Pakistan Journal of Applied Economics, Vol.19 No.2, (129–151), Winter 2009

TESTING DETERMINANTS OF GROWTH IN HETEROGENEOUS PANEL*

Ambreen FATIMA, Azhar IQBAL and Hassan Mujtaba N. SALEEM**

The study investigates the relationship between economic growth, government size, private consumption, private investment, exports and imports, using data from ten Asian countries for the period 1970 to 2001. Country-by-country and panel results based on ADF, Johansen, Panel Unit Root (IPS), and Panel co-integration [Larsson et al. (2001) tests are presented. ADF and Panel Unit Root (IPS) test results show that all the series are integrated of order one. After establishing that the series are integrated of order one, the study then tested the long run implications of the model with the help of the Johansen Co-integration technique. A long run relationship among the variables using the panel co-integration test over the entire period for the sampled countries was detected. The study concluded that in the long-run government size is an important determinant of economic growth in Asian countries included in the sample. The findings also indicate that in countries like India, Indonesia, Malaysia and Philippines, an increase in the size of the government promotes the growth process, while in countries such as Bangladesh, Korea, Pakistan, Singapore, Sri Lanka and Thailand growth in the size of the government retards economic growth in the long run.

I. Introduction

The relationship between economic growth and government spending, or more generally the size of the public sector, is an important subject of analysis and debate. On theoretical grounds, the major controversy has been on whether or not the public sector increases the long-run steady state growth rate of an economy.

* The initial version of the paper was presented at the 13th International Conference on Panel Data, 7-9 July 2006, University of Cambridge, UK.

** The authors are Lecturer/Staff Economist, Applied Economics Research Centre, University of Karachi, Pakistan, Econometrician, Wachovia Corporation, USA, and Assistant Professor, Department of Management Sciences, Islamia University of Bahawalpur, Bahawalpur, Pakistan, respectively.

The general view is that public expenditure, notably on physical infrastructure or on human capital, can be growth-enhancing but the financing of such expenditures (mostly through taxes) can be growth-retarding (because of disincentive effects). The overall impact depends on the trade-off between the productivity of public expenditure and the distortionary effects of taxes. Many kinds of public expenditures, even of a recurrent nature, can contribute positively to economic growth.

High levels of government consumption are likely to increase employment, profitability and investment via multiplier effects on aggregate demand. Thus, government spending raises aggregate demand, leading to increased output depending on the size and effectiveness of expenditure multipliers. An opposite view maintains that government consumption crowds out private investment, dampens economic stimuli in the short run and reduces capital accumulation in the long-run. Strictly, crowding-out results from a fiscal deficit and the associated effect on interest rates, but adverse economic impacts may be due to government spending in general [Diamond (1989)]. In this paper, a simple empirical model is formulated and Panel Cointegration techniques are used to investigate empirically, the impact of size and/or efficiency of the government sector on economic growth in ten Asian countries.

Such kind of impact analysis has been documented by a number of researchers but the controversy about the effects of government size on economic growth still remains. Several studies such as Afxentiou (1982), Barth and Brady (1987), Landau [(1983), (1986)], and Ram (1986) have focused exclusively on this issue and can be quoted in this context. Resurgence of empirical work has been accepted as a by-product of the endogenous growth literature. For example, the empirical studies have been undertaken *inter alia*, Castles and Dowrick (1990), Dowrick (1993), Barro (1991) and Barro and Sala-I-Martin (1995) and the literature cited therein is full of conflicting results.

One view suggests that larger government size depresses economic growth because government wastes scarce economic resources; government operations are often carried out inefficiently; the regulatory process of government impose excessive burdens and costs on the economic system; and many of the government's fiscal and monetary policies tend to distort economic incentives and lower the productivity of the system and thus can be characterized as a "leakly bucket." The other view suggests that a larger government size is likely to be a more powerful engine of economic growth because of the government's role in harmonizing conflicts between private and social interests; prevention of exploitation of the country by foreigners; and securing a socially optimal direction for growth and development. Hence, it can be concluded that government activity stimulates economic growth.

Ram (1986) concluded that "government size has a positive effect on economic performance and growth (and there is a) pervasive indication of a positive externality effect of government size on the rest of the economy." Similarly, Castles and

Dowrick (1990) concluded that government consumption expenditures enhance economic growth and indicate some areas of social expenditure which may increase growth. The reasons for these conflicting results may be associated with various factors such as differences in model formulation, the use of time series and cross-section data, different time periods analyzed, differences in the countries included in (cross-section) samples, and differences in data sets used. The literature is full of different conclusions.

This paper contributes to the latter strand of the literature. It applies a more developed panel co-integration technique [Larsson et al. (2001)] to examine the long-run relationship between size of government and economic growth. In examining the relationship between government size and economic growth, other factors which stimulate growth are also considered. The study includes the growth rates of GDP; the ratio of investment to GDP; the ratio of total government consumption spending to GDP; the ratio of total household consumption spending to GDP; the ratio of exports to GDP; and the ratio of imports to GDP. Exports and imports variable have been included to investigate whether imports and exports lead to any links between the trade variables and growth because past findings from cross-country studies have suggested so.

Finally, due to the fact that cross national studies suffer from heterogeneity bias, the study uses the panel data approach to estimate the long-run relationship among the variables. Panel data give more information, more variability, less collinearity among variables, more degrees of freedom, and more efficiency. It can better detect and measure the effects that simply cannot be observed in pure cross-section or pure time series data. This paper uses a model that provides, not only the long-run dynamics of individual estimates of the effects of government size on economic growth, but also provides panel estimation of the long-run relationships for ten Asian countries.[1]

The approach followed has two main advantages over past empirical research. First, a specific equation is derived which establishes an explicit, clear-cut causation effect between the growth rate of GDP and the government size. Second, most of the previous studies have used cross-sectional data and thus have implicitly assumed that the regression parameters are constant across countries. In order to avoid this, panel data has been used. The results of this study provide strong evidence of the relationship between government size and economic growth. The study begins by examining the statistical properties of the data using panel unit root test. The study fails to reject the null hypothesis of unit root for the variables included. Long run implications of the model for co-integration of the variables is then tested. A long run relationship among the variables is detected using Johansen Co-integration and panel co-integration test over the entire period for the countries of Asia. The paper

[1] Bangladesh, India, Indonesia, Korea, Malaysia Pakistan, Philippines, Singapore, Srilanka and Thailand.

is organized as follows: Section II presents the theoretical framework, Section III provides the econometric methodology, data and explanation of variables, Section IV presents the empirical results, and Section V provides the conclusions.

II. Theoretical Framework

Since government consumption expenditure is a component of GDP, a logical consequence is the expectation of a positive correlation between the two. However, as mentioned earlier, on both conceptual as well as empirical grounds, the contribution of the public sector to growth may exceed or fall short of the change in the government size, measured by the share of government consumption in GDP [Dalamagas (2000)]. There are a number of channels through which government size can retard economic growth. An increase in government consumption tends to increase the amount of distortionary taxation, and hence reduces growth. The distortions in resource allocation associated with the excess burdens and disincentive effects generated by rising taxation are likely to offset the positive effects of government sector growth.

Moreover, government consumption expenditure does not seem to be complementary to private sector investment; it induces a crowding out of the latter because of a higher government share in GDP. In addition to being detrimental to efficiency – economic regulation, bureaucracy and rewarding productivity in the production of collective goods lead to a higher income tax rate. Since individuals retain a smaller fraction of their returns from their investment, they have less incentive to invest. All these contribute to the distortion effect on the process of growth. The explanation given above for such a relationship is based on the theoretical foundation provided by Barro (1990) to categorized government consumption expenditures on the basis of their productive and unproductive nature. The former is expected to be growth-promoting and the latter growth-retarding.

The main focus of the study is on the effects of government size on growth. However, we also consider some specific issues raised by earlier studies, especially, those using cross-country growth regressions. The reason for this is the lack of a consensus theoretical framework that guides empirical research on growth. Existing cross-country models do not completely specify the variables that should be held constant while drawing statistical inferences on the relationship between growth and the variables of primary interest. Furthermore, as there is no accepted theory as to what determines economic growth, there is no generally accepted set of variables to be included.[2] Various studies and common sense suggest various

[2] For example, Feder (1983) and Ram (1986) used an augmented neoclassical production function to conduct their empirical studies, while Romer (1989) and Barro (1990) used endogenous growth models. Kormendi and Meguire (1985) and Grier and Tullock (1989) used a variety of models to motivate an assortment of variables that they used in their empirical studies.

factors which could have a significant impact on economic growth. Hence, empirical investigations of causal links between growth and government size variables, such as, household consumption expenditure (private consumption) international trade and private investment are considered.

The following empirical framework to investigate long run growth is used. In general form, this model can be defined as:

$$Y_t = f(C_t, I_t, G_t, X_t, M_t) \tag{1}$$

where,

Y_t = represents economic growth (GDP),
C_t = the share of household consumption expenditure in GDP,
G_t = share of government consumption expenditures in GDP (for government size),
I_t = the share of investment expenditure in GDP,
X_t = the share of exports in GDP,
M_t = the share of imports in GDP.

In the context of developing countries, exports (X_t) and imports (M_t) are also potential determinants of growth. Hence, they are included in the framework. Further, it is expected that Investment (I_t) has a positive effect on government consumption expenditure. The logramethic form of regression equation (1) is expressed as:

$$\ln Y_t = \ln\alpha + \alpha_1 \ln C_t + \alpha_2 \ln I_t + \alpha_3 \ln G_t + \alpha_4 \ln X_t + \alpha_5 \ln M_t + \varepsilon_t \tag{2}$$

where $\alpha_1, \alpha_2, \ldots\ldots \alpha_5$ are the elasticities and ε_t is the stochastic term with standard properties. The null hypothesis is that all coefficients except α_3 are positive, while α_3 may be positive or negative. On theoretical grounds the relationship between international trade and growth has been formalized by Revera-Batiz and Romer (1991), Grossman and Helpman (1990), and Romer [(1986), (1990b)]. While theoretical discussions frequently focus on the relationship between international trade and growth, the empirical investigations have typically examined the relationship between exports and growth. When discussing their results on the effects of international trade on growth, Levine and Renelt (1992) pointed out, "when one substitutes imports or total trade for exports in cross-country growth regressions, one obtains essentially the same coefficient estimate and coefficient standard error." Hence, it is interesting to ask whether in a time-series, results would be the same. This is an important question to investigate because if the imports and exports variables maintain the same relationship with growth, then they would not be measuring their own effects *per se*. The effects of trade has been defined more broadly in the literature.[3]

[3] Several studies of fiscal policy have excluded trade indicators from their analysis. These include

The question of 'whether government size has an impact on imports and (or) exports' is still an open one. Hence, inclusion of such variables in the analysis is useful for learning about the type of inter-temporal interactions which exist between international trade and government size.

A second issue that is considered here is the relationship between growth; investment; and international trade. Theoretically, the relationship between growth and trade is based on the improved allocation of resources and not necessarily on enhanced resource accumulation. However, findings from Levine and Renelt (1992) indicate that the relationship between growth and trade becomes insignificant when investment is introduced in the growth equation. The relationship between investment and the trade variables is significant. Since the study found that investment is robustly and positively correlated with growth, it suggests the existence of a two-link chain between trade and growth through investment. Finally, as far as the private (household) consumption is concerned, Kweka et al. (1999) concluded that this variable shows a positive correlation with the size of government (i.e., as a determinant of GDP – increase in this variable leads to enhanced economic growth).

III. Methodology, Data, and Variable Descriptions

a) Unit Root and Cointegration in Panel Data[4]

To examine the long-run relationship between economic growth, government size, private consumption, private investment, exports and imports for individual countries, a standard technique of cointegration is used. In particular, Johansen [(1988), (1995)] and Johansen and Juselius (1990) cointegration tests are applied.[5] To implement the Johansen test, the time series properties of the variables are examined first. The Augmented Dickey Fuller (ADF) test is used to find the order of integration of each series. If these series are found to be integrated of order one (i.e., non-stationary at levels) then cointegration tests can be applied to examine the long-run relationship between these variables.

To examine the cointegration among the above mentioned variables panel data, panel cointegration test developed by Larsson, Lyhagen and Lothgren (2001) is applied. Larsson et al. (2001) proposed a panel test of the hypothesis that all the N

Landau (1983), Ram (1986), Grier and Tullock (1989), and Barro [(1990), (1991)]. Some other studies have ignored fiscal policy when studying trade policy. These include Feder (1983) and Edwards (1989). Studies that have included variables for both include Kormendi and Meguire (1985), Romer (1990a), and Levine and Renelt [(1991), (1992)].

[4] We discuss only Panel Unit Root and Panel Cointegration, because simple Unit Root (ADF) and Cointegration (Johansen approach) are common as can be seen from Fuller (1979) and Johansen (1995), respectively.

[5] This methodology is extensively discussed in the relevant literature [see in partici;ar Larsson et al. (2001)].

countries in the panel have the same (maximum) number of cointegrating relationships among the P variables in a general p-variate vector error correction model (VECM).

H_o: rank $(\Pi_i) = r_i < r$ for all i=1, ..., N, against the full rank alternative for all countries,

H_1: rank $(\Pi_i) = p$ for all i=1, ..., N

$$Z_{\overline{LR}}\,[H(r)/H(p)] = -\frac{\sqrt{N[\overline{LR}_{NT}\{H(r)\ /\ H(p) - E(Z_k)\}]}}{\sqrt{\mathrm{VAR}(Z_k)}} \tag{3}$$

where the *LR*-bar statistic $\overline{LR}_{NT}$ [H(r) / H(p)] is defined as the average of the N individual trace statistics LR_{iT} [H(r) / H(p)] statistic as $\overline{LR}_{NT}$ [H(r) / H(p)] = (1/N) $\sum_{i=1}^{N} LR_{iT}$[H(r)/H(p)], and $E(Z_k)$ and Var (Z_k) are the mean and variance of the asymptotic trace statistic. Based on the result of Theorem 1 in Larsson et al. (2001), the standardized statistic $\Psi_{\overline{LR}}$ average weakly to a standard normal distribution as N and T→∞. The proposed testing procedure is the sequential procedure suggested by Johansen (1988). First, the hypothesis r=0 is tested and if this hypothesis is rejected, the hypothesis r=1 is tested. This sequential procedure is continued until the null hypothesis is not rejected or the hypothesis r=p−1 is rejected. This procedure gives the rank estimator. Johansen (1995) has shown that this procedure asymptotically yields the correct size of the trace statistic. As the trace statistic diverges to infinity with T when the true rank is larger than the hypothesized rank which is also true for panel rank statistic $\overline{LR}_{NT}$ and the standardized static $Z_{\overline{LR}}$. To perform the panel rank test the expected value $E(Z_k)$ and $Var(Z_k)$ of the asymptotic trace statistic are needed for the calculations of the standardized panel rank statistic $Z_{\overline{LR}}$ (H(r) / H(p)). These movements can be obtained from stochastic simulations as described in Johansen (1995). The values of these movements for different degrees of freedom are provided in Larsson et al. (2001).

Before applying the above panel cointegration test, panel unit root test developed by Im, Pesaran and Shin [(2003), (IPS)] is applied on each of the series included in the cointegrating equation. IPS test is performed as follows:

For each series, $Y_{i,t}$, estimate the following model:

$$y_{i,t} = \rho_i y_{it-1} + \Sigma^{\rho_i}_{j=1} \alpha_{ij} \Delta y_{it-j} + z'_{it}\,\gamma + \varepsilon_{it} \tag{4}$$

and test the null hypothesis: H_o : $\rho_i = 1$ for all i, with the alternative hypothesis: H_a :

$\rho_i < 1$ for at least one i. The IPS t-bar statistic is defined as the average of the individual ADF statistic as:

$$\bar{t} = (1/N) \sum_{i=1}^{N} t_{\rho i} \tag{5}$$

where $t_{\rho i}$ is the individual t-statistic of testing $H_o : \rho_i = 1$ in equation (4). It is known for a fixed N as $T \rightarrow \infty$

$$t_{\rho i} \Rightarrow \frac{\int_0^1 W_{iz}\, dW_{iz}}{[\int_0^1 W_{iz}^2]^{1/2}} = t_{iT} \tag{6}$$

IPS assumed that t_{iT} are iid and have finite mean variance. Then

$$\frac{\sqrt{N[(1/N)\sum_{i=1}^{N} t_{iT} - E(t_{iT}/\rho_i=1)]}}{\sqrt{Var(t_{iT}/\rho_{i=1})}} \Rightarrow N(0, 1) \tag{7}$$

as $N \rightarrow \infty$ by the Lindeberg-Levy central limit theorem. Hence,

$$t_{IPS} = \frac{\sqrt{N[\bar{t} - E(t_{iT}/\rho_i = 1)]}}{\sqrt{Var(t_{iT}/\rho_{i=1})}} \Rightarrow N(0, 1) \tag{8}$$

as $T \rightarrow \infty$ followed by $N \rightarrow \infty$ sequentially. The values of $E[t_{iT}/\rho_i=1]$ and $Var[t_{iT}/\rho_i=1]$ have been computed by IPS via simulations for different values of T and ρ_i's.

b) Data and Variables

Data used in this study is obtained from the World Bank Development Indicator (WDI) reports. Analysis is carried out by using the annual data spanning the period from 1970 to 2001 for ten countries, Bangladesh, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka and Thailand. Annual observations have been used because the impact and adjustment of lags of various macroeconomic relations are too long for monthly observations. The same applies to quarterly observations. Annual observations yield smaller degrees of freedom. The noisy effects associated with monthly or quarterly observations tend to average out with annual data which better approximates the relationship between variables.

The variables used in this study are as follow: Y_t Gross Domestic Product (GDP), taken as a proxy for economic growth; G_t is the share of government consumption expenditure in GDP taken as a proxy for government size; X_t is the share of exports in GDP; I_t is the share of investment in GDP; M_t is the share of imports in GDP; C_t is the share of household consumption expenditure in GDP. All these variables are expressed in natural logarithm and, hence, their first differences approximate their growth rates.

IV. Empirical Analysis

a) Unit Root and Johansen Co-integration Test

The preliminary step in the analyses is concerned with establishing the long-run relationship among the variables for individual countries. The distinction whether the levels or differences of a series is stationary or not leads to substantially different conclusions. The testing for non-stationarity (i.e., unit roots) before testing for co-integration among the variables is the usual practice nowadays. A non-stationary time series is said to be integrated of order d if it achieves stationarity after being differentiated (d) times. This notion is usually denoted by $X_t \sim I(d)$. Hence, all the series are tested for the probable order of difference stationarity by using the augmented Dickey-Fuller (ADF) tests.

For this purpose, as mentioned earlier the test for the existence of a unit root in the level and first difference of each of the variables in the sample is tested by the well-known Augmented Dickey Fuller Procedure (ADF). The ADF test result is presented in Table 1. The result reveals that all variables are non-stationary at their level. However, the stationarity property is found in the first differences of the variables in the case of all ten countries. The Augmented Dickey Fuller is implemented to test the null hypothesis. The series in equation is I(0) in the column under level or I(1) in the column under 1st difference. On the basis of the results mentioned in Table 1, the study draws the conclusion that the first order differences of the variables are stationary.

After establishing the fact that the individual series are stationary (at 1st difference), Johansen and Jusellius (1990) co-integration method (J-J co-integration test) is used to estimate the long run relationships. The result of the J-J test is summarized in Table 2. Trace statistics are used to examine the null hypothesis of non-co-integration against the alternative of co-integration. For Bangladesh, starting with the null hypothesis of no co-integration (r=0), the trace statistic is 211.359 which is above 5 per cent critical value of 114.9. Hence, we reject the null hypothesis r=0, in favour of the general alternative r=1.

As it is evident from Table 2, the null hypothesis of r<=1, r<=2, r<=3 and r<=4, can be rejected at 5 per cent level of significance, hence, their alternative o

TABLE 1

ADF Test

	Level		1st Difference	
	Intercept	Trend	Intercept	Trend
Bangladesh				
C_t	-0.394639	-3.535851	-11.763090*	-10.825860*
G_t	-2.046434	-1.920233	-4.360889*	-4.391995*
I_t	-1.081797	-3.525594	-9.849332*	-9.700274*
M_t	-1.671875	-1.943994	-4.512964*	-4.416189*
X_t	-0.855919	-3.620288	-5.693265*	-5.937723*
Y_t	0.025965	-1.802336	-7.058859*	-6.961551*
Indonesia				
C_t	-2.632392	-2.423937	-4.545184*	-5.443481*
G_t	-1.169967	-1.995649	-4.509907*	-4.652640*
I_t	-2.314243	-2.095265	-4.673181*	-5.270911*
M_t	-1.487944	-2.758211	-5.392868*	-5.299403*
X_t	-2.235824	-2.667056	-4.564165*	-4.466991*
Y_t	-2.842785	-2.673561	-4.289732*	-5.142434*
India				
C_t	-1.472110	-2.489302	-6.050030*	-5.965394*
G_t	-0.900717	-2.937583	-5.390725*	-5.304756*
I_t	-2.143723	-2.248358	-7.096393*	-7.781309*
M_t	-1.405334	-2.450769	-4.415532*	-4.569040*
X_t	-0.929024	-2.022892	-3.19929**	-3.133424
Y_t	-1.597670	-2.476641	-4.32038*	-4.613216*
Korea				
C_t	-2.599384	-1.150367	-3.117727**	-4.125917**
G_t	-2.440229	-2.331471	-5.208404*	-5.151069*

(continued)

TABLE 1
(continued)

ADF Test

	Level		1st Difference	
	Intercept	Trend	Intercept	Trend
I_t	-2.615372	-2.427782	-5.627995*	-6.118358*
M_t	-2.713542	-2.682236	-4.236684*	-4.231091*
Xt	-2.771009	-2.976283	-3.978075*	-3.763436**
Yt	-2.311788	-0.824897	-3.876015*	-5.165383*
Malaysia				
C_t	-0.757080	-2.271642	-6.221215*	-6.142486*
G_t	-1.244453	-3.151570	-6.106289*	-5.879835*
I_t	-2.581901	-2.910492	-3.642557*	-3.659345**
M_t	-0.805625	-3.064128	-4.347494*	-4.230725*
X_t	-0.296387	-2.926713	-6.242354*	-5.965137*
Y_t	-2.891363	-1.883174	-3.510756**	-4.581981*
Philippines				
C_t	-1.243569	-2.204202	-3.773198*	-3.696237**
G_t	-1.151171	-1.527986	-3.292462**	-3.442606**
I_t	-2.308986	-2.967322	-4.418164*	-4.507655*
M_t	-1.085687	-2.270020	-4.426822*	-4.299681*
X_t	-0.148829	-1.917311	-4.790535*	-4.892872*
Y_t	-2.246491	-2.245377	-3.792195*	-4.348784*
Pakistan				
C_t	-1.190432	-1.831430	-4.324750*	-4.239895*
G_t	-1.677027	-1.317431	-4.049270*	-4.036163*
I_t	-1.966974	-1.649388	-3.600569**	-4.056913*
M_t	-2.733437	-2.661512	-3.900267*	-4.862417*
X_t	-0.899488	-3.268199	-4.998571*	-4.855415*
Y_t	-1.164364	-1.615730	-4.429106*	-4.583223*

(continued)

TABLE 1
(continued)

ADF Test

	Level		1st Difference	
	Intercept	Trend	Intercept	Trend
Singapore				
C_t	-2.061569	-1.687724	-2.264608	-2.392642
G_t	-2.476634	-2.119621	-3.562084**	-3.665688**
I_t	0.024878	-1.290654	-3.131720**	-3.439154**
M_t	-2.117053	-3.397402	-4.193960*	-3.986786**
X_t	-2.689643	-3.369636	-4.437151*	-4.142999**
Y_t	-2.442453	-1.471563	-3.146280**	-3.736398**
Sri Lanka				
C_t	-2.882921	-3.580028	-4.348346*	-4.419885*
G_t	-2.444783	-2.287886	-4.174204*	-4.455375*
I_t	-1.927811	-1.840781	-2.926153	-2.906233
M_t	-2.451839	-2.628930	-4.337301*	-4.448771*
X_t	-1.447505	-1.875740	-4.001459*	-3.891446**
Y_t	-0.736857	-2.674223	-4.270066*	-4.197641**
Thailand				
C_t	-1.089587	-0.789404	-3.423226**	-3.593958**
G_t	-2.344582	-2.251861	-3.621718*	-3.548949**
I_t	-2.210027	-2.005996	-3.953150*	-4.253255*
M_t	-0.446021	-2.619433	-3.799688*	-3.735060**
X_t	0.414009	-1.570536	-3.562566**	-3.761399**
Y_t	-2.275038	-0.664004	-2.777115	-3.473853**

Note:
* Represent significant at 1per cent.
** Represent significant at 5 per cent.
*** Represent significant at 10 per cent.
Critical values are: –3.61, –2.94, –2.61 (significant at 1 per cent, 5 per cent, 10 per cent, respectively when difference is constant), and –4.22, –3.53, –3.21 (significant at 1 per cent, 5 per cent, 10 per cent, respectively, when difference is constant and trend).

r=2, r=3, r=4 and r=5 are accepted. Consequently, it is concluded that there are 5 co-integrating relations in the long run. In the case of Indonesia, Korea, Philippines and Sri Lanka the LR test also indicates 5 co-integrating equation(s) at 5 per cent significance level. For Malaysia, Singapore and Thailand, the LR test indicates 4 co-integrating relationships; while for India and Pakistan this test indicates only 3 co-integrating relations. Thus, on the basis of the results mentioned in Table 2 the study concludes that there is a stable long run relationship among the variables in all the Asian countries included in our sample and size of the government does impact upon economic growth in the long-run.

The long-run test also indicates that in countries such as India, Indonesia, Malaysia, and the Philippines, government size is found to be promoting the growth process. While in countries such as Bangladesh, Korea, Pakistan, Singapore, Sri Lanka and Thailand the growth in the size of the government retards the process of growth in the long run.

Furthermore, to test the magnitude/direction and the significance of the effect of government size on economic growth, co-integrating coefficients normalized on Y_t were analyzed. The results, presented in Table 5, further strengthen the earlier contention that in countries such as India, Indonesia, Malaysia and the Philippines growth in government size is found to promote the growth process, while in countries such as Bangladesh, Korea, Pakistan, Singapore, Sri Lanka and Thailand the growth in the size of the government retards this process in the long run. These results indicate that in 6 countries of the 10 included in the sample, there is a negative effect of government size. Both, developing and developed countries show a negative relationship between the government size and the economic growth. Therefore, the level of development does not matter for the effect to be growth retarding. One possible explanation might be that when a government programme does not facilitate or encourage economic activity, or has only a small positive effect, then the aggregate impact on the economy is negative because benefits are limited. Further, if the programme actually undermines work, saving, and investment or encourages misallocation of resources, then the overall adverse impact on economic growth is more pronounced.

The other possible explanation is given by Edmund (1993); according to him the net impact of government size on growth may initially be positive and then weakens or becomes negative beyond some threshold level of development.

b) Panel Unit Root (IPS Test Result)

The second step in our analysis is concerned by establishing the degree of integration (order of integration) of each variable in the panel data set. For this purpose, we test for the existence of panel unit root at level and differences of each series in the sample countries. If all the series are stationary, the traditional estima-

TABLE 2

J-J Co-Integration Test

	Likeli-hood Ratio	5 % Critical Value	1 % Critical Value
Bangladesh			
R = 0	211.35900*	114.90	124.75
R< = 1	134.82180*	87.31	96.58
R< = 2	88.55445*	62.99	70.05
R< = 3	50.21705*	42.44	48.45
R< = 4	27.92468**	25.32	30.45
R< = 5	11.36376	12.25	16.26
Indonesia			
R = 0	221.917000*	114.90	124.75
R< = 1	138.272500*	87.31	96.58
R< = 2	87.753740*	62.99	70.05
R< = 3	48.753320*	42.44	48.45
R< = 4	25.723240**	25.32	30.45
R< = 5	7.011534	12.25	16.26
India			
R = 0	159.409100*	114.90	124.75
R< = 1	105.569300*	87.31	96.58
R< = 2	66.652820**	62.99	70.05
R< = 3	40.775110	42.44	48.45
R< = 4	19.520730	25.32	30.45
R< = 5	6.960577	12.25	16.26
Korea			
R = 0	260.849300*	114.90	124.75
R< = 1	159.151100*	87.31	96.58

(continued)

TABLE 2
(continued)
J-J Co-Integration Test

	Likeli-hood Ratio	5 % Critical Value	1 % Critical Value
R< = 2	93.680320*	62.99	70.05
R< = 3	59.847090*	42.44	48.45
R< = 4	28.883660*	25.32	30.45
R< = 5	10.858160	12.25	16.26
Malaysia			
R = 0	219.87110*	114.90	124.75
R< = 1	136.67770*	87.31	96.58
R< = 2	88.68765*	62.99	70.05
R< = 3	47.06430**	42.44	48.45
R< = 4	25.02589	25.32	30.45
R< = 5	10.49965	12.25	16.26
Philippines			
R = 0	225.92900*	114.90	124.75
R< = 1	142.99310*	87.31	96.58
R< = 2	90.62406*	62.99	70.05
R< = 3	50.95914*	42.44	48.45
R< = 4	27.64369**	25.32	30.45
R< = 5	11.49724	12.25	16.26
Pakistan			
R = 0	288.140900*	114.90	124.75
R< = 1	149.499200*	87.31	96.58
R< = 2	69.843450**	62.99	70.05
R< = 3	36.452890	42.44	48.45
R< = 4	17.853670	25.32	30.45
R< = 5	7.366019	12.25	16.26

TABLE 2
(continued)
J-J Co-Integration Test

	Likeli-hood Ratio	5 % Critical Value	1 % Critical Value
Singapore			
R = 0	209.828400*	114.90	124.75
R< = 1	134.273600*	87.31	96.58
R< = 2	83.753890*	62.99	70.05
R< = 3	49.269480*	42.44	48.45
R< = 4	19.534720	25.32	30.45
R< = 5	4.066231	12.25	16.26
Sri Lanka			
R = 0	203.000500*	114.90	124.75
R< = 1	141.342000*	87.31	96.58
R< = 2	92.825930*	62.99	70.05
R< = 3	52.426550*	42.44	48.45
R< = 4	26.825220**	25.32	30.45
R< = 5	9.363417	12.25	16.26
Thailand			
R = 0	237.057400*	114.90	124.75
R< = 1	155.544200*	87.31	96.58
R< = 2	94.256790*	62.99	70.05
R< = 3	46.278080**	42.44	48.45
R< = 4	17.817520	25.32	30.45
R< = 5	2.613549	12.25	16.26

Note: **(*) denotes rejection of the hypothesis at 5 per cent (1 per cent) significance level. L.R. test indicates 6 co-integrating equation(s) at 5 per cent significance level in Bangladesh. In case of Indonesia, Korea, Philippines and Sri Lanka L.R. test indicates 5 co-integrating equation(s) at 5 per cent significance level. For Malaysia, Singapore and Thailand L.R. test indicates 4 co-integrating relation. While for India and Pakistan test indicate 3 co-integrating relation.

tion methods can be used to estimate relationships among the variables [i.e., private consumption, government consumption expenditure, private investment, imports, exports and economic growth (GDP)]. If, however, at least one of the series is non-stationary then more care in selection of variables is required. In the first case, it is assumed that none of the individual series in the model has a time trend. Thus, it is assumed for each series Y_{it}, that $E(Y_{it}) = 0$. This means that each series may contain a non-zero intercept but not a time trend.

The results based on the IPS t-bar test are reported in Table 3. The null hypothesis of the test report is that the variable contains a unit root (non-stationary) and the alternative hypothesis is that it is stationary. As IPS is a one-sided test, a statistic less than -2.05 (-1.9) can cause rejection at one per cent (5 per cent) of the null hypothesis of non-stationarity. The results show that all the series, private consumption, government consumption expenditure, private investment, imports, exports and economic growth clearly reject the null hypothesis of non-stationarity.

However, the assumption that there is no time trend may not be very appropriate. Therefore, stationarity is tested allowing for a time trend. Table 3 also reports, the results of the panel unit root (IPS) test with time trend. Again it is found that all the series failed to reject the null hypothesis of non-stationarity. So at level all the series are non-stationary in both specifications (with and without time trend).

Table 3 which also presents the results of 1st difference IPS test statistic suggests, that all the series are stationary at 1st difference or all the series are stationary in both specifications (with and without time trend) which means that there is

TABLE 3

Panel Unit Root (IPS) Test

	Level		1st Difference	
Variables	Intercept	Trend	Intercept	Trend
C_t	-0.3933	-0.0863	-12.0170*	-10.7468*
G_t	-0.9387	-0.0411	-10.0898*	-8.4153*
I_t	-1.3654	-0.4546	-11.7005*	-11.0597*
M_t	-0.5996	-1.7520	-9.8427*	-8.2492*
X_t	1.1553	-1.6553	-10.5031*	-8.5193*
Y_t	-1.1423	1.2544	-9.1166*	-9.2552*

Note: *Represent Significant at 1 per cent.

no problem with the I(2) variable. Given the presence of non-stationary variables in both specifications (with and without trend), we now proceed to test for panel co-integration.

c) Panel Co-integration Test Results

Given the results of the IPS test, it is possible to apply panel co-integration methodology in order to test for the existence of a stable long-run relationship among the variables. In Table 4, results from Larsson et al. (2001) based on likelihood (LR) panel test of co-integration are reported. Panel LR Test has the null hypothesis: there is no co-integration and the alternative hypothesis there is co-integration. Rejection of Panel LR test concludes that the average of individual LR test statistics across the countries in the Panel is far away from the mean μ considered under the null hypothesis (that is no cointegration).

The panel rank test a one sided test of the hypothesis H_0: rank $(\prod_i) = r_i \leq r$ for all i, is rejected if $Z_{LR}[H(r) / H(P)] > Z_{j.\alpha}$ is the standard normal $(1-\alpha)$ quantile. Therefore, in this case, C_t, Y_t, G_t, I_t, X_t and M_t, we reject the null hypothesis that the largest rank in the panel is r = 0 (as seen from Table 4). Therefore, we reject the null hypothesis of no co-integration in the model. Based on panel co-integration rank test government size, economic growth, consumption, investment, imports and exports are co-integrated. This implies that there is a stable long-run relationship between government size and economic growth. Another explanation of the Panel Cointegration test may be of different structure and policies, on average all countries in the Panel have stable long-run relationship among Y_t, C_t, G_t, I_t, X_t and M_t regardless of differences in economic set up structural policies. Overall, this study concludes that in the long-run, the size of the government not only has an impact on economic growth but also on imports, exports and investment.

TABLE 4

Panel Co-integration Test

	R=0	R<=1	R<=2	R<=3	R<=4	R<=5	Ranks
$Z_{LR}[H(r)/H(p)]$	71.43*	56.00*	46.50*	50.22*	23.36*	1.59	4

Note: *Represent Significant at 5 per cent. Critical Value for 5 per cent and above is 1.645.

TABLE 5

Co-integrating coefficients Normalized on Y_t

	C_t	G_t	I_t	X_t	M_t	Trend
Bangladesh	-4.239	-0.408	-0.529	-2.196	1.507	
	(0.270)	(0.022)	(0.047)	(0.112)	(0.087)	0.049
	(-15.724)*	(-18.36)*	(-11.152)*	(-19.54)*	(17.25)*	
Indonesia	11.599	7.087	2.106	-1.588	2.529	
	(1.646)	(0.727)	(0.346)	(0.660)	(0.576)	0.076
	(7.045)*	(9.750)*	(6.089)*	(-2.405)*	(4.387)*	
India	17.507	4.108	6.492	1.189	1.192	
	(3.389)	(0.540)	(1.059)	(0.430)	(0.316)	0.007
	(5.165)*	(7.612)*	(6.131)*	(-2.768)*	(3.767)*	
Korea	-3.144	-1.906	2.013	2.516	-0.699	
	(0.500)	(0.316)	(0.166)	(0.430)	(0.277)	0.042
	(-6.291)*	(-6.024)*	(12.10)*	(5.853)*	(-2.524)*	
Malaysia	-2.989	2.626	1.716	1.685	1.395	
	(0.177)	(0.113)	(0.045)	(-0.094)	(0.163)	0.040
	(-16.890)*	(23.17)*	(37.95)*	(-18.009)*	(8.534)*	

TABLE 5
(continued)

Co-integrating coefficients Normalized on Y_t

	C_t	G_t	I_t	X_t	M_t	trend
Philippines	110.309 (123.538) (0.893)	10.871 (13.306) (0.817)	65.038 (70.079) (0.928)	86.053 (-94.231) (-0.913)	69.271 (75.936) (0.912)	0.190
Pakistan	-27.381 (2.356) (-11.624)*	-4.881 (0.394) (-12.38)*	-6.494 (0.593) (-10.948)*	9.590 (0.672) (14.264)*	-4.784 (0.430) (-11.125)*	0.032
Singapore	-1.474 (0.392) (-3.756)*	-1.993 (0.196) (-10.18)*	0.646 (0.181) (3.574)*	-2.937 (0.264) (-11.119)*	3.806 (0.320) (11.895)*	0.022
Sri Lanka	-24.755 (7.704) (-3.213)*	-0.907 (0.353) (-2.570)*	-3.343 (1.009) (-3.314)*	9.464 (2.941) (3.218)*	-7.759 (2.528) (-3.069)*	0.011
Thailand	-4.437 (1.431) (-3.101)*	-0.751 (0.266) (-2.819)*	-1.456 (0.448) (-3.252)*	3.445 (0.433) (7.951)*	-5.056 (0.788) (-6.416)*	0.072

Note: Figures in parentheses are standard error and t-statistics.

V. Conclusions

It can be concluded from the above results that the government should provide goods and services that help citizens escape from anarchy to higher levels of economic and social welfare. Many public goods can have positive effects on the efficiency of the private economic sector. Government activity can lead to productivity increase by increasing the rate of utilization of the existing capital stock in a country prone to stagnation and unemployment. It can reduce social conflict by reducing economic inequality and poverty, and by inducing higher work efforts to the negative income effects of high taxation. But, of course, government activity can also have negative effects on economic productivity by inducing lower work efforts; savings due to the substitution effects of high taxation; diverting profit creating activities into rent-seeking activities; and crowding out private sector investment and production.

In general, the research results, with a prior expectation do not support an out-and-out rejection of government spending as an informative tool for determining economic growth in the case of panel of ten Asian countries for the period 1971-2001.

The empirical results based on the ADF test and panel unit root (IPS) test clearly shows that all the series in the model are I(1) (stationary at 1st differences). Country-by-country and panel results based on J-J Multivariate co-integration test and newly developed Larsson et al. (2001) panel cointegration test show a long-run stable relationship between government size and economic growth in the Asian countries. This long-run relationship is found to be retarding the growth process in six of ten Asian countries included in the sample.

In conclusion, the study results provide mixed evidence of the effect of government spending on economic growth. Some forms of spending, especially those that are necessary for the provision of public good is growth promoting. However, there can always be an economic cost when resources are taken from the private sector (taxes) to finance outlays (provision of public goods), but the benefits sometime exceed costs – meaning that the net effect on economic performance may be positive and where costs exceed benefits – with a net negative effect on growth.

Applied Economics Research Centre, University of Karachi, Pakistan,
Wachovia Corporation, USA,
and Islamia University of Bahawalpur, Pakistan

References

Afxentiou, P.C., 1982, Economic development and the public sector: An evaluation, Atlantic Economic Journal, 10(4): 32-38.

Barro, R.J., 1990, Government spending in a simple model of endogenous growth, Journal of Political Economy, 98(2): 103-125.

Barro, R.J., 1991, Economic growth in a cross section of countries, Quarterly Journal of Economics, 06: 407-444.

Barro, R.J., and X. Sala-i-Íartin, 1995, Economic Growth, New York: McGraw-Hill.

Barth, J., and M. Brady, 1987, The impact of government spending on economic activity, Manuscript, Washington, DC: George Washington University.

Castles, F.G., and S. Dowrick, 1990, The impact of government spending levels on medium term economic growth in the OECD, 1960-1985, Journal of Theoretical Policies, 2(2): 173-204.

Dalamagas, Basil, 2000, Public sector and economic growth: the Greek experience, Applied Economics, 32: 277-288.

Diamond, J., 1989, Government expenditure and economic growth: An empirical investigation, Washington, D.C: IMF working paper: 89/45.

Dowrick, S., 1993, Government consumption: Its effects on productivity growth and investment, in: N. Gemmel, ed., The growth of the public sector: Theories and international evidence, Aldershot: Edward Elgar : 136-152.

Edmund J., Sheehey, 1993, Effect of government size on growth, Eastern Economic Journal, 19(3).

Edwards, S., 1989, Openness, outward orientation, trade liberalization and economic performance in developing countries, World Bank working paper series: 191.

Feder, G., 1983, On export and economic growth, Journal of Development Economics, 12(3): 59-74.

Fuller, W.A., 1976, Introduction to statistical time series, New York, N.Y: John Wiley : 371-373.

Grier, K., and G. Tullock, 1989, An empirical analysis of cross-national economic growth, 1951-1980, Journal of Monetary Economics, 24(1): 259-276.

Grossman, G.M., and E. Helpman, 1990, Trade, innovation, and growth, American Economic Review, Papers and proceedings, 80(5): 86-91.

Im, K.S., M.H. Pesaran and Y. Shin, 2003, Testing for unit roots in Heterogeneous Panels, Journal of Econometrics, 153: 53-74

Johansen, S., 1988, Statistical analysis of Cointegration Vectors, Journal of Economic Dynamics and Control,.12: 231-254.

Johansen, S., 1995, Likelihood-based inference in cointegrated Vector Autoregressive Models, Oxford: Oxford University Press, Chapter 15.

Johansen, S., and K. Jusellius, 1990, Maximum likelihood estimation and inference on cointegration – with applications to the demand for money, Oxford Bulletin of Economics and Statistics, 52: 169-210.

Kormendi, R., and P. Meguire, 1985, Macroeconomic determinants of growth: cross-country evidence, Journal of Monetary Economics, 16(4): 141-63.

Kweka, Josaphat P., and M. Oliver, 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.

Landau, D., 1983, Government expenditure economic growth: A cross-country study, Southern Economic Journal, 49 (3): 783-792.

Landau, D., 1986, Government and economic growth in the less developed countries: An empirical study for 1960-1980, Economic Development and Cultural Change, 35(1): 35-75.

Larsson, R., J. Lyahagen, and M. Lothgren, 2001, Likelihood-based cointegration tests in Heterogeneous Panels, Econometrics Journal, 4: 109-142.

Levin, A., and C.F. Lin, 1992, Unit Root in panel data: Asymptotic and finite-sample properties, Unpublishgd manuscript, San Diefo: University of California.

Levine, R., and D. Renelt, 1991, Cross country studies of growth and policy: Some methodological: Conceptual, and statistical problems, World Bank Working Papers, Series No.608.

Levine, R., and D. Renelt, 1992, A sensilivity analysis of cross-country growth regressions, The American Economic Review, 82(4): 943-963.

Ram, R., 1986, Government size aid economic growth: A new framework and some evidence from cross-section and time series data, American Economic Review, 76(6): 191-203.

Rivera-Batiz, L., and P.M. Romer, 1991, Economic integration an endogenous growth, Quqrterly Journal of Economics, 106(4): 531-556.

Romer, P.M., 1986, Increasing returns and long-run growth, Journal of Political Economy, 94(5):1002-1037.

Romer, P.M., 1989, Human capital and growth: Theory and evidence, National Bureau of Economic Research, Cambridge, MA: Working paper no. 3171.

Romer, P.M., 1990a, Capital, labor, and productivity, Brookings Papers on Economic Activity, Special issue, 337-420.

Romer, P.M., 1990b, Endogenous technological change, Journal of Political Economy, 98(2): 71-102.