression. Maddala and Wu (1999), showed that it is more powerful than the t -bar in IPS test.

Panel Cointegration Tests

The next step was to test for the existence of a relationship between the real per capita GDP growth rates and the independent variables using panel cointegration tests suggested by Pedroni (1999, 2004). We made use of seven panel cointegrations by Pedroni (1999, 2004), since he determined the appropriateness of the tests to be applied to estimated residuals from a cointegration regression after normalising the panel statistics with correction terms.

The procedures proposed by Pedroni make use of estimated residual from the hypothesised long-run regression of the following form (Pedroni, 1999):

$$y_{i,t} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \dots + \beta_{Mi} x_{Mi,t} + e_{i,t} \quad (19)$$

for $t = 1, \dots, T; i = 1, \dots, N; m = 1, \dots, M$,

where T is the number of observations over time, N is the number of cross-sectional units in the panel, and M is number of regressors. In this set

up, α_i is the member specific intercept or fixed effects parameter which varies across individual cross-sectional units. The same is true of the slope coefficients and member specific time effects,

$$\delta_i t.$$

Pedroni (1999, 2004) proposed the heterogeneous panel and heterogeneous group mean panel test statistics to test for panel cointegration as follows:

1. Panel v -statistic:

$$T^2 N^{3/2} Z_{\hat{v},N,T} = T^2 N^{3/2} \left(\sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t}^2 \right)^{-1} \quad (20)$$

2. Panel ρ -Statistic:

$$T \sqrt{N} Z_{\hat{\rho},N,T} = T \sqrt{N} \left(\sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t}^2 \right)^{-1} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (21)$$

3. Panel t -Statistic (non-parametric):

$$Z_{t,N,T} = \left(\hat{\sigma}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t}^2 \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (22)$$

4. Panel t -Statistic (parametric):

$$Z_{t,N,T}^* = \left(\hat{s}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^* \quad (23)$$

5. Group ρ -Statistic:

$$TN^{-1/2} \tilde{Z}_{\hat{\rho},N,T} = TN^{-1/2} \sum_{i=1}^N \left(\sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^N \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (24)$$

6. Group t -Statistic (non-parametric);

$$N^{-1/2} \tilde{Z}_{t,N,T} = N^{-1/2} \sum_{i=1}^N \left(\sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (25)$$

7. Group t -Statistic (parametric):

$$N^{-1/2} \tilde{Z}_{t,N,T}^* = N^{-1/2} \sum_{i=1}^N \left(\sum_{t=1}^T \hat{s}_i \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^* \quad (26)$$

where

$$\hat{\lambda}_i = \frac{1}{T} \sum_{s=1}^{k_i} \left(1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\mu}_{i,t} \hat{\mu}_{i,t-s}, \quad \hat{s}_i^2 = \frac{1}{T} \sum_{t=1}^T \hat{\mu}_{i,t}^2, \quad \hat{\sigma}_i^2 = \hat{s}_i^2 + 2\hat{\lambda}_i,$$

$$\hat{\sigma}_{NT}^2 = \frac{1}{T} \sum_{t=1}^T \hat{L}_{11t}^2 \hat{\sigma}_i^2, \quad \hat{s}_i^{*2} = \frac{1}{T} \sum_{t=1}^T \hat{\mu}_{i,t}^{*2} \left(\hat{s}_{NT}^{*2} = \frac{1}{N} \sum_{i=1}^N \hat{s}_i^{*2} \right)$$

and

$$\hat{L}_{11t}^2 = \frac{1}{T} \sum_{t=1}^{k_i} \hat{\eta}_{i,t}^2 + \frac{2}{T} \sum_{T=1}^T \left(1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\eta}_{i,t} \hat{\eta}_{i,t-s}$$

where the residuals $\hat{\mu}_{i,t}$, $\hat{\mu}_{i,t}^*$, and $\hat{\eta}_{i,t}$ are obtained from the following regressions:

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \hat{\mu}_{i,t}, \quad \hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \sum_{k=1}^{K_i} \hat{\gamma}_{i,k} \Delta \hat{e}_{i,t-k} + \hat{\mu}_{i,t}^*, \quad \text{and} \quad \Delta y_{i,t} = \sum_{m=1}^M \hat{b}_{mi} \Delta x_{mi,t} + \hat{\eta}_{i,t}$$

Fully Modified Ordinary Least Squares (FMOLS) Estimation

In this section, we adopted FMOLS procedure from Christopoulos and Tsionas (2003). In order to obtain asymptotically efficient consistent estimates in panel series, non-exogeneity and serial correlation problems are tackled by employing fully modified OLS (FMOLS) introduced by Pedroni (1996). Since the explanatory variables are cointegrated with a time trend, and thus a long-run equilibrium relationship exists among these variables through the panel unit root test and panel cointegration test, we proceeded to estimate Equation (13) to Equation (14) by the method or fully modified OLS (FMOLS) for heterogenous cointegrated panels (Pedroni, 1996, 2000). This methodology allows consistent and efficient estimation of cointegration vectors and also addresses the problem of non-stationary regressors, as well as the problem of simultaneity biases. It is well known that OLS estimation

yields biased results because the regressors are endogenously determined in the $I(1)$ case. The starting point OLS is as in the following cointegrated system for panel data:

$$y_{it} = \alpha_i + x_{it}' \beta + e_{it} \quad (27)$$

$$x_{it} = x_{i,t-1} + \varepsilon_{it}$$

where $\xi_i = [e_i, \varepsilon_i']$ is the stationary with covariance matrix Ω_i . The estimator β will be consistent when the error process $\omega_i + [e_i, \varepsilon_i']'$ satisfies the assumption of cointegration between

y_i and x_i . The limiting distribution of OLS estimator depends upon nuisance parameters. Following Phillips and Hansen (1990), a semi-parametric correction can be made to the OLS estimator that eliminates the second order bias caused by the fact that the regressors are endogenous. Pedroni (1996, 2000) followed the same principle in the panel data context, and allowed for the heterogeneity in the short-run dynamics and fixed effects. FMOLS Pedroni's estimator was constructed as follow:

$$\hat{\beta}_{FM} - \beta = \left(\sum_{i=1}^N \hat{\Omega}_{22}^{-1} \sum_{t=1}^T (x_{it} - \bar{x}_i)^2 \right)^{-1} \sum_{i=1}^N \hat{\Omega}_{21}^{-1} \hat{\Omega}_{22}^{-1} \left(\sum_{t=1}^T (x_{it} - \bar{x}_i) e_{it}^* - T \hat{\gamma}_i \right) \quad (28)$$

$$\hat{e}_{it}^* = e_{it} - \hat{\Omega}_{22}^{-1} \hat{\Omega}_{21t}, \quad \hat{\gamma}_i = \hat{\Gamma}_{21t} + \hat{\Omega}_{21t}^0 - \hat{\Omega}_{22t}^{-1} \hat{\Omega}_{21t} (\hat{\Gamma}_{22t} + \hat{\Omega}_{22t}^0)$$

where the covariance matrix can be decomposed as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i$, where Ω_i^0 is the contemporaneous covariance matrix, and Γ_i is a weighted sum of autocovariances. Also, $\hat{\Omega}_i^0$ denotes an appropriate estimator of Ω_i^0 .

In this study, we employed both the within-dimension and between-dimension panel FMOLS tests from Pedroni (1996, 2000). An important advantage of the between-dimension estimators is that the form in which the pooled data allows for greater flexibility in the presence

of heterogeneity of the cointegrating vectors. Specifically, whereas test statistics constructed from the within-dimension estimators are designed

to test the null hypothesis $H_0 : \beta_i = \beta_0$ for all i against the alternative hypothesis

$H_A : \beta_i = \beta_A \neq \beta_0$ where the value β_A is the same for all i , test statistics constructed from the between-dimension estimators are designed to

test the null hypothesis $H_0 : \beta_i = \beta_0$ for all i against the alternative hypothesis $H_A : \beta_i \neq \beta_0$,

so that the values for β_i are not constrained to be the same under the alternative hypothesis. Clearly, this is an important advantage for applications such as the present one, because there is no reason to believe that, if the cointegrating slopes are not equal to one, they necessarily take on some other arbitrary common value. Another advantage of the between-dimension estimators is that the point estimates have a more useful interpretation in the event that the true cointegrating vectors are heterogeneous. Specifically, point estimates for the between-dimension estimator can be interpreted as the mean value for the cointegrating vectors. This is not true for the within-dimension estimators (Pedroni, 2001).

DATA AND CHOICE OF VARIABLES

The data set consisted of a panel of observations for 13 Asian countries, namely China, Hong Kong, Korea, Japan, Indonesia, Malaysia, Philippines, Singapore, Thailand, Bangladesh, India, Pakistan, and Sri Lanka for the period 1982-2001. All data were collected from the World Development Indicator (World Bank CD-ROM 2005), Asian Development Bank 2004, and The Government Finance Statistics (GFS) for the various years. All these data were converted to US dollars based on year 2000 constant prices.

Following Demetriades and Law (2006), the data set on institutional quality indicators

employed from the International Country Risk Guide (ICRG) – a monthly publication of Political Risk Services (PRS) – five PRS indicators were used to measure the overall institutional environment, namely: (i) *Corruption*, which reflects the likelihood that officials will demand illegal payment or use their position or power to their own advantage; (ii) *Rule of Law*, which reveals the degree to which citizens are willing to accept established institutions to make and implement laws, and to adjudicate disputes, which can also be interpreted as a measure of rule obedience (Clague, 1993) or government credibility; (iii) *Bureaucratic Quality*, which represents autonomy from political pressure, strength, and expertise to govern without drastic changes in policy or interruptions in government services, as well as the existence of an established mechanism for recruitment and training of bureaucrats; (iv) *Government Repudiation of Contracts*, which describes the risk of a modification in a contract taking due to change in government priorities; and (v) *Risk of Expropriation*, which reflects the risk that the rules of the game may be abruptly changed. The above first three variables were scaled from 0 to 6, whereas the last two variables were scaled from 0 to 10. Higher values indicate better rating for institutional quality and vice versa. The scale of corruption, bureaucratic quality, and rule of law was first converted to 0 to 10 (multiplying them by 5/3) to make them comparable to the other indicators. The institution indicator was obtained by summing up the above six indicators.

EMPIRICAL RESULTS

Table 1a and Table 1b report the results of the LLC, IPS, and MW panel unit root tests for the data on aggregate of government expenditure variables (*GE*), aggregate of other fiscal variables (*OFV*), institutions (*INS*), savings rate (s_k), population growth rate ($n+g+\delta$), interactions of aggregate of government expenditure variables in institutions

($GE*INS$), and interaction of aggregate of other fiscal variables in institutions ($OFV*INS$) for both the scenarios of constant and constant plus time trend term. The tests were run for the full sample of 13 countries and over the period 1982 to 2001. Table 1a indicates that all variables are $I(0)$ in the constant of the panel unit root regression. These results clearly showed that the null hypothesis of a panel unit root in the level of the series cannot be rejected at various lag lengths. We assumed that there was no time trend. Therefore, we tested for stationarity allowing for a constant plus time

trend. In the absence of a constant plus time trend, again we found that the null hypothesis of having panel unit root is generally rejected in all series at level form and various lag lengths.

As discussed above, we concluded that most of the variables are non-stationary in with and without time trend specifications at level by applying the LLC, IPS, and MW tests, which were also applied for heterogeneous panel to test the series for the presence of a unit root. The results of the panel unit root tests confirmed that the variables were non-stationary at level.

Table 1a: Panel Unit Root Tests: Level

	CONSTANT			CONSTANT + TREND		
	LLC	IPS	MW	LLC	IPS	MW
\lnrgdpc	-0.35(5)	1.72(0)	21.81(1)	2.1192)	1.15(1)	30.44(1)
$\ln GE$	-1.52(0)	3.52(0)	17.41(0)	3.34(0)	1.58(1)	13.73(1)
$\ln OFV$	-0.99(0)	3.51(0)	9.33(0)	0.42(1)	-0.59(0)	25.08(1)
$\ln INS$	0.04(0)	1.75(0)	12.95(0)	0.29(0)	1.04(0)	18.12(0)
$\ln S_k$	0.10(0)	-0.71(0)	33.11(0)	1.73(2)	-0.03(0)	25.25(0)
$(n+g+\delta)$	-1.08(2)	-0.51(4)	22.38(4)	0.12(2)	-0.77(2)	28.97(2)
$(GE*INS)$	-1.84(0)	3.26(0)	13.99(0)	1.97(0)	3.18(1)	19.21(1)
$(OFV*INS)$	-1.21(0)	3.18(0)	12.02(0)	1.60(0)	2.61(1)	12.59(1)

Notes: The number in { } denotes lag length, the lag length was chosen on the basis of the Akaike's Information Criteria (AIC) where we specified maximum lag order (k) in autoregression and then we selected appropriate lag order according to the AIC.

For LLC t -stat all reported values were distributed $N(0,1)$ under null of unit root or no cointegration.

Table 1b presents the results of the tests at first difference for LLC, IPS, and MW tests in constant and constant plus time trend. We can see that for all series, the null hypothesis of unit root test was rejected at 95% critical value (1% level). Hence, based on LLC, IPS, and MW tests, there was evidence that all the series are in fact integrated of order one.

We concluded that the results of panel unit root tests (LLC, IPS, and MW tests), reported in Table 1b, support the hypothesis of a unit root in all variables across countries, as well as the hypothesis of zero order integration in first differences. At most of the 1% significance level, we found that all test statistics in both with and

without trends significantly confirm that all series strongly reject the unit root null. The presence of unit root in the variables also indicated that all the independent variables $\ln GE$, $\ln OFV$, $\ln INS$, $\ln S_k$, $\ln(n+g+\delta)$, $\ln(GE*INS)$, $\ln(OFV*INS)$, and dependent variables (\lnrgdpc) are in fact integrated of order one, or are $I(1)$ processed when the individual country data were pooled together. The findings of a unit root on the variables in this study are consistent with the results of a number of previous studies, such as Campbell and Perron (1991), McCoskey and Selden (1998), Macdonald and Nagayasu (2000), Lee and Chang (2006), and Al-Awad and Harb (2005).

Table 1b: Panel Unit Root Tests: First Difference

	CONSTANT			CONSTANT + TREND		
	LLC	IPS	MW	LLC	IPS	MW
$\ln rgdpc$	-7.51(0)*	-5.57(0)*	75.95(0)*	-8.25(0)*	-5.30(0)*	71.07(0)*
	-5.00(0)*	-4.69(0)*	67.90(0)*	-5.49(0)*	-3.78(0)*	56.40(0)*
$\ln GE$	-14.17(0)*	-12.74(0)*	172.04(0)*	-13.29(0)*	-11.77(0)*	144.00(0)*
$\ln OFV$	-7.49(0)*	-5.89(0)*	79.39(0)*	-6.68(0)*	-3.37(0)*	49.39(0)*
$\ln INS$	-10.64(0)*	-9.03(0)*	121.18(0)*	-9.42(0)*	-6.53(0)*	85.39(0)*
$\ln S_k$	-19.09(0)*	-17.09(0)*	230.74(0)*	-16.87(0)*	-15.26(0)*	185.03(0)*
$(n+g+\delta)$	-7.61(0)*	-8.88(0)*	121.80(0)*	-9.02(0)*	-8.58(0)*	110.92(0)*
$(GE*INS)$	-9.16(0)*	-8.81(0)*	118.58(0)*	-9.34(0)*	-8.00(0)*	101.03(0)*

Notes: The number in { } denote lag length, the lag length was chosen on the basis of Akaike's Information Criteria (AIC) where we specified maximum lag order (k) in autoregression and then we selected appropriate lag order according to AIC.

For LLC *t*-stat, all reported values were distributed $N(0,1)$ under null of unit root or no cointegration.

Given the results of LLC, IPS, and MW tests, it is possible to apply panel cointegration methodology in order to test for the existence of a stable long-run relation among the variables.

PANEL COINTEGRATION TESTS

The next step was to test whether the variables are cointegrated using Pedroni's (1999, 2001, 2004) methodology as described previously for Model 1 Model 2. This was to investigate whether a long-run steady state or cointegration exists among the variables and to confirm what Oh, Kim, Kim, and Ahn, (1999) and Coiteux and Olivier (2000) stated that the panel cointegration tests have much higher testing power than the conventional cointegration test. Since the variables were found to be integrated in the same order $I(1)$, we continued with the panel cointegration tests proposed by Pedroni (1999, 2001, 2004). Cointegrations were carried out for constant and constant plus time trend, and the summary of the results of cointegration analyses are presented in Table 2.

In constant level, we found that Model 1, which is with the interaction term, indicates that only one out of seven statistics reject the null hypothesis of non-cointegration at the 1% level of significance. While in Model 2, there was none of seven statistics that reject the null hypothesis. In the panel cointegration test for Model 1 and

Model 2 with constant plus trend level, the results indicated that five out of seven statistics reject the null hypothesis of non-cointegration at the 1% level of significance. It was shown that independent variables do hold cointegration in the long run for a group of 13 Asian countries with respect to real per capita GDP. However, since all the statistics conclude in favour of cointegration, and this, combined with the fact that according to Pedroni (1999) the panel non-parametric (*t*-statistic) and parametric (*adf*-statistic) statistics are more reliable in constant plus time trend, we concluded that there is a long-run cointegration among our variables in 13 Asian countries.

Overall in Table 2, we found that most of the panel statistics were more reliable in constant plus time trend compared to the panel statistics in constant. As indicated by the panel non-parametric (*t*-statistic) and parametric (*adf*-statistic) statistics as well as group statistics that are analogous to the IPS-test statistics, the null hypothesis of non-cointegration was rejected at the 1% level of significance. These results also implied that taken as a group, the theory of growth through augmented Solow model for Model 1 and Model 2 does hold over the estimation period.

Table 2: Panel Cointegration Tests for Heterogeneous Panel (Dependent Variable: Real Per Capita GDP)

	Constant		Constant + Trend	
	Model 1	Model 2	Model 1	Model 2
Panel- v	-2.24	-2.40	3.795*	2.886*
Panel- ρ	3.15	3.34	3.897	4.598
Panel- t	2.50	2.97	-1.932*	-2.148*
Panel- adf	2.72	2.24	-1.795*	-1.824*
Group- ρ	4.31	4.01	4.627	4.973
Group- t	-1.76	1.83	-2.676*	-2.212*
Group- adf	-2.62*	2.11	-2.043*	-1.892*

Notes. All statistics are from Pedroni's procedure (1999) which is the adjusted values can be compared to the $N(0,1)$ distribution. The Pedroni (2004) statistics are one-sided tests with a critical value of 1.64 ($k < -1.64$ implies rejection of the null), except the u-statistic that has a critical value of 1.64 ($k > 1.64$ suggests rejection of the null). *, ** indicates rejection of the null hypothesis of no-cointegration at 1%, and 5%, level of significance, respectively.

Cointegration Estimation Results – FMOLS

The previous section already confirmed that all variables in two equations (two models) are cointegrated. In other words, a long-run equilibrium exists among the variables. This section discusses the estimated long-run equation. Following Pedroni (2000, and 2001), cointegrating explanatory variables for the data was estimated using the Fully Modified OLS (FMOLS) technique. In Table 3 and Table 4, results are reported for within group (within-dimension) FMOLS and panel group (between-dimension) FMOLS estimators without and with common time dummies.

Within group in Table 3, within group FMOLS results without time dummies, all variables in Model 1 and Model 2 reported tests that reject the null hypotheses at the 1% and 5% levels of significance. Panel group FMOLS showed that all variables in Model 1 and Model 2 reported tests that reject the null hypotheses at the 1% and 5% levels of significance. For the aggregate of government expenditure ($\ln GE$),

the estimate of coefficient was positive [0.07 and 0.72 (within group) and 1.06 and 0.88 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. Therefore, there is presence of a long-run relationship between government expenditure and GDP. The estimate of the coefficient for the aggregate of other fiscal variables ($\ln OFV$) was positive [0.02 (within group) and 0.02 and 0.04 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. The aggregate of other fiscal variables positively affect growth and there is a long-run cointegration between the aggregate of other fiscal variables and economic growth.

There was a positive coefficient [0.43 and 0.52 (within group) and 0.05 and 0.10 (panel group)] and statistically significant at the 5% (within group) and 1% (panel group) level for institutions ($\ln ins$) in Model 1 and Model 2. Thus, there is a long-run cointegration between

institutions and economic growth. The estimate of the coefficient for the savings in physical capital (investment) ($\ln s_k$) was positive [0.13 and 0.16 (within group) and 0.12 and 0.16 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. We concluded that investment and economic growth have a long-run cointegration. The coefficient on population growth ($\ln(n+g+\delta)$) was negative [-0.20 (within group) and -0.49 and -0.37 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. Both groups showed that there is still a long-run cointegration between population growth and economic growth, and population growth has an adverse effect on economic growth. The interaction term between institutions and aggregate of government expenditure ($\ln GE*INS$) and institutions and aggregate of other fiscal variables ($\ln OFV*INS$) had positive coefficients (0.32 and 0.02 (within group) and 0.34 and 0.02 (panel group)) and statistically significant at the 5% and 1% level in within group and panel group for Model 1 and Model 2, respectively. We concluded

that the aggregate of government expenditure and aggregate of fiscal policy variables, which interact with the institutions variable, have a potential impact on long-run steady-state levels of growth. Thus, there is a long-run cointegration between aggregate of government expenditure and aggregate of fiscal policy variables that interact with institutions variable and economic growth. Again we found that while the inclusion of an interaction term between aggregate of government expenditure and institutions, and aggregate of fiscal policy and institutions as an added regressor in the growth equations (Model 1 and Model 2), do not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 1 or Model 2.

Comparing the results reported in within group and panel group, we found that the panel groups give higher values of estimation coefficient and higher values of significance (1% level) which would be a more accurate representation of the average long-run relationship. Therefore, we concluded that all variables are cointegrated and there is long-run relationship.

Table 3: FMOLS Results, Without Time Dummies (Dependent Variable: Real GDP Per Capita)

	Within Group		Panel Group	
	Model 1	Model 2	Model 1	Model 2
$\ln GE$	0.07**(2.20)	1.06*(-3.56)	0.88*(11.19)	0.72**(2.65)
$\ln OFV$	0.02**(-2.50)	0.02*(-4.69)	0.04*(-6.86)	0.02**(-2.49)
$\ln ins$	0.43**(-1.94)	0.05*(-4.71)	0.10*(-10.09)	0.52**(-2.87)
$\ln s_k$	0.13**(-1.99)	0.12*(-4.46)	0.16*(-4.95)	0.16**(-2.32)
$\ln(n+g+\delta)$	-0.20**(-2.37)	-0.49*(-5.01)	-0.37*(-5.65)	-0.20**(-2.28)
$\ln(GE*INS)$	0.32***(2.81)	0.34*(3.40)	-	-
$\ln(OFV*INS)$	-	-	0.02*(-4.52)	0.02**(-2.04)

Note: The null hypothesis for the t -ratio is $H_0 = \beta_i = 0$; Figures in parentheses are t -statistics; (*) and (**) significant with 95% (90%) confidence level;

“within-dimension” reports Pedroni (1996) weighted within-dimension adjusted-FM;

“between-dimension” reports Pedroni (1996, 2000) group mean panel FMOLS.

Table 4 presents the results of within group and panel group FMOLS with time dummies, respectively. In within group, all variables reported that tests rejected the null hypotheses of non-cointegration at the 1% and 5% level of significance. On the other hand, panel group showed that all variables reported that tests rejected the null hypotheses of non-cointegration at the 1% level of significance. For the aggregate of government expenditure ($\ln GE$), the estimate of coefficient is positive [0.29 and 2.08 (within group) and 2.23 and 2.53 (panel group)] and statistically significant at the 5%

level in within group and statistically significant at the 1% level in panel group. Therefore, there is a presence of a long-run relationship between government expenditure and GDP. The estimate of the coefficient for the aggregate of other fiscal variables ($\ln OFV$) is positive [0.04 and 0.09 (within group) and 0.02 and 0.48 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. The aggregate of other fiscal variables positively affect growth and there is a long-run cointegration between the aggregate of fiscal policy and economic growth.

Table 4: FMOLS Results, With Time Dummies (Dependent Variable: Real GDP Per Capita)

	Within Group		Panel Group	
	Model 1	Model 2	Model 1	Model 2
$\ln GE$	0.29**(-1.99)	2.23*(-4.76)	2.53*(11.11)	2.08**(2.15)
$\ln OFV$	0.04*(4.39)	0.02*(-3.62)	0.48*(-3.60)	0.09*(3.36)
$\ln ins$	1.17*(4.60)	.25*(-3.34)	1.64*(-4.30)	1.21*(3.60)
$\ln S_k$	0.14**(-2.24)	0.25*(-3.50)	0.21*(-3.09)	0.16**(-2.32)
$\ln(n+g+\delta)$	-0.21**(-2.37)	-0.29*(-5.98)	-0.27*(-5.09)	-0.19**(-2.28)
$\ln(GE*INS)$	0.28**(-2.55)	0.50*(-5.13)	-	-
$\ln(OFV*INS)$	-	-	0.14*(-6.14)	0.22**(-2.04)

Note: The null hypothesis for the t -ratio is $H_0 = \beta_i = 0$; figures in parentheses are t -statistics;

(*) and (**) significant with 95% (90%) confidence level;

“within-dimension” reports Pedroni (1996) weighted within-dimension adjusted-FM;

“between-dimension” reports Pedroni (1996, 2000) group mean panel FMOLS.

There was a positive coefficient [1.17 and 1.21 (within group) and 0.25 and 1.64 (panel group)] and statistically significant at the 1% level for institutions ($\ln ins$) in Model 1 and Model 2. Thus, there is a long-run cointegration between institutions and economic growth. The estimate of the coefficient for the savings in physical capital (investment) ($\ln S_k$) was positive [0.14 and 0.16 (within group) and 0.25 and 0.21 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. We concluded that investment and economic growth have a long-run cointegration. The coefficient on population

growth ($\ln(n+g+\delta)$) was negative [-0.21 and -0.19 (within group) and -0.29 and -0.27 (panel group)] and statistically significant at the 5% level in within group and statistically significant at the 1% level in panel group. Both tables show that there is still a long-run cointegration between population growth, and economic growth and population growth has an adverse effect on economic growth. The interaction term between institutions and aggregate of government expenditure ($\ln GE*INS$), and institutions and aggregate of other fiscal variables ($\ln OFV*INS$) had positive coefficients [0.28 and 0.22 (within group) and 0.50 and 0.14 (panel group)] and statistically significant at the 5% and 1% level

in within group and panel group for Model 1 and Model 2, respectively. We concluded that aggregate of government expenditure and aggregate of fiscal policy variables interact with institutions variable and have a potential impact on long-run steady-state levels of growth. Thus, there is a long-run cointegration between aggregate of government expenditure and aggregate of fiscal policy variables which interact with institutions variable and economic growth. Comparing the results reported in within group and panel group, we found that the panel groups give higher values of estimation coefficient and higher values of significance (1% level) which would be a more accurate representation of the average long-run relationship. Therefore, we concluded that all variables are cointegrated and there is a long-run relationship.

Overall, our results in Table 3 and Table 4 show that the within group's estimator without and with time dummies almost have a coefficient of panel relative to all variable levels and are statistically significant at 1% and 5% levels. Meanwhile, for the panel group's estimator without and with time dummies have the coefficient of panel relative to all variable levels and are statistically significant at the 1% level. It is interesting to note that panel group FMOLS estimators consistently produce larger estimates than do the within group estimators. Therefore, our results support Pedroni's (2001) arguments that the panel groups estimators produce consistent estimates of the average slope under the alternative hypothesis that the slopes are different from one another and vary across countries, whereas the within groups estimators do not.

CONCLUSION

Several important conclusions can be drawn from the study. Firstly, our study attempted to identify the important role of institutions, which is government anti-diversion policies with a weighted average of (i) corruption in government, (ii) rule of law, (iii) bureaucratic quality, (iv) repudiation of government contract, and (v) expropriation risk determinants of economic

growth rates in a sample of 13 Asian countries. While the inclusion of institutions as an added regressor in the growth equations does not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts. This is not surprising given that institutions are positively correlated with some of the regressors. The results from the analysis are significant, and provide support for the historical evidence presented by North and Thomas (1973), Rosenberg and Birdzell (1986), and North (1990). They showed that the security of property rights provides incentives for economic growth in the world. Secure role of institutions also lead to an efficient allocation of government expenditure and fiscal policy.

Secondly, this study provided another framework of a set of linkages to capture most of the important interaction among economic growth, institutions, government expenditure, and fiscal policy. Economic indicator especially interacts with non-economic indicator. The positive results of the effect of interaction term between the aggregate of government expenditure and institutions, and the aggregate of fiscal policy and institutions on economic growth in 13 Asian economies are really interesting. These interaction terms as an added regressor in the growth equations do not generally affect the sign or absolute magnitude of the estimates; they are not less precisely estimated than their counterparts. This result support earlier findings from other researchers who stated that typically economic agents in models of interaction are thought of as being placed on a lattice and interacting with their neighbours (Durlauf, 1990, Benabou, 1996, Blume, 1993, Ellison, 1993, Brock & Durlauf 2001).

Thirdly, we assessed the empirical evidence on the link between fiscal policy and growth by considering five policy areas: public sector wages and salaries, expenditure on other goods and services, transfers and subsidies, interest payment on government debt, capital expenditure (minus government expenditure on health, education and defence), tax revenues, non-tax revenue, and grant. The analyses of fiscal policy in 13 Asian economies showed that the authorities do make active use of fiscal policy.

This implies that fiscal policy is practically possible and can be effective in influencing the real per capita GDP. There is thus a rationale for fiscal policy.

We also assessed the empirical evidence on the link between government expenditure and growth by considering three expenditure areas: health expenditure, education expenditure and defence expenditure. The analyses of government expenditure in 13 Asian economies showed that the authorities do make active use of government expenditure even though there are very limited areas. This implies that government expenditure is practically possible and can be effective in influencing the real per capita GDP.

Fourthly, we estimated our equation (Model 1 and Model 2) using Fully Modified OLS (OLS) as proposed by Pedroni (2000), and found a positive and statistically significant impact of aggregate of government expenditure, aggregate of fiscal policy, institutions, and interaction term (between aggregate of government expenditure and institutions, aggregate of fiscal policy and institutions), and savings in physical capital (investment) on economic growth. On the other hand, we found that the population growth rate is negative and significantly related to GDP per capita.

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