Government Size and Economic Growth in Emerging Market Economies: A Panel Cointegration Approach

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Abstract

This paper explores the relationship between government size and economic growth in the presence of domestic investment using cutting-edge Panel Cointegration testing and Dynamic Ordinary Least Square (DOLS) estimation technique, applied on a sample of 19 emerging market economies' macroeconomic variables for the period 1970 to 2006. Perusal of the literature on this relationship suggests that the diversity in results hence conclusion obtained from different studies have emerged specifically on the basis of alternative indicators used as proxy measures of the respective variables, apart from the diversity in sample chosen and methodology adopted. This Paper finds a significant and positive influence of government size and the domestic investment on economic growth in the long-run. The elasticity of economic growth with respect to government size is higher than the corresponding elasticity with respect to domestic investment, irrespective of the proxy variables used to measure these indicators. The conclusion of this paper is important at the onset of the present global financial crisis, as the crisis shows that some fundamentals of free market, deregulation and general reduction in government intervention and greater reliance on the allocative function of the market just do not always work even in some of the most sophisticated market economies.

Keywords: Government size, Economic growth, Emerging Economies, Panel Cointegration, Dynamic OLS

JEL Classification: E62, H50, O40, C23

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I. Introduction

This paper provides empirical evidence on the long run relation between government size and economic growth in presence of domestic investment for a selected group of countries, namely Emerging Market Economies (EME). A term coined in 1981 by Antoine W. Van Agtmael of the International Finance Corporation of World Bank, an emerging market economy (EME) is defined as an developing economy with low to middle per capita income, that have undertaken economic development and reform programs in the market oriented line and have begun to 'emerge' as significant players in the global economy. Such countries constitute approximately 80% of the global population[1].

This paper is motivated by the following facts. First, the potential causes for the creation of EME are the failure of state-led economic development and the need for capital investment. The failure of state led growth and its tremendous negative impact pushed those countries to adopt open door policies, to replace their traditional state interventionist policies, undertake domestic economic and political reforms and to change from the state's being in charge of the economy to facilitating economic growth along market-oriented lines. Thus, finding out the relationship between government size and economic growth in the long run for this group of countries will be a testable proposition. Second, the present global financial crisis have been showing that some fundamentals of free market, deregulation and general reduction in government intervention and greater reliance on the allocative function of the market just do not always work even in the most sophisticated market economy like United Sates. Therefore, it seems right time to further investigate and analyze the role of government size in influencing economic growth in long run, especially for these EME. However, till date not much attention has been paid to find out such

[1] www.economywatch.com

relation ship for the EME as a group. Though there is a study on Chile , an emerging economy, by Cerda, Rodrigo A., González, Hermann and Lagos, Luis Felipe (2006), where the evidence of non Keynesian impacts of fiscal policy is found using Structural Vector Auto Regression (SVAR) analysis for the period from1833 to 2000.

The relationship between government size and economic growt h has long been a debated issue theoretically as well as empirically since 1960. On theoretical grounds the major controversy has been on whether or not the public sector increases the long run steady state growth rate of the economy. At the empirical level, basically two points emerges. The first point of view attributes to the government a non-negligible role to play in the pr ocess of economic development and a larger government size is likely to have positive impact on long-run economic growth (Rubinson(1977), Ram (1986, 1989), GÜNALP and GÜR (2002), Grossman (1990), Lin (1994), Holmes and Hutton (1990), Tulsidharan (2006), Ghali (1999)). The second point of view suggests that a larger government size is likely to have adverse effect on the efficiency and economic growth. (Landau (1983), Barth and Brady (1987), Grier and Tullock (1987), Diamond (1989), Barro (1989, 1990, 1991), Levine and Renelt(1991), Morrissey Oliver and Kweka Josaphat P. (1999), Fölster and Henkerson (2000)) At the same time economists have adopted different measures of government size and economic growth in their respective studies.

This paper explores this debated relationship between government size and economic growth in the presence of domestic investment exploiting the annual panel data on 19 emerging market economies' macroeconomic variables, for the period 1970-2006. A co integrating relation i.e. a long-run equilibrium relationship among the variables in the regression equation is found by heteroscedastic panel co integration test. The Dynamic Ordinary Least Square (DOLS) method of panel co integration estimation is employed to estimate and test the structural parameters. There is little evidence of using panel co integration analysis to arrive at the long run relationship between government size and economic growth (Arpaia and Turrini (2008), Fatima, Azhar and Saleem (2006)). However none of the study has established their relation in terms of Dynamic OLS (DOLS) methodology in panel co integration model.

This method is superior to a number of other estimators as it can be applied to system of variables with different orders of integration. Kao and Chiang in a comparison of finite sample properties of alternative estimators found that (1) the Ordinary Least Square OLS estimator has a non-negligible bias in finite samples (2) the Fully Modified OLS (FM-OLS) estimator does not improve over the OLS estimator in general, and (3) the DOLS estimator may be more promising than OLS or FM estimators in estimating the co integrated panel regressions. Including lead and lag terms, DOLS correct the nuisance parameter in order to obtain coefficient estimates with nice limiting distribution properties. While the pooled mean group estimation include only lag terms as explanatory variables. Therefore, in DOLS method it would desirable to choose the number of lead and lag; such a way so that beyond this lag and lead the coefficients of the lags and leads of the first difference of the explanatory variables is effectively zero. Thus the **endogeniety of the regressors can be removed** and the estimate of DOLS equation can be performed unbiased.

The contribution of this paper is as follows. First, this study being perhaps the first attempt to find out above relationship for a group of EME, finds a strong significant positive impact of government size on economic growth. Inclusion of size of investment as another explanatory variable does not alter the result. In fact, in this case the elasticity of economic growth with respect to the government size is found to be higher than that of the size of domestic investment in long run. Second, given the fact that the diversity of the empirical studies can be attributed to the different measures adopted to represent government size and economic growth in their respective studies, this paper establishes the long run relationship using all possible alternate proxy variables for government size, investment size and economic growth available in the literature Finally, the study greatly improves the credibility in regression analyses by applying, Dynamic Ordinary Least Square (DOLS). To date there is hardly evidence that after testing for panel cointegration, DOLS estimation and inference methodology has been used to estimate the structural parameters and hence to arrive at the long run relationship between government size and economic growth.

The rest of the paper is organized as follows. Section III briefly outlines the representative sample profile and variable used in the study. Section IV describes the methodology, consists of a three-step procedure such as (1) panel unit root test, (2) panel cointegration test and (3) estimation and inference in DOLS panel cointegration model. Section V provides the empirical results and section VI concludes.

Ii. An Overview of the Empirical Literature on the Government Size and Economic Growth

At the empirical level two broad views emerges. On the one hand people claim for a positive relationship between government size and economic growth (Rubinson (1977), Ram (1986, 1989), GÜNALP and GÜR (2002), Grossman (1990), Lin (1994), Holmes and Hutton (1990), Tulsidharan (2006), Ghali (1999)). The rationales behind this positive role of the government are: government plays a crucial role in harmonizing conflicts between private and social interests and providing a socially optimal direction for growth and development. In countries characterized by the existence of monopolies, the lack of fully developed markets of capital, insurance and asymmetric information public sector investment can make factor and product markets work more efficiently and generate substantial positive spill over effects for the private sector. In general government expenditure plays an important role in physical and human capital formation over time. Government investment can be considered as one of important beneficial factors for increase in output directly or indirectly through its interaction with the private sectors (Aschauer (1989); Barro (1991); Easterly and Rebelo (1993); Gramlich (1994); Cashin (1995); Gupta et al. (2002); and Turnovsky (2004)). Also, the relationship between public expenditures and economic growth is not necessarily unidirectional. Public expenditures affect economic growth, but at the same time economic growth can also lead to changes in either aggregate public expenditure (e.g. in accordance with Wagner's law) or some of its components (for instance, through changes in the demand for certain public services). Cheng and Lai (1997) found a bidirectional causal relation between government expenditures and economic growth.

At the other extreme economists highlighted a negative relation ship between government size and economic growth effect on the efficiency and economic growth (Landau (1983), Barth and Brady (1987), Grier and Tullock (1987), Diamond (1989) Barro (1989, 1990, 1991), Levine and Renelt (1991), Morrissey Oliver and Kweka Josaphat P. (1999), Fölster and Henkerson (2000)).The arguments of this school of thought are: the government operations are often carried out inefficiently. For example, public investments undertaken by heavily subsidized and inefficient state owned enterprises in agriculture, manufacturing, energy, banking and other financial services, has often reduced the possibility of private investment. Moreover, the financing of public expenditures through external and internal indebtedness, the repression of the private financial system, has crowded out the private sector from profit able investment opportunities. Not only that due to the leakage in public services delivery system the objective of the various development initiatives or programmes under taken by government are not fully or partially materialized, affecting long run sustainable economic growth. Furthermore, there may be disincentive effect of government's fiscal and monetary policies, which have negative impact on the overall economic productivity. The overall impact of the government policies depends, in fact, on the mode of financing of the public expenditure, i.e., the trade-off between the productivity of public expenditure and the distortionary effects of tax burdens. These negative impacts have resulted in a large process of deregulation of product and factor markets and privatization of public enterprises for many countries, especially after the debt crisis. Further, the government has to make huge investment in social overhead capital. But the financing of such expenditures can be growth retarding (because of disincentive effects).

For a comprehensive review of the related literature mention may be made also of the studies which have postulated some kind of a different conclusion. For example, Kormendi and Meguire (1985) and Hsieh and Lai (1994) have found no significant impact between government expenditure and economic growth. Gupta, K. L (1988), Sheehey Edmund (1993) have found negative effect of government consumption expenditure on eco nomic growth for developed countries and positive for the developing countries .

There is little evidence of using panel co integration analysis to arrive at the long run relationship between government size and economic growth. There are only two studies which used panel co integration analysis on this concerned relationship. The study by Arpai a and Turrini (2008), based on European countries uses pooled mean group estimation procedure, which allowed testing the hypothesis that the long-run elasticity between government expenditure and potential output is the same for all countries, after panel unit root and panel co integration tests. Fatima, Azhar and Saleem (2006) investigated only panel cointegration relationship among economic growth, government size, private consumption, private investment, export and import using data from ten Asian countries for the period of 1970 to 2001. However none of the study has established their relation in terms of Dynamic OLS (DOLS) methodology in panel co integration mod el.

The noticeable fact is that the diversity of the empirical studies can be attributed to the different measures adopted to represent government size and economic growth in their respective works. The alternative measure of government size are: (i) government expenditure share in real GDP (Landau (1986)) (ii) real government expenditure to real GDP (Barro(1989, 1990)), (iii) growth rate of real government expenditure share to GDP (Kormendi and Meguire (1985)) (iv) product of rate of growth of government consumption expenditure and the share of government expenditure to GDP(Ram (1986))and (v) rate of growth of government consumption expenditure(Ram (1986)). Similarly, the following alternative measures of economic growth are being used: (i) growth rate of per capita real GDP(Landau (1986), Barro(1989,1990)) (ii) growth rate of real GDP(Kormendi and Meguire (1985)), Ram(1986)).Needless to mention that using same variables, conclusions of two studies differs due to the difference in their sample design, i ncluding country sets (developed, developing or less developed), type of data (time series or cross section or panel), the size of the sample and last but not least, due to the methodology applied to arrive at the relationship. The results are not robust with respect to the assumed measure of the respective variables even in the same sample. For example, Ram (1986) found exactly an opposite result when he used the share of government consumption expenditure to GDP as measure of government size instead of his other measure.

III. Sample and Variable

IMF categorizes its 22 member countries as emerging market economies. On the other hand as of June 2006, MSCI (Morgan Stanley Capital International) emerging market index, based on the equity market performance in the global emerging markets, consists of 25 countries EME includes the countries in the regions of Southeast Asia, Latin America, Africa and Middle East. Furthermore the former socialist countries in central and East Europe which are called 'transformation countries' due to their change in the political system from a central planning to a decentralized market oriented economy. Due to data constraint we have included the nineteen countries namely, Brazil(BRA), Chile(CHL), China(CHN), Colombia(COL), Ecuador (ECU), Egypt(EGY), Hungary(HUN), India(IND), Indonesia(IDN), South Korea(KOR), Malaysia(MYS), Mexico(MEX), Morocco(MAR), Pakistan(PAK), Peru(PER), Philippines(PHL), South Africa(ZAF), Thailand(THA) and Venezuela(VEN) and a data set of thirty-seven years from 1970 to 2006 .

The paper uses alternative proxies: (a) Three measures for the government size :(i) Real General Government Final Consumption expenditure (GFCE),(ii) real per capita General Government Final Consumption expenditure (GFCEPC), (iii) General Government Final Consumption expenditure share to GDP (GFCEP), (b) two measures for economic growth : (i) Real GDP, (ii) real per capita GDP (GDPPC) and (c) three measures for size of domestic investment: (i) Real Gross Capital Formation (GCF) (ii) real per capita Gross Capital Formation (GCFPC) (iii) Gross Capital Formation share to GDP (GCFP). The annual data at constant 2000 US$, in order to use their real in term, are extracted from the World Development Indicators 2008 of World Bank.

IV. Methodology

The analysis of unit roots and co integration in panel data has been a fruitful area of study in recent years, with Levin and Lin (1992, 1993) and Quah (1994) being the seminal contributions in this field. According to Maddala and Wu (1999), commonly used unit root test like Dicky-Fuller (DF), augmented Dicky-Fuller (ADF) and Phillips-Peron (PP) tests lack power in distinguishing the unit root null from stationary alternative, and that the using panel data unit root test as well as panel cointegration test is one way of increasing the power of unit root and cointegration tests based on single time series. For these above stated advantages, this paper employs a three stage procedure to evolve the long-run equilibrium relationship between government expenditure and GDP. This three step procedure are (1) assessing the stationarity of the variables using various routine panel unit root test, (2) in case the variables are not stationary, checking whether they are characterized by a cointegration relationship (3) in case cointegration holds, estimating panel cointegration model using Dynamic Ordinary Least Square (DOLS) methods, methodology is given below.

A. Panel Unit Root Tests

In panel unit root test, two types of specifications are made, one with common or homogeneous unit root process (Levin, Lin, and Chu (LLC), Breitung, and Hadri tests) and other with individual or heterogeneous unit root process assumptions (Im, Pesaran, and Shin (IPS), and Fisher-ADF and Fisher-PP tests).

LLC and Breitung both consider the following basic ADF specification:

$$\Delta Y_{i,t} = \alpha_i + \rho Y_{i,t-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{i,t-k} + \delta_i t + \theta_t + u_{it} \quad (1)$$

This model allows for two-way fixed effects, one coming from the α_i, i.e. unit specific fixed effects and the second from the θ_t, i.e. unit specific time trends. The coefficient of lagged Y_i is restricted to be homogeneous across all units of the panel. The null (H_0) and alternative (H_1) hypothesis of this test is: $H_0 : \rho = 0$ and $H_1 : \rho < 0$.

On the other hand Im, Pesaran and Shin (1997) extended the LLC test allowing heterogeneity on the coefficient of the $Y_{i,t-1}$ variable and proposing a basic testing procedure which is based on the average of the individual unit root test statistics. The proposed model is given as follows:

$$\Delta Y_{i,t} = \alpha_i + \rho_i Y_{i,t-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{i,t-k} + \delta_i t + \theta_t + u_{it} \tag{2}$$

With $H_0 : \rho_i = 0$ for all i and $H_1 : \rho_i < 0$ for at least one i. The corresponding $\bar{t}$ statistic, applicable to a balanced panel only, is defined as $\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{\rho i}$, where $t_{\rho i}$ is individual ADF t-statistic for testing $H_0 : \rho_i = 0$ for all i. Besides, Hadri panel unit root test is similar to the KPSS unit root test (Kwiatkowski et al. (1992)) and has a null hypothesis of no unit root in any of the series in the panel. Like the KPSS test, the Hadri test is based on the residuals from the individual OLS regressions of Y_{it} on a constant, or on a constant and a trend and require only the specification of the form of the OLS regressions: whether to include only individual specific constant terms, or whether to include both constant and trend terms. Further, simulation evidence suggests that in various settings Hadri test appears to over reject the null of stationarity, and may yield results that directly contradict those obtained using alternative test statistics (Hlouskova and Wagner (2006)).

In the panel unit root test we have used Schwarz (1978) criterion for the lag differences selection and the Newey-West (1994) method and the Bartlett Karnel for the bandwidth selection.

B. Panel Cointegration Test

Pedroni (1999, 2004) and Kao (1999) extend the Engle-Granger framework to tests involving panel data. Our study makes use of these tests. Pedroni proposes the following panel regression model.

$$Y_{it} = \alpha_i + \delta_i t + \sum_{m=1}^{M} \beta_{mi} X_{mi,t} + e_{i,t} \tag{3}$$

Where Y and X are assumed to be integrated of order one, I (1). The general approach is to obtain residuals from Equation (3) and then to test whether residuals are I (1) by running the auxiliary regression,

$$e_{it} = \rho_i e_{it-1} + u_{it} \tag{4}$$

Or

$$e_{it} = \rho_i e_{it-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta e_{it-j} + v_{it} \tag{5}$$

for each cross-section. The different cointegration statistics proposed by Pedroni can be classified into two categories. The first category includes Panel v - Statistic, Panel rho-Statistic, Panel PP-Statistic, Panel ADF-Statistic, based on pooling along the 'within' dimension, i.e. pooling the AR coefficients across different sections of the panel for the unit root test on the residuals. The second category includes Group rho-Statistic, Group PP-Statistic, Group ADF-Statistic, based on pooling the 'between' dimension i.e. averaging the AR coeff icients for each member of the panel for the unit root test on the residuals. On the other hand, the Kao residual based cointegration test follows the same basic approach as the Pedroni tests but specifies cross-section specific intercepts and homogeneous coefficients on the panel regressors.

C. Estimation and inference of Panel Cointegrating Model

In this study to observe the long run rapport, Dynamic Ordinary Least Square (DOLS) model is employed which was developed by Stock and Watson (1993) for the investigation of long-run relationships among dependent variable on all explanatory variables in levels, leads and lags of the first difference of all I(1) explanatory variables. Given the superiority of the estimator ov er the other as indicated above, we would like to use Dynamic Ordinary Least Square (DOLS) methodology to estimate the panel cointegration models. The DOLS estimator, $\hat{\beta}$, can be obtained by running the following regression:

$$Y_{i,t} = \alpha_i + X_{i,t}^{/}\beta + \sum_{j=-q_1}^{q_2} c_{ij}\Delta X_{i,t+j} + v_{i,t} \quad (10)$$

In this study we have used one lead and one lag in DOLS model. To account for country heterogeneity, fixed effects are specified and cross section weights are used in GLS weight specification. Unlike Pooled Mean group estimator, to ensure contemporaneous values for the regressors, the White cross-section method is applied. This method treats the panel regression as a multivariate regression and compute white-type robust standard errors for the system of equations. The estimators are therefore robust to cross-equation (or contemporaneous) correlation and different error variance in each cross section [2].

V. Empirical Result

We have taken the natural logarithm of all the variables to standardize the data. The log-transformed variables are denoted writing "L" - prefix to the variables. While specifying different models corresponding to different proxies, both the dependent variable and explanatory variables are expressed in terms of logarithm.

A. Panel Unit Root Tests Results

Table 1.A to Table 1.C display the summarized results of Levine, Lin and Chu (LLC), Breitung and Hadri common unit root test as well as Im, Pesaran and Shin (IPS), ADF-Fisher, Phillips-Perron individual individual unit root tests. It is found that the null of no unit root is accepted for all the variables at their first differences in Hadri `test and the null of unit root are rejected for all the variables at their first differences in rest of the tests. Therefore, it can be concluded that the variables are I (1) series, i.e. stationary at their first difference level.

[2] Matthee, Marianne & Saayman, Andrea : 'A Panel Data approach to the Behavioural Equilibrium Exchange Rate of the Z AR'

B. Panel Cointegration Tests Results

Table 2.A to Table 2.F summarise the result obtained from various panel cointegration tests applying to the different models corresponding to different proxy variables assumed in the study.

In model-1(Table 2.A), we have taken real GDP as proxy for economic growth and real government final consumption expenditure as a measure of government size, without any measure of domestic investment. According to both of Pedroni and Kao residual cointegration test, these above mentioned variables are cointegrated. In model-2 (Table 2.B), we have taken real GDP as proxy for economic growth, real government fin al consumption expenditure as a measure of government size and real gross capital formation as the measure of the size of domestic investment. According to Pedroni Panel V-statistic and group rho-statistic we can say that the series are cointegrated. As pe r Kao residual cointegration test, the null of no cointegration in this model can be rejected at 1% level of significance. In model-3 (Table 2.C), we have taken real per capita GDP as proxy for economic growth, real per capita government final consumption expenditure as a measure of government size, again without any measure of domestic investment. According to both of Pedroni and Kao residual cointegration test, these above mentioned variables are cointegrated. In model-4 (Table 2.D), we have taken real per capita GDP as proxy for economic growth, real per capita government final consumption expenditure as a measure of government size and real per capita gross capital formation as the measure of the size of domestic investment. According to Pedroni Panel V-statistic, group rho-statistic, group PP-statistic and group ADF-statistic; we can say that the series are cointegrated. As per Kao residual cointegration test, the above series are found to be cointegrated. In model-5 (Table 2.E), we have taken real per capita GDP as proxy for economic growth, government final consumption expenditure share to GDP as a measure of government size. Here also no measure of domestic investment is taken into account. According to Pedroni residual cointegration test statistics these above mentioned variables are found to be cointegrated. Finally, in model-6 (Table 2.F), we have taken real per capita GDP as proxy for economic growth, government final consumption expenditure share to GDP as a measure of government size and gross capital formation share to GDP as the measure of the size of domestic investment. According to Pedroni residual cointegration test we can say that the series are cointegrated.

C. Estimation and inference of Panel Cointegrating Model

The estimated long-run elasticity of economic growth with respect to the government size and the size of domestic investment individually determined in different models, employing DOLS estimation method, are tabulated in Table 3 along with their corresponding significance level. The results suggest the following observations. First, in the two variables model 1, 3 and 5, where variation in government size is explaining the whole variation in economic growth, we found that the long run elasticity of economic growth with respect to the government size is significantly positive, 0.94, 0.89 (very close to 1) and 0.15 respectively. The very low value of elasticity found in model 5, where government size is measured by the government consumption expenditure share to GDP, more likely to explain the issue that the studies whenever government size is measured by the government consumption expenditure share to GDP to explain economic growth have concluded that government size has either no role or insignificant positive role in explaining economic growth (Barro (1989, 1990), Landau (1986) etc.). Second, when the size of domestic investment is also included as explanatory variable along with the government size to explain economic growth in model 2, 4 and 6, it is found that in all of these three cases the elasticity of economic growth with respect to government size as measured by government final consumption (0.50) is higher than the elasticity of economic growth with respect to the size of domestic investment (0.45) in long run.

VI. Conclusion

The present study has investigated the long run relationship between government size and economic growth in the presence of domestic investment, exploring the data on 19 emerging market economies, for the period 1970-2006, irrespective of the income group they are belonging to, using panel co integration techniques. The long run co integration relationship is obtained through the three-step procedure (1) panel unit root test, (2) panel co integration test and (3) estimation and inference in panel co integration method, using DOLS method.

As experience says that the pattern of government size on economic growth varies across different studies depending on the way of defining these variables, the study uses alternative proxies for economic growth, government size and domestic investment. The significant findings of the present study are as follows:

- In the long run economic growth can be influenced significantly and positively by government size as well as by the size of domestic investment. The result does not alter according to the alternate measure of the indicators.
- The role of government size on economic growth is found to be higher than that of the size of the domestic investment irrespective of the proxy variables used to measure these indicators.

In the era of globalization the government's role in most of the cases, being pushed to a minimal which encourage pro-market and pro-business role of state. The findings of the study do not corroborate the popular argument in favour of restricted government activities limited to administrative and regulatory sphere and supports that the expansion of government activities along with investment in an economy positively can stimulate economic growth in the long run.

Appendix

Table 1.A: Panel Unit Root Test Results

Variable		Method					
		Levin, Lin & Chu t	Breitung t-stat	Im, Pesaran and Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square	Hadri Z-stat
		Exogenous Variables: Individual effects					
LGDP	Level	-2.67531 (0.004)	-1.13273 (0.129)	2.47434 (0.993)	36.252 (0.551)	34.4583 (0.634)	16.2517 (0.000)***
	1st Difference	-14.7208 (0.000)***	-9.64342 (0.000)***	-13.9407 (0.000)***	245.326 (0.000)***	244.595 (0.000)***	2.18029 (0.015)
LGFCE	Level	-4.78274 (0.000)	-0.93166 (0.176)	-0.31463 (0.377)	61.42 (0.009)	65.3965 (0.004)	15.8643 (0.000)***
	1st Difference	-14.2427 (0.000)***	-9.53455 (0.000)***	-15.7369 (0.000)***	292.449 (0.000)***	346.98 (0.000)***	2.53694 (0.006)
LGCF	Level	-1.12737 (0.130)	-1.59083 (0.056)	1.12294 (0.869)	35.7215 (0.575)	34.3605 (0.639)	15.1379 (0.000)***
	1st Difference	-20.1562 (0.000)***	-13.5947 (0.000)***	-17.6544 (0.000)***	328.377 (0.000)***	362.209 (0.000)***	1.14391 (0.126)
LGDPPC	Level	-0.2325 (0.408)	-1.14064 (0.127)	2.59274 (0.995)	34.212 (0.645)	28.5694 (0.866)	15.9618 (0.000)***
	1st Difference	-14.602 (0.000)***	-9.81607 (0.000)***	-13.9577 (0.000)***	246.134 (0.000)***	245.373 (0.000)***	1.71912 (0.043)
LGFCEPC	Level	-1.06764 (0.143)	-1.38454 (0.083)	0.3106 (0.622)	48.7682 (0.113)	53.9351 (0.045)	15.0638 (0.000)***
	1st Difference	-15.6581 (0.000)***	-9.02791 (0.000)***	-17.2194 (0.000)***	320.856 (0.000)***	347.826 (0.000)***	1.16653 (0.122)
LGCFPC	Level	-0.35104 (0.363)	-1.7202 (0.043)	-0.96224 (0.168)	60.9319 (0.011)	50.17 (0.089)	13.5426 (0.000)***
	1st Difference	-20.1028 (0.000)***	-13.6643 (0.000)***	-17.5829 (0.000)***	327.641 (0.000)***	353.709 (0.000)***	1.00392 (0.158)
LGFCEP	Level	-2.62027 (0.004)	-1.56394 (0.059)	-1.9017 (0.029)	49.0564 (0.108)	45.3367 (0.193)	9.39198 (0.000)***
	1st Difference	-19.875 (0.000)***	-13.1813 (0.000)***	-19.3397 (0.000)***	363.78 (0.000)***	418.903 (0.000)***	-0.62006 (0.732)
LGCFP	Level	-3.25008 (0.001)	-4.12312 (0.000)***	-3.426 (0.000)***	72.9304 (0.001)	69.361 (0.001)	6.12779 (0.000)***
	1st Difference	-23.6552 (0.000)***	-15.4261 (0.000)***	-21.4288 (0.000)***	406.14 (0.000)***	458.08 (0.000)***	0.62824 (0.265)

*** implies significant at 1% level.

Table 1.B: Panel Unit Root Test Results

Variable	Method					
	Levin, Lin & Chu t	Breitung t-stat	Im, Pesaran and Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square	Hadri Z-stat
	Exogenous Variables: Individual effects, individual linear trends					
LGDP	-1.18501 (0.118)	2.18997 (0.986)	-0.13913 (0.445)	42.635 (0.279)	52.6979 (0.057)	8.38007 (0.000)
	-13.9997 (0.000) ***	-7.03668 (0.000) ***	-12.4251 (0.000) ***	228.249 (0.000) ***	233.57 (0.000) ***	4.84868 (0.000) ***
LGFCE	-3.66662 (0.000) ***	1.00042 (0.841)	-3.80088 (0.000) ***	82.5863 (0.000) ***	38.8057 (0.433)	9.09391 (0.000) ***
	-12.1329 (0.000) ***	-6.9478 (0.000) ***	-14.611 (0.000) ***	251.142 (0.000) ***	557.695 (0.000) ***	4.29992 (0.000) ***
LGCF	-2.43798 (0.007)	1.97831 (0.976)	-2.21715 (0.013)	62.2935 (0.008)	33.0551 (0.697)	7.68277 (0.000)
	-18.7515 (0.000) ***	-12.402 (0.000) ***	-15.6602 (0.000) ***	264.612 (0.000) ***	386.502 (0.000) ***	4.23178 (0.000) ***
LGDPPC	-0.04848 (0.481)	3.6116 (1.000)	0.36798 (0.644)	36.7261 (0.528)	35.27 (0.596)	7.59287 (0.000)***
	-13.838 (0.000) ***	-8.47232 (0.000) ***	-12.2785 (0.000) ***	224.447 (0.000) ***	229.678 (0.000) ***	4.80925 (0.000) ***
LGFCEPC	-0.46316 (0.322)	1.92354 (0.973)	-3.18453 (0.001)	73.0307 (0.001)	36.0254 (0.561)	8.37634 (0.000)***
	-12.053 (0.000) ***	-8.39018 (0.000) ***	-14.4522 (0.000) ***	248.526 (0.000) ***	562.376 (0.000) ***	4.14482 (0.000) ***
LGCFPC	-2.07568 (0.019)	2.11907 (0.983)	-2.0391 (0.021)	61.188 (0.010)	29.4303 (0.839)	7.85348 (0.000)
	-18.7281 (0.000) ***	-12.8124 (0.000) ***	-15.6447 (0.000) ***	263.87 (0.000) ***	384.298 (0.000) ***	4.2892 (0.000) ***
LGFCEP	-1.87713 (0.030)	-0.76321 (0.223)	-1.01594 (0.155)	39.743 (0.392)	35.0978 (0.604)	6.59492 (0.000)
	-17.898 (0.000) ***	-13.1262 (0.000) ***	-17.1229 (0.000) ***	300.463 (0.000) ***	640.005 (0.000) ***	3.72423 (0.000) ***
LGCFP	-4.31862 (0.000)***	1.25405 (0.895)	-3.83189 (0.000)***	76.0863 (0.000)***	61.8797 (0.009)	6.98375 (0.000)***
	-20.601 (0.000) ***	-14.4452 (0.000) ***	-18.8268 (0.000) ***	329.401 (0.000) ***	1064.69 (0.000) ***	5.45903 (0.000) ***

Table 1.C: Panel Unit Root Test Results

Variable	Method			
	Levin, Lin & Chu t	Breitung t-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square
	Exogenous Variables: None			
LGDP	24.1573 (1.000)	3.09249 (0.999)	0.16778 (1.000)	0.02712 (1.000)
	-7.38388 (0.000)***	-7.40952 (0.000)***	126.382 (0.000)***	152.754 (0.000)***
LGFCE	17.6742 (1.000)	1.82997 (0.966)	0.14146 (1.000)	0.14361 (1.000)
	-10.0248 (0.000)***	-8.71643 (0.000)***	228.091 (0.000)***	307.011 (0.000)***
LGCF	10.7045 (1.000)	-0.96222 (0.168)	1.59816 (1.000)	0.83361 (1.000)
	-17.126 (0.000)***	-16.1237 (0.000)***	348.977 (0.000)***	407.814 (0.000)***
LGDPPC	13.4423 (1.000)	-0.95179 (0.171)	2.39122 (1.000)	2.15498 (1.000)
	-10.4 (0.000)***	-10.0706 (0.000)***	192.876 (0.000)***	241.333 (0.000)***
LGFCEPC	10.098 (1.000)	0.40472 (0.657)	1.93526 (1.000)	1.73646 (1.000)
	-14.4422 (0.000)***	-12.466 (0.000)***	322.106 (0.000)***	393.615 (0.000)***
LGCFPC	6.06573 (1.000)	-1.72655 (0.042)	5.20511 (1.000)	4.24627 (1.000)
	-19.0907 (0.000)***	-17.6348 (0.000)***	403.068 (0.000)***	483.719 (0.000)***
LGFCEP	1.15709 (0.876)	0.48528 (0.686)	16.0716 (0.999)	17.5964 (0.998)
	-22.8702 (0.000)***	-19.2075 (0.000)***	548.387 (0.000)***	847.542 (0.000)***
LGCFP	0.99273 (0.840)	-1.03311 (0.151)	15.5316 (1.000)	15.1307 (1.000)
	-24.688 (0.000)***	-22.3424 (0.000)***	596.657 (0.000)***	1069.64 (0.000)***

Note (for Table 1.A to 1.C): Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.
Null: Unit root (assumes common unit root process) for Levin, Lin & Chu t and Breitung t -stat
Null: Unit root (assumes individual unit root process) for Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square and PP - Fisher Chi-square statistics
Null: No unit root (assumes common unit root process) for Hadri Z -stat

Table 2.A: Panel Cointegration Test Results

Model: 1 Dependent: log(real GDP), Explanatory: log(real Government final consumption expenditure)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegration Test:						
1.1 Panel v-Statistic	1.92682 (0.062)*	1.70075 (0.094)*	8.597365 (0.000)***	6.35601 (0.000)***	0.558677 (0.341)	-0.30427 (0.381)
1.2 Panel rho-Statistic	0.431094 (0.364)	0.720298 (0.308)	1.86213 (0.071)*	1.891477 (0.067)*	-0.61307 (0.331)	-0.71942 (0.308)
1.3 Panel PP-Statistic	-0.13099 (0.396)	0.30751 (0.381)	0.014264 (0.399)	0.449487 (0.361)	-1.89789 (0.066)*	-2.37007 (0.024)**
1.4 Panel ADF-Statistic	0.478368 (0.356)	0.809346 (0.288)	0.296002 (0.382)	0.627794 (0.328)	-1.93115 (0.062)*	-2.29645 (0.029)**
1.5 Group rho-Statistic	1.285488 (0.175)		2.463025 (0.019)**		1.634944 (0.105)	
1.6 Group PP-Statistic	0.189007 (0.392)		0.495754 (0.353)		-2.50876 (0.017)**	
1.7 Group ADF-Statistic	0.149174 (0.395)		0.407011 (0.367)		-2.66312 (0.012)**	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	-3.57095 (0.000)***					

*** implies significant at 1% level, **implies significant at 5% level and * implies significant at 10% level.

Table 2.B: Panel Cointegration Test Results

Model: 2 Dependent: log(real GDP), Explanatory: log(real Government final consumption expenditure) and log(real gross capital formation)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegration Test:						
1.1 Panel v-Statistic	0.7671 (0.297)	1.163861 (0.203)	13.68548 (0.000)***	10.84282 (0.000)***	0.093201 (0.397)	-0.44223 (0.362)
1.2 Panel rho-Statistic	0.596499 (0.334)	0.314844 (0.380)	1.481391 (0.133)	1.102436 (0.217)	-0.28727 (0.383)	-0.07374 (0.398)
1.3 Panel PP-Statistic	-0.65435 (0.322)	-1.02209 (0.237)	-0.9229 (0.261)	-1.31585 (0.168)	-1.42417 (0.145)	-1.09347 (0.219)
1.4 Panel ADF-Statistic	-0.57361 (0.338)	-0.98384 (0.246)	-0.9547 (0.253)	-1.3288 (0.165)	-1.47656 (0.134)	-1.17108 (0.201)
1.5 Group rho-Statistic	1.537317 (0.122)		1.937449 (0.061)*		1.146821 (0.207)	
1.6 Group PP-Statistic	-0.61644 (0.330)		-1.40276 (0.149)		-1.49933 (0.130)	
1.7 Group ADF-Statistic	-0.55448 (0.342)		-1.23694 (0.186)		-1.59 (0.113)	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	-3.56507 (0.000)***					

Table 2.C: Panel Cointegration Test Results

Model: 3 Dependent: log(real per capita GDP), Explanatory: log(real per capita Government final consumption expenditure)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegration Test:						
1.1 Panel v-Statistic	-0.56911 (0.339)	0.142024 (0.395)	4.040229 (0.000)***	3.132244 (0.003)***	-1.95833 (0.059)*	-2.24497 (0.032)**
1.2 Panel rho-Statistic	1.139085 (0.209)	0.971371 (0.249)	1.836733 (0.074)*	1.891827 (0.067)*	-0.49435 (0.353)	-0.61916 (0.329)
1.3 Panel PP-Statistic	0.433138 (0.363)	0.445294 (0.361)	0.12821 (0.396)	0.67505 (0.318)	-2.12588 (0.042)**	-2.32763 (0.027)**
1.4 Panel ADF-Statistic	0.957636 (0.252)	0.818623 (0.285)	0.374938 (0.372)	0.697409 (0.313)	-2.21845 (0.034)**	-2.40465 (0.022)**
1.5 Group rho-Statistic	2.249159 (0.032)**		2.716003 (0.010)**		1.710891 (0.092)*	
1.6 Group PP-Statistic	1.186849 (0.197)		0.939416 (0.257)		-2.46791 (0.019)**	
1.7 Group ADF-Statistic	1.173729 (0.200)		1.004038 (0.241)		-2.62134 (0.013)**	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	-2.73589 (0.003)***					

Table 2.D: Panel Cointegration Test Results

Model: 4 Dependent: log(real per capita GDP), Explanatory: log(real per capita Government final consumption expenditure) and log(real per capita gross capital formation)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegrat ion Test:						
1.1 Panel v-Statistic	-0.48018 (0.356)	-0.14029 (0.395)	7.907761 (0.000)***	5.91876 (0.000)***	-2.22767 (0.033)**	-2.40069 (0.022)**
1.2 Panel rho-Statistic	0.815554 (0.286)	1.183378 (0.198)	1.253883 (0.182)	1.00735 (0.240)	-0.00454 (0.399)	-0.12177 (0.396)
1.3 Panel PP-Statistic	-0.55503 (0.342)	-0.03554 (0.399)	-1.30171 (0.171)	-1.41719 (0.146)	-1.32825 (0.165)	-1.1472 (0.207)
1.4 Panel ADF-Statistic	0.172154 (0.393)	0.563986 (0.340)	-1.47977 (0.134)	-1.39449 (0.151)	-1.48363 (0.133)	-1.28853 (0.174)
1.5 Group rho-Statistic	2.210854 (0.035)**		1.813708 (0.077)*		0.88617 (0.269)	
1.6 Group PP-Statistic	0.427914 (0.364)		-1.48421 (0.133)		-1.7373 (0.088)*	
1.7 Group ADF-Statistic	0.917589 (0.262)		-1.29418 (0.173)		-1.89803 (0.066)*	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	-2.58639 (0.005)***					

Table 2.E: Panel Cointegration Test Results

Model: 5 Dependent: log(real per capita GDP), Explanatory: log(Government final consumption expenditure share to GDP)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegration Test:						
1.1 Panel v-Statistic	-2.659 (0.012)**	-2.14509 (0.040)**	18.6196 (0.000)***	8.671846 (0.000)***	-2.76644 (0.009)***	-2.99855 (0.005)***
1.2 Panel rho-Statistic	1.819976 (0.076)*	1.547573 (0.121)	0.884246 (0.270)	0.791132 (0.292)	-1.01168 (0.239)	-1.63927 (0.104)
1.3 Panel PP-Statistic	1.789284 (0.081)*	1.268053 (0.179)	-0.2034 (0.391)	0.112006 (0.396)	-1.50496 (0.129)	-2.16279 (0.039)**
1.4 Panel ADF-Statistic	1.509878 (0.128)	1.404006 (0.149)	-1.70589 (0.093)*	-0.91768 (0.262)	-1.64842 (0.103)	-2.31404 (0.027)**
1.5 Group rho-Statistic	2.774464 (0.009)***		1.733316 (0.089)*		1.471825 (0.135)	
1.6 Group PP-Statistic	2.139337 (0.041)		0.187487 (0.392)		-0.73163 (0.305)	
1.7 Group ADF-Statistic	2.211581 (0.035)**		-1.42833 (0.144)		-0.90771 (0.264)	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	1.166275 (0.122)					

Table 2.F: Panel Cointegration Test Results

Model: 6 Dependent: log(real per capita GDP), Explanatory: log(Government final consumption expenditure share to GDP) and log(gross capital formation share to GDP)	Trend assumption: No deterministic trend		Trend assumption: Deterministic intercept and trend		Trend assumption: No deterministic intercept or trend	
	Statistic	Weighted Statistic	Statistic	Weighted Statistic	Statistic	Weighted Statistic
1. Pedroni Residual Cointegration Test:						
1.1 Panel v-Statistic	-3.09394 (0.003)***	-2.663064 (0.012)**	19.52747 (0.000)***	9.054538 (0.000)***	-2.64748 (0.012)**	-2.924086 (0.006)***
1.2 Panel rho-Statistic	2.029365 (0.051)*	2.038696 (0.050)*	1.684479 (0.097)*	1.038716 (0.233)	-0.2737 (0.384)	-2.0351 (0.050)**
1.3 Panel PP-Statistic	1.674725 (0.098)*	1.540071 (0.122)	0.342868 (0.376)	-0.01268 (0.399)	-0.7666 (0.297)	-2.57337 (0.015)**
1.4 Panel ADF-Statistic	1.892669 (0.067)*	1.697328 (0.095)*	-0.327493 (0.378)	-0.48462 (0.355)	-1.15105 (0.206)	-3.23417 (0.002)***
1.5 Group rho-Statistic	3.299725 (0.002)***		2.256794 (0.031)**		0.653158 (0.322)	
1.6 Group PP-Statistic	2.34977 (0.025)**		0.28211 (0.383)		-0.61631 (0.330)	
1.7 Group ADF-Statistic	2.309026 (0.028)**		-0.475463 (0.356)		-1.54085 (0.122)	
2. Kao Residual Cointegration Test:						
ADF-t Statistic	0.551871 (0.291)					

Note (for Table 2.A to 2.F): Null Hypothesis: No cointegration
Alternative hypothesis: individual AR coefs. (Between -dimension)

Table 3: Estimation and Inference using DOLS Method

Dependent: LGDP					Dependent: LGDPPC					Dependent: LGDPPC				
Explanatory variables	**Coefficients**	**Standard error**	**t-statistic**	**Probability**	**Explanatory variables**	**Coefficients**	**Standard error**	**t-statistic**	**Probability**	**Explanatory variables**	**Coefficients**	**Standard error**	**t-statistic**	**Probability**
Model-1					***Model-3***					***Model-5***				
C	3.42	0.32	10.85	0.00***	C	2.63	0.09	27.80	0.00***	C	7.02	0.08	88.66	0.00***
LGFCE	0.94	0.01	68.89	0.00***	LGFCEPC	0.89	0.02	49.45	0.00***	LGFCEP	0.15	0.03	4.89	0.00***
Model-2					***Model-4***					***Model- 6***				
C	3.02	0.19	16.25	0.00***	C	2.33	0.06	40.98	0.00***	C	6.02	0.24	24.64	0.00***
LGFCE	0.50	0.01	34.45	0.00***	LGFCEPC	0.50	0.02	29.12	0.00***	LGFCEP	0.50	0.04	3.78	0.00***
LGCF	0.45	0.01	39.56	0.00***	LGCFPC	0.45	0.01	37.09	0.00***	LGCFP	0.45	0.04	6.92	0.00***

References

Arpaia Alfonso and Turrini Alessandro (2008), 'Government Expenditure and Economic Growth in the EU: Long-run Tendencies and Short-term Adjustment', Economic Papers 300, Economic Financial Affairs.

Arrow, K. J. and Kurz, M. (1970), 'Optimal Growth with Irreversible Investment in a Ramsey Model', *Econometrica*, Econometric Society, 38(2), 331-44.

Ashauer, DA (1989), 'Is Public Expenditure Productive?' *Journal of Monetary Economics*, 23, 177-200.

Barro, R. J. (1989), 'A Cross-Country Study of Growth, Saving, and Government', NBER Working Papers 2855.

---(1990), Government Spending in a Simple Model of Endogenous Growth, *Journal of Political Economy*, 98(2), 103-25.

---(1991), 'Economic Growth in a Cross Section of Countries', *Quarterly Journal of Economics*, 106, 407-44

Barth, J. and Brady, M. (1987), 'The Impact of Government Spending on Economic Activity', Manuscript. George Washington University, Washington, DC.

Breitung, J. and Mayer, W. (1994), 'Testing for Unit Roots in Panel Data: Are Wages on Different Bargaining levels Cointegrated?', *Applied Economics*, 26, 353-361.

Cashin (1995), 'Government Spending, Taxes and Economic Growth', IMF Papers, 42(2), 237-69.

Cerda, Rodrigo A., González, Hermann and Lagos, Luis Felipe (2006), 'Is Fiscal Policy Effective? Evidence for an Emerging Economy: Chile 1833 - 2000', *Applied Economics Letters,* 13(9), 575-80.

Cheng, B. S. and Lai, T. W. (1997), 'Government Expenditures and Economic Growth in South Korea: A VAR Approach', *Journal of Economic Development*, 22(1), 11-23.Conomics

Choi, I. (2002), 'Instrumental Variables Estimation of a Nearly Nonstationary, Heterogeneous Error Component Model', *Journal of Econometrics*, 109, 1-32.

Diamond, J (1989), 'Government Expenditure and Economic Growth: An Empirical Investigation', *IMF Working Paper*, No. 89/45, Washington D.C.

Easterly, W and Rebelo, S. (1993), 'Fiscal Policy and Economic Growth: An Empirical Investigation,' *Journal of Monetary Economics*, 32, 417-458.

Fatima Ambreen, Iqbal Azhar and saleem , H. M. N. (2006), unpublished paper, presented in"13th International Conference on Panel Data", 7 -9 July 2006, University of Cambridge, UK.

Fisher, R. A. (1932), *Statistical Methods for Research Workers,* Oliver & Boyd, Edinburgh, 4th Edition.

Fölster, S. and Henrekson, M. (2001), 'Growth effects of government expenditure and taxation in rich countries,' European Economic Review 45, 1501-1520

Ghali, K.H. (1999), 'Government Size and Economic growth: Evidence from a Multivariate Cointegration Analysis', *Applied Economics*, 31(8), 975-987

Gramlich (1994), 'Infrastructure Investment: A Review Essay', *Journal of Economic Literature*, 32, 1176-1196.

Grier, K. B. and Tullock, G. (1987), 'An Empirical Analysis of Cross-national Economic Growth, 1950-80', Manuscript, California Institute of Technology, Pasadena, CA.

Grossman, p. J. (1990), 'Government and growth: Cross-sectional evidence', *Public Choice,* 65(3), 217-27.

GÜNALP, B. and GÜR, T. H. (2002), 'Government Expenditures and Economic Growth in Developing Countries: Evidence From a Panel Data Analysis', METU Studies in Development, 29 (3-4), 311-32.

Gupta et al. (2002), 'Expenditure Composition, Fiscal Adjustment, and Growth in Low-income Countries', IMF Working Paper No. 02/77.

Gupta, K. L (1988), 'Macroeconomic Determinants of Growth: Some Implications of Disaggregation', *Applied Economics*, 20(6), 843-52.

Hadri, K. (1998), 'Testing for Stationarity in Heterogeneous Panel Data', Mimeo.

Hsieh and Lai (1994), 'Government Spending and Economic Growth: The G-7 Experience' *Applied Economics*, vol. 26, issue 5, pages 535-42.

Hlouskova, Jaroslava and M. Wagner (2006), 'The Performance of Panel Unit Root and Stationarity Tests: Results from a Large Scale Simulation Study', *Econometric Reviews*, 25, 85-116.

Holmes, J.M. and Hutton, P.A. (1990), 'On the Casual Relationship between Government Expenditure and National Income', *Review of Economics and Statistics*, 72, 87-95.

Im, K.S., Pesaran, M.H. and Shin, Y. (1997), 'Testing for Unit Roots in Heterogeneous Panels', Manuscript (Department of Applied Economics, University of Cambridge).

Kao, C. (1999), 'Spurious Regression and Residual-Based Tests for Cointegration in Panel Data', *Journal of Econometrics,* 90, 1-44.

Kao, C., Chiang, M.H. and Chen, B. (1999), 'International R&D Spillovers: An Application of Estimation and Inference in Panel Cointegration', *Oxford Bulletin of economics and Statistics,* 61, 691-709.

Kormendi, R. and Meguire, P. (1985), 'Macroeconomic Determinants of Growth: Cross-Country Evidence', *Journal of Monetary Economics,* 16, 141-164.

Kwiatkowski, Denis, Peter C. B. Phillips, Peter Schmidt & Yongcheol Shin (1992), 'Testing the Null Hypothesis of Stationary against the Alternative of a Unit Root', *Journal of Econometrics,* 54, 159-78.

Landau, D. (1983), 'Government Expenditure and Economic Growth: A Cross Country Study', *Southern Economic Journal*, 49(3), 783-92

---(1986), 'Government and Economic Growth in the Less Developed Countries: An Empirical Study for 1960-1980', *Economic Development and Cultural Change*, 35, 35-75.

Levin, A. and Lin, C.F. (1992), Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties, Discussion Paper # 92-93(University of California at San Diego).

---(1993), Unit Root Tests in Panel Data: New Results, Discussion Paper #93-56(University of California at San Diego).

Levine, R. and Renelt, D. (1991), Cross Country Studies of Growth and Policy: Some Methodological, Conceptual and statistical Problems, World Bank Working Paper Series No. 608

Lin, S.A.Y. (1994) 'Government Spending and Economic Growth', *Applied Economics,* 26, 83-94

Maddala, G. S. and Wu, S. (1999), 'A Comparative Study of Unit Root Tests With Panel Data and a New Simple Test', *Oxford Bulletin of Economics and Statistics,* 61, 631-652.

Morrissey Oliver and Kweka Josaphat P. (1999), 'Government Spending and Economic Growth-Empirical Evidence from Tanzania (1965-1996)', provisional draft of a paper prepared for the DSA Annual Conference, University of Bath, 12-14 September.

Newey, W. K. and West, K. D. (1994), Automatic Lag Selection in Covariance Estimation, Review of Economic Studies 61, 631—654.

Pedroni, P. (1999), 'Critical Values for Cointegration Test in Heterogeneous Panels with Multiple Regressors', *Oxford Bulletin of Economics and Statistics,* 61, 653-678

Pedroni, P. (2004), 'Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis', *Econometric Theory*, 20, 597–625.

Phillips, P.C.B. and Moon, H. (1999), 'Linear Regression Limit Theory for Nonstationary Panel Data', *Econometrica,* 67, 1057-1111.

Quah, D. (1994), 'Exploiting Cross Section Variation for Unit Root Inference in Dynamic Data', *Economics Letters,* 44, 9-19.

Ram (1986), 'Government Size and Economic Growth: A New Framework and Some Evidence from Cross-section and Time-series Data', *American Economic Review,* 76, 191-203.

---(1989), 'Government Size and Economic Growth: A New Framework and Some Evidence from Cross-section and Time-series Data: Reply', *American Economic Review,* 79(1), 281-84.

Rao, V.B. (1989), 'Impact of Government Size on Economic Growth: A Reexamination', *American Economic Review,* 79, 183-204.

Rubinson, R. (1977), Dependency, Government Revenue, and economic Growth 1955-70, *Studies in Comparative International Development*, 12, 3-28.

Russell Davidson and James MacKinnon (1981), 'Tests for Model Specification in the Presence of Alternative Hypotheses: Some Further Results', Working Papers 430, Queen's University, Department of Economics.

Saayman, A. and Matthee, M., 'A Panel Data Approach to the Behavioural Equilibrium Exchange Rate of the Zar', School of Economics, Northwest University.

Schwarz, G. (1978), 'Estimating the Dimension of a Model', Annals of Statistics, 6, 461-464.

Sheehey Edmund, J. (1993), 'The Effect of Government Size on Economic Growth', *Eastern Economic Journal,* 19(3), 321-28.

Stock, J. and Watson, M. (1993), 'A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems', *Econometrica*, 61, 783-820

Tulsidharan, S. (2006), 'Government Expenditure and Economic Growth in India (1960 to 2000)', *Finance India*, 20(1), 169-79.

Turnovsky, S. J. (2004), 'The Transitional Dynamics of Fiscal Policy: Long-Run Capital Accumulation and Growth,' Journal of Money, Credit, and Banking 36, 883