Causality between Public Expenditure and Economic Growth in Sri Lanka: A Time Series Analysis

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Abstract

This paper examines the causality between public expenditure and economic growth in Sri Lanka using time series annual data over the period of 1977-2009. In particular, this study keeps a special focused on various selected components of public expenditure by applying a multivariate cointegration and Vector Error Correction Modeling (VECM) techniques. The empirical evidence suggests, in long run, public expenditure on education, agriculture, health and transport and communication have positive and statistically significant effects on economic growth while defense expenditure shows a negative but a statistically significant effect on economic growth. Granger causality analysis confirms that there is a unidirectional causality running from education expenditure to economic growth, defense expenditure to economic growth, and agriculture expenditure to economic growth, which supports the existence of Keynesian hypothesis in Sri Lanka. Analysis also indicates that existence of bidirectional causality between health expenditure and economic growth, transport and communication expenditure and economic growth. Therefore, the findings of this study provide an important implication to policy makers to improve the efficiency of public expenditure by reallocating among sectors in a growth context.

Keywords: Causality, Economic growth, Public expenditure and Sri Lanka.

Introduction

The relationship between public expenditure and economic growth has emerged as one of the most researched issues in both developed and developing countries in recent years. Public expenditure policies relating to sound government finances are essential to promote growth and preserving macroeconomic stability. Moreover, public expenditure can also pursue other objectives, including redistribution, which can contribute to economic welfare. In this context, there

has been growing debate in developing countries on "quality" of public finance, in particular, how much governments should spend and on what, and how expenditure reform can contribute to sustainable economic growth and stability. Sri Lanka is not an exceptional country involving in these issues. Over the last three decades the trend and components of public expenditure in Sri Lanka has changed dramatically. Despite the effect of public expenditure on economic growth has been widely examined in Sri Lanka, the effect of components of public expenditure on economic growth has not so far been widely addressed in the literature. Most of these studies have either focused on aggregate public expenditure or only on one type of public expenditure [Dilrukshini, 2004; Herath, 2010]. This paper tries to contribute to the existing literature by examining the relationship between composition of public expenditure and economic growth in Sri Lanka over the period 1977-2009. In this context, this study attempts to make realistic policy contributions in achieving fiscal policy goals by establishing a link between public expenditure and economic growth. The findings of this study will provides an important implication to policy makers to improve the efficiency of public expenditure policies relating to sound government finances which can promote growth and preserving macroeconomic stability. Moreover, this study employs a multivariate cointegration and Vector Error Correction Modeling (VECM) techniques by utilizing time series annual data drawn from various annual reports of the Central Bank of Sri Lanka. A key feature of the model is that public expenditure is disaggregated into various components, including education, defense, health, agriculture and transport and communication. The major limitation of the study is that only flow of public expenditure is taken into account in the model and it did not consider the potential impact of other factors towards economic growth. Further, sample period is also limited since it considers only the post economic liberalization period.

The paper is organized as follows. Section two briefly reviews the theoretical and empirical literature. Section three presents an overview of public expenditure in Sri Lanka since the economic liberalization. Section four brings out the sources of data and the methodological framework adopted in the study, while section five presents the empirical results of this study. The final section presents the conclusion.

Literature Review

Theoretical Framework

The long run relationship between public expenditure and economic growth emerged a serious debate and resulted in various conclusions. Wagner's law and the Keynesian theory present two opposite perceptions in terms of the relationship between public expenditure and economic growth. According to the Wagner's law, government spending is an endogenous factor that is driven by the growth of national income. Basically, as per capita income increases, public sector's importance will grow (Bird, 1971). Moreover it states that in the process of economic development, government economic activity increases relative to private economic activity (Wagner, 1883). Wagner offered three reasons why this would be the case. First, the administrative and protective functions of the state would substitute public for private activity. Second, economic development would lead to an increase in cultural and welfare expenditures. And third, government intervention would be required to manage and finance natural monopolies. However, In the Keynesian paradigm (Keynes, 1936), economic growth occurs as a result of rising public expenditure, and considered as an independent exogenous variable to influence the economic growth. Furthermore, public expenditure can be used as a policy variable, and which can impact upon growth and development in the short run. As per this hypothesis public expenditure promotes economic growth through upward shift in real effective demand in an economy operating at less than full employment level. A fiscal expansion is expected as a result of multiplier effect on output behind its assumption of price rigidity and the possibility of excess capacity. Both the Wagner's law and Keynesian hypothesis are short run phenomenon in which the causality testing approach does help to identify the short run relations between public expenditure and economic growth. While according to Wagner's approach causality runs from growth in community output to public expenditure, the Keynesian approach assumes that causality runs from public expenditure to growth in community output in times of recessions. Empirically, however, it has been found that the link between public expenditure and growth is contingent upon the nature of expenditure. Typically, studies have found that current expenditure does not have any significant influence on the real growth of the economy whereas capital expenditure particularly on health, housing and

welfare has significant impact on growth (Diamond, 1989). Similarly, in the framework of endogenous growth theory (Romer, 1994), public expenditure on investments in areas such as infrastructure, human capital, science and technology exerts positive influence on economic growth (Tanzi & Zee, 1997).

Empirical Studies

A large number of studies have attempted to examine the impact of public expenditure on economic growth in both developed and developing countries and most of them provide mixed results. Castles & Dowrick (1990) used the shares of disaggregated public expenditure in health, education and social transfers to explain economic growth. They found that social transfers and education had a positive effect on growth. Devarajan, et al. (1996) also assessed the impact of different types of public expenditure on economic growth though they did not find any significant link. Komain & Brahmasrene (2007) examined the relationship between public expenditure and economic growth in Thailand, by employing the granger causality test. The results revealed that public expenditure and economic growth are not cointegrated. Moreover, the results indicated a significant positive effect of public expenditure on economic growth. Barro (1991) in a study of 98 developed and developing economies found a positive but weak relation between government expenditure and economic growth over the 1960-1985 periods. Kwabena, et al. (2006) investigated the effects of higher education on the growth rate of per capita income in African countries during 1960-2000. They identified that all levels of education, including higher education human capital, have positive and statistically significant effect on the growth rate of per capita income in African counties. Ramayandi (2003) reviewed the relationship between government size and economic growth in the context of Indonesia and identified that government size tends to have a negative impact on growth. Loizides & Vamvouks (2005) employed the causality test to examine the relationship between public expenditure and economic growth, using data set on Greece, United Kingdom and Ireland. The authors found that government size granger causes economic growth in all the countries they studied. The results also indicate that economic growth granger causes public expenditure for Greece and United Kingdom.

Landau (1986) concluded that the public expenditure on education, defense and capital development had a weak or even no impact on economic growth. Ranjan & Sharma (2008) examined the effect of public expenditure on economic growth during the period 1950-2007 in India. They found a significant positive impact of public expenditure on economic growth. They also reported an existence of co-integration among the variables. Singh & Sahni (1984) used the Granger causality test to determine the causality direction between national income and public expenditures in India. Aggregate as well as disaggregate expenditure data for the period of 1950-1981 was used. Data used in the study were annual and deflated by using implicit national income deflator. The study finds no causal relationship confirming the Wagnerian law or the opposite view.

Herath (2010) examined a relationship between public expenditure and economic growth in Sri Lanka for the period 1959 to 2003. The study found government expenditure has a positive effect on economic growth; further this study suggests that openness is beneficial for Sri Lanka as it increases economic growth. Shaista, et al. (2010) examined the long run relationship between social expenditure and economic growth in Asian developing countries including Sri Lanka. According to the analysis the study concludes that expenditure in infrastructure, education and health plays an important role in promoting economic growth in all the selected Asian countries. Dilrukshini (2004) studied the relationship between public expenditure and economic growth in Sri Lanka during 1952-2002 using time series data to tests the validity of Wagner's Law, and found that there is no empirical support either for the Wagner's Law or Keynesian hypothesis, in the case of Sri Lanka.

Public Expenditure and Economic Growth in Sri Lanka

Despite countries are attempt to achieve its macroeconomic objectives through its fiscal and monetary policies, the effects of public expenditure in achieving fiscal policy goals of pursuing economic growth, equity and maintaining macroeconomic stability has emerged as one of the great issue in recent years. Following the political independence in 1948, the successive governments of Sri Lanka started to take the primary responsibility of building the capital and

infrastructure base to promote economic growth and social well being of the people. This led the government to increase its spending on social and welfare activities. The outcomes of these activities also have reflected in many human development indicators. Following the economic liberalization, Sri Lanka has come almost full circle with respect to economic policy regimes. Despite Sri Lanka experienced with a number of external and domestic shocks, including global economic crisis, oil crisis, internal civil war and natural disaster, it has recorded an average about five percent economic growth during past three decades.

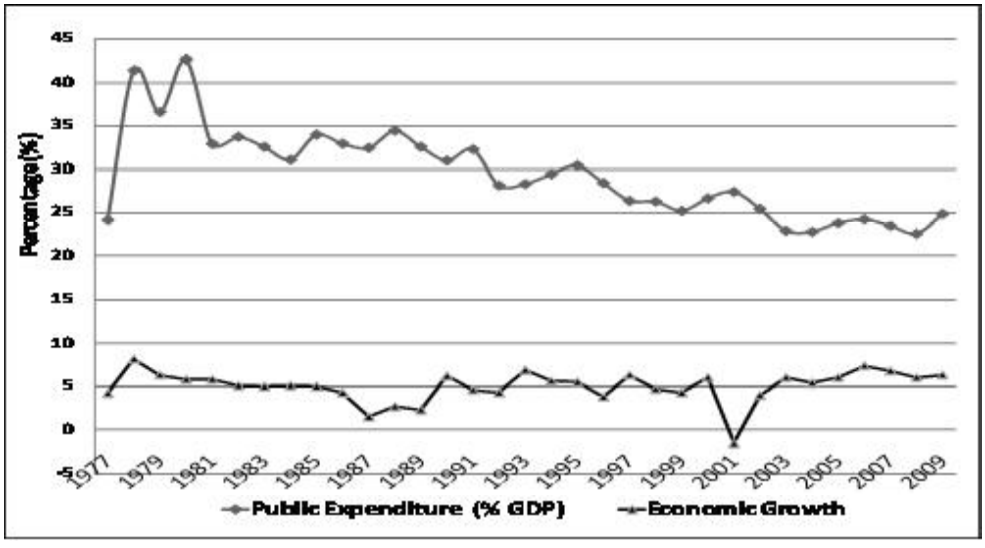
Table 1: Public Expenditure (% GDP) in South Asian Countries

Years	Sri Lanka	India	Pakistan	Bangladesh
1990	28.7	17.3	25.9	12.4
1995	29.6	14.1	23.0	14.4
2000	25.0	15.5	18.9	14.5
2002	23.8	16.8	18.6	14.9
2004	22.6	15.8	16.4	14.8
2006	24.2	14.1	18.7	14.7
2007	23.2	15.1	19.3	14.3

Source: Key indicators of Asia & Pacific; Asian Development Bank 2008

Table 1 shows the trend of public expenditure as percentage of GDP in selected south Asian countries from 1990 to 2007. In Bangladesh, total expenditure was only 12.4 percent of GDP in 1990s and this was mere increased to 14.3 percent in 2007. In India, during 1990s the expenditure was 17.3 percent while this was reduced up to 15.1 percent of GDP in 2007. It is also noted that the expenditure situation in Pakistan during 1990s was 25.9 percent but this has slightly decreased to 19.3 percent in 2007. Therefore, the data presented in the above table clearly illustrates that public expenditure in Sri Lanka remains considerably highest than its regional counterparts in the last two decade.

Figure 1: Trend of Public Expenditure (% GDP) and Economic Growth in Sri Lanka, 1977-2009



Source: Central Bank Annual Report, various years

Figure 1 shows the trend of public expenditure and economic growth in Sri Lanka over the period of 1977-2009. Despite public expenditure as a percentage of GDP shows downward trend, the total public expenditure in terms of rupees or dollars has shown an upward trend reflecting expansion of the overall government sector (CBSL, 2009). Furthermore, the rise in public expenditure and changes in the components of public expenditure have raised concerns regarding the sustainability of the growth process particularly after economic liberalization. The pattern in public expenditure in Sri Lanka since the eighties has been mainly influenced by a change in role of the government in the growth process, financing pattern of the deficits (debt and interest payments) and the need for fiscal consolidation. With a view to understand as to how public expenditure play as a central instrument in promoting economic growth, it is useful to analytically classify the various components of public expenditure in terms of their influence on various segments of economy. Public expenditure can be classified under two categories namely current expenditure and capital expenditure. Current expenditure represents the consumption while the capital expenditure represents asset creation by the government. These expenditures are also classified in terms of developmental and non developmental categories so as to assess their welfare impact. The

developmental expenditure mainly includes expenditure on economic services such as agriculture, industry, energy, communication, transport, science, technology and environment etc and social services including education, health, employment, nutrition, and housing etc. The remaining categories such as government administration, interest payments, pensions, defense and other non productive services constitute non developmental expenditure. The economic growth is normally more responsive to developmental expenditure. Given the above classification of public expenditure, it is constructive to identify the role of selected components of public expenditure towards achieving the long term growth in Sri Lanka.

Table 2: Public Expenditure in Selected Components (% GDP)

Period	Defense (DEF)	Agriculture (AGR)	Education (EDU)	Health (HEL)	Transport & Communication (TRC)
1980-1985	1.25	6.98	3.01	1.71	3.34
1986-1990	2.27	3.62	2.83	1.63	3.50
1991-1995	3.52	1.53	2.83	1.52	2.58
1996-2000	3.54	0.82	2.12	1.23	1.58
2001-2005	2.95	0.91	2.23	1.58	1.62
2006-2009	2.84	1.20	2.34	1.75	2.01

Source: Central Bank Annual Report, various years

Table 2, shows the average share of the public expenditure on selected components including education, defense, health, agriculture and transport and communication during the period 1980 to 2009 in Sri Lanka. As noted in table 2, following the liberalization, the share of defense expenditure started to increase while the share of other sector expenditure has decreased considerably. In 1980-1985 periods, the share of defense expenditure as a percentage of GDP was 1.25 percent while it increased to 3.54 percent by 1996-2000 periods and in 2006-2009 periods the share of this expenditure was slightly decreased to 2.84 percent. At the same time, the share of agriculture expenditure has decreased to 1.2 percent in 2006-2009 periods to 6.98 percent in 1980-1985 periods. On the other hand, the share of education expenditure decreased from 3.01 percent in 1980-1985 periods to 2.34

percent in 2006-2009 periods. Moreover, government expenditure as a percentage of GDP on transport and communication sector also declined from 3.34 percent in 1980-1985 to 2.01 percent in 2006-2009. Therefore, it is evident that during 1980-2009 periods the defense expenditure dominated all other expenditure categories accounting an average about 2.5 of GDP, which is not surprising given the civil war situation in the country. Secondly, expenditure in the education sectors shows the highest allocation since government in the country recognize the role of education in development and therefore devoted much public resources to this sector. On the other hand, due to higher private sector participation in health care, expenditure on health sector remained averaged about 1.5 percent of the GDP.

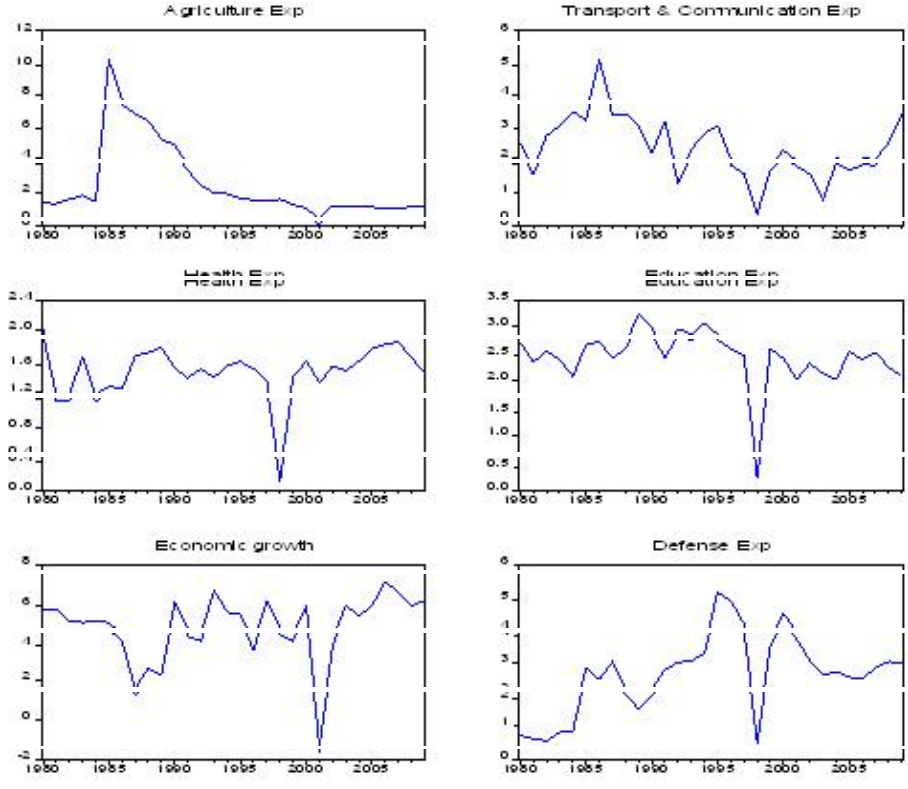
Data and Methodology

Annual time series data for the period of 1977 to 2009 is used in the study. All the data have been obtained from various annual reports of the Central Bank of Sri Lanka. All data figures are expressed in rupees millions, unless otherwise stated.

Model Specification

Several models of government investment and growth have been designed to investigate the relationship between public expenditure and economic growth. Keynesian model emphasize, expansion in public expenditure leads to higher economic growth. In contrast, neo classical growth model states fiscal policy does not have any impacts on economic growth. However, the empirical finding of this study is based on the Keynesian growth model. Furthermore, the analysis incorporates five components of public expenditure namely agriculture, education, health, defense and transport and communication into the model. The behaviors of selected key variables are graphically shown below.

Figure 2: Trend of the selected key variables (Percentage of GDP), 1980-2009



Source: Central Bank Annual Report, various years

The functional form of our model can thus be written as follows.

$$EG = f(AGR, DEF, EDU, HEL, TRC) \ldots\ldots\ldots\ldots (1)$$

Here, the economic growth is hypothesized to depend on the aforementioned variables. Moreover, for estimating the relative elasticity, the natural logarithms of all the variables have been utilized. An advantage of grouping the above variables in natural logarithmic form is to achieve stationarity in the lower order of integration in case the logs of these variables are nonstationary at levels. The log linear multiple regression model is formulated as follows:

$$\ln EG_t = \beta_1 + \beta_2 \ln AGR_t + \beta_3 \ln DEF_t + \beta_4 \ln EDU_t + \beta_5 \ln HEL_t + \beta_6 \ln TRC_t + U_t \ldots\ldots (2)$$

Where, β_j are the coefficients of the regression model, *t* indexes time. According to the above model, economic growth expressed as a function of public expenditure. Real GDP is used as the dependent variable ($RGDP_t$), while the key explanatory variables include agriculture expenditure (AGR) education expenditure (EDU_t), health expenditure (HEL_t), defense expenditure (DEF_t), and transport and communication expenditures (TRC_t). U_t is the Error Term. The above model enables us to identify the impacts of different types of public expenditure on economic growth in Sri Lanka.It is expected that all the coefficients on the explanatory variables have a positive sign in the empirical results.

This study employs econometric techniques of Vector Autoregressive (VAR) model with six variables. As a first step towards the analysis of causal relationship between public expenditure and economic growth, the stationary test for all the variables has been tested. In the second step, this study adopts Johanson & Juselius (1990) method to examine the cointegration among the variables. This approach would be extended to the employment of Vector Error Correction Model (VECM), if the variables in the underlying regressions are found to be cointegrated. Furthermore, Granger (1981) causality analysis has been used to examine the causality direction among the variables.

Unit Root Test

The test for stationarity of the individual series in the above (2) economic model has been tested by applying both Augmented Dickey-Fuller (ADF) and Phillips-Perron test procedure in E-views version 5.0. In the ADF tests, suppose Xt is the test series which could be the level or first difference of the economic series whose stationarity is being examined, the form of ADF test procedure adopted was a test for significance of the coefficient associated with the lagged value of the test series (X_{t-1}) in the following ADF regression:

$$\Delta X_t = a + b_t + pX_{t-1} + \sum_{i=1}^{k} \Delta X_{t-1} + U_t \ldots\ldots\ldots\ldots (3)$$

Where, X_t is the individual time series, ΔX_t, is the first difference of the series X_t. ($\Delta X_t = X_t - X_{t-1}$)

k is the lag order, t is the linear time trend. Ut is serially uncorrelated random term and 'a' is constant. The above ADF test suggests that a time series is said to be nonstationary, if the ADF test revealed the Null Hypothesis that p=0 could not be rejected against an alternative that p< 0, and stationary if otherwise. Economic series are said to be integrated of order d, denoted as I (d), where the order of integration is the number of unit roots contained in the series or the number of differencing operations it takes to make the series stationary.

Johanson Cointegration Tests

The next step in the examination of statistical properties of the series is testing for cointegration among the endogenous variables. Cointegration technique are used to examine the long run relationship between economic variables if they are integrated of order one I (1). A long run relationship means that the variables move together over time, so that short run disturbances from the long run trend will be corrected. This study adopts Johanson and Juselius (1990) method to test for cointegration. The Johanson cointegration methodology is a system method which allows determination of how many independent cointegration relationships exist among the set of variables being considered. Further, this method requires that variables entering the cointegration relationship to be integrated of the same order and yields two likelihood statistics known as trace and maximum Eigen value statistics which are given by;

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\lambda_i)..... \qquad (4)$$

$$\lambda_{Max}(r, r+1) = -T\ln(1-\lambda_{r+1})..... \qquad (5)$$

Where, T is the number of observation; i is the i^{th} Eigen value; λ_i and r=0, 1, 2… n-1. The trace statistic tests the null hypothesis of "at most r cointegration relations" against the alternative of "more than r cointegrating relations". Further, the lag length used in the estimation is obtained on the basis of the Akaike Information Criteria (AIC).

Vector Error Correction Model (VECM) and Variance Decomposition Analysis

The advantage of Vector Error Correction Model (VECM) approach would be useful in finding the direction of causality among variables and distinguishing between the short run and long run of such causality. As per this study, to determine the short run dynamics of the regression model, following six Error Correction Model (ECM) has been established.

$$\Delta \ln EG_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (6)$$

$$\Delta \ln AGR_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (7)$$

$$\Delta \ln DEF_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (8)$$

$$\Delta \ln EDU_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (9)$$

$$\Delta \ln HEL_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (10)$$

$$\Delta \ln TRC_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln AGR_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln DEF_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta \ln EDU_{t-i} + \sum_{i=1}^{n} b_{4i} \Delta \ln HEL_{t-i} + \sum_{i=1}^{n} b_{5i} \Delta \ln TRC_{t-i} + \sum_{i=1}^{n} b_{6i} \Delta \ln EG_{t-i} - b_6 EC_{t-1} + U_t \quad (11)$$

Where, EC_t (Error Correction) term measures the long run equilibrium relationship while the coefficients on the lagged difference term indicate the short run dynamics. The coefficient of error terms are expected to capture the adjustments of the depended variable towards long run equilibrium showing the speed of adjustment to long run solution that enters to influence short run movements in growth, while the coefficients of other independent variables are expected to capture the short run influence on economic growth. Moreover, the relative importance of the variables in impacting economic growth in Sri Lanka has been examined by variance decomposition analysis.

Granger Causality Tests

The systematic testing and determination of causal direction approach developed by Granger (1981) is simply based on the axiom that past and present may cause the future but the future cannot cause the past. The following two equations postulate the bivariate regressions that are run by the E-views 5.0 program for this particular study.

$$Y_t = \alpha + \sum_{i=1}^{m} \beta_i Y_{t-1}) + \sum_{j=1}^{n} \beta \varphi_i X_{t-1}) + \varepsilon_t \ldots\ldots\ldots\ldots (12)$$

$$X_t = \chi + \sum_{i=1}^{m} \varphi_i X_{t-1}) + \sum_{j=1}^{n} \mu_i Y_{t-1}) + \nu_t \ldots\ldots\ldots\ldots (13)$$

Where: Y_t and X_t are two stationary series and *i* and *j* stand for lag lengths. The unilateral causality is exists when Y_t is said to be Granger caused by X_t which means the coefficients on the lagged of X_t are statistically significant. The same is true for the other way around. On the other hand, a bilateral causality is said to exist when both coefficients are statistically significant, and there is independence when both are statistically insignificant (Granger, 1981).

Results and Discussion

Unit Root Tests

The first step of Johanson cointegration approach is to test the presence of unit root in time series variables used in the study. Table 3 shows the results of ADF and PP statistics and corresponding critical values of all the variables in their level and first differenced forms. As reported in Table 3, only the RGDP variable is stationary in levels forms. Hence the ADF test was applied to the transformed series of each variable to check for the possibility of stationarity in first differences. Third and fifth columns reports that computed ADF and PP exceed its critical values at 1 , 5, and 1 0 percent levels for all the variables. Thus, the null hypothesis that the series is non stationery is rejected. Since, all the variables are integrated of the same order; we can test for the existence of a long run relationship between economic growth and public expenditure through applying Johansen and Juselius (1 990) cointegration approach.

Table 3: Results of ADF and PP Unit Root Test

Variable	ADF Test Statistics		PP Test Statistics		Decision (Order of Integration)
	Level	First Difference	Level	First Difference	
LNRGDP	-4.400*	-5.799*	2.335	-3.857**	I(1)
LNEDU	2.143	-5.325*	0.747	-3.873**	I(1)
LNDEF	1.057	-3.895**	0.368	-2.871***	I(1)
LNHEL	2.065	-3.366***	0.397	-4.962*	I(1)
LNTRC	1.583	-4.283*	-1.182	-8.746*	I(1)
LNAGR	2.427	-4.309*	1.793	3.215***	I(1)

Source: Author's calculations using E-views software

Note: *, **, *** Represents significance at 1%, 5% and 1 0% critical value respectively.

Optimal lag length in the VAR

A major requirement in conducting Johansen cointegration tests and estimation of a VAR system is the choice of an optimal lag length. In this study, the optimal lag length choice was made by examining the lag structure in an unrestricted VAR using VAR lag order selection criteria. Table 3 shows the evidence based on the VAR lag order selection criteria. Sequential modified LR test statistic

(LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ) suggests that optimum lag order for VAR is two lags, VAR (2). Therefore the following analyses in this study were based on VAR with two lags.

Table 4: Results of VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1923.302	NA	4.604	124.471	124.748	124.561
1	-1732.838	294.913	2.264	114.505	116.448	115.139
2	-1650.322	95.824*	1.494*	111.504*	115.112*	112.680*

Source: Author's calculations using E-views software
Note: * indicates lag order selected by the criterion. (each test at 5% level).

Johansen Cointegration Tests

The results for the Johansen maximum likelihood test reported in table: 5 and 6 confirm the rejection of the null hypothesis of no cointegration among the variables. In particular, the computed Trace, maximum Eigen value statistic and their corresponding critical values indicate that the null hypothesis of no cointegration (r=0) can be rejected under 5 percent level of significance. This indicating that there exist a long run equilibrium relationship among the variables.

Table 5: Trace Test

Hypothesized No of Cointegration equations	Trace Statistics	0.05 Critical Value
None**	114.414	69.818
At most 1	47.856	65.063
At most 2	29.797	36.386
At most 3	15.494	17.208
At most 4	0.940	3.841
At most 5	0.071	2.314

Source: Author's calculations using E-views software
**denotes rejection of the hypothesis at the 0.05 level.

Table 6: Maximum Eigen Value Test

Hypothesized No of Cointegration equations	Maximum Eigen Statistics	0.05 Critical Value
None**	49.351	33.876
At most 1	27.584	28.677
At most 2	19.177	21.131
At most 3	14.264	16.267
At most 4	2.940	3.841
At most 5	1.543	2.421

Source: Author's calculations using E-views software
**denotes rejection of the hypothesis at the 0.05 level.
Note: Trace test and Maximum Eigen value test indicates one cointegrating equation at the 0.05 level.

Table 7: Long Run Model

$$\ln EG_t = \beta_1 + \beta_2 \ln AGR_t + \beta_3 \ln DEF_t + \beta_4 \ln EDU_t + \beta_5 \ln HEL_t + \beta_6 \ln TRC_t + U_t$$

Independent Variables	Coefficient	Std. Error	t - Statistic
LNDEF	-0.216**	0.106	-2.025
LNEDU	0.386**	0.212	1.824
LNHEL	0.023	0.212	0.105
LNTRC	0.564**	0.331	-1.704
LNAGR	0.374**	0.212	1.762
Constant	17.426	638.352	0.027
R-squared	0.927		
Adj.R-squared	0.894		
Durbin-Watson stat	2.200		
F-statistic	68.530 (0.000)		

Source: Author's calculations using E-views software
Note: *, **, *** Represents 1%, 5% and 10% significance level respectively.
Dependent Variable: Economic Growth

The result of long run regression is presented in the table 7. In public expenditure, five sectors have been considered in the analysis. Significance of the regression parameters are tested by usual t statistic. The estimated results show that there exists a long run relationship among the variables. As evident from the estimation, education and defense expenditure variables are found to be statistically significant, with coefficients showing a 0.38, -0.22 effects on economic growth respectively. The result also reflects the increase of government expenditure

on education in Sri Lanka, which is heavily contributing in the long run economic growth. Since economic liberalization, government had recognized the importance of education sector in growth and development process and made a significant allocation to the public expenditure on education sector. Hence, the result indicates that education sector had contributed positively to economic growth in Sri Lanka over the study period. Further, it also indicates the finance allocated for the development of education sector has been properly utilized. This finding is inconsistency with previous findings of negative or insignificant positive effects of education expenditure on growth for developing countries. (Landau 1986, Deverajan et al. 1996). On the other hand defense expenditure indicates the negative impacts on economic growth. Empirical evidence also reveals the positive impact of overall health expenditure on growth but insignificant. Generally increasing health expenditure considered as an investment in human capital and is expected to promote higher economic growth. Hence, the positive impacts of health expenditure on growth may be attributed to the fact that rises in the health status and the productivity of the human capital. Further, regression results show, the transport and communication expenditure and agriculture expenditure also significant at the 10 percent critical level, suggesting that an increase in these two expenditures would also increase annual economic growth.

Estimation of Vector Error Correction Model (VECM)

Table 8 presents the estimated coefficient of the Vector Error Correction Model (VECM), with the restrictions implied by the one cointegration equation imposed. Examination of the F-statistics and the adjusted R^2, suggests that the variables in the VECM significantly explained short run changes in RGDP, accounting for 91 percent of the short run variation. Further, the estimated error correction coefficient in the D(LRGDP) equation is significant at 10 percent level, indicating that in Sri Lanka expenditure on agriculture, education, defense, health, and transport and communication are cointegrated. This shows that RGDP in Sri Lanka adjusts significantly to shocks to its equilibrium relationship with its hypothesized determinants that are caused by exogenous changes in past values of AGR, EDU, DEF, TRC, HEL and RGDP. Further it also indicates a relatively slow adjustment towards long run equilibrium in about five years. In particular,

about 19 percent of the deviation of the RGDP from its long run equilibrium level is corrected each year.

Table 8: Vector Error Correction Model (VECM)

Variable	D(LAGR)	D(LDEF)	D(LEDU)	D(LHEL)	D(LRGDP)	D(LTRC)
EC	-0.054*	-0.048***	-0.016	-0.058*	-0.191**	-0.237*
t-statistics	-3.213	-1.915	-1.33	-3.022	-1.832	-3.076
D(LNAGR(-1))	-0.642**	-0.136	0.055	0.071	0.096	1.454
t-statistics	-2.421	-0.345	0.290	0.236	0.591	1.198
D(LNAGR(-2))	-0.099	-0.396	-0.067	0.037	0.129	1.602
t-statistics	-0.361	-0.971	-0.341	0.121	0.766	1.278
D(LNDEF(-1))	0.146	-0.519*	-0.466	-0.650	-0.201**	0.155
t-statistics	1.120	-2.663	-1.362	-1.377	-2.493	0.258
D(LNDEF(-2))	-0.539	-0.690**	-0.309	-0.573	-0.338**	-0.355
t-statistics	-1.495	-2.147	-1.001	-1.339	-2.538	-0.359
D(LNEDU(-1))	-1.971	0.199	0.282	0.023	0.813***	-5.754
t-statistics	-1.501	0.169	0.500	0.025	1.675	-1.596
D(LNEDU(-2))	1.190	-1.7659	0.589	1.866	1.079***	1.981
t-statistics	1.054	-1.052	0.729	1.459	1.752	0.384
D(LNHEL(-1))	-1.167	-1.278**	-0.894**	-3.032**	0.354	-2.959
t-statistics	-1.228	-1.640	-2.384	-5.109	1.097	-1.235
D(LNHEL(-2))	-1.128	-0.3614	-0.683**	-1.916*	-0.374	-0.155
t-statistics	-1.056	-0.593	-2.330	-4.130	-1.481	-0.082
D(LNRGDP(-1))	-0.628**	-2.272*	-0.545*	-0.688**	-0.177	-6.143*
t-statistics	-2.375	-5.775	-2.880	-2.295	-1.088	-5.081
D(LNRGDP(-2))	-1.167**	0.323	-0.169	-1.319**	-0.408	-7.906*
t-statistics	-2.118	0.394	-0.429	-2.112	-1.202	-3.136
D(LNTRC(-1))	0.052	0.174	0.093	0.178***	-0.021	-0.276
t-statistics	0.633	1.425	1.586	0.912	-0.415	-0.731
D(LNTRC(-2))	0.175*	0.399*	0.091*	0.165*	0.061	-0.104
t-statistics	3.747	5.736	2.717	3.110	1.125	-0.487
C	1109.55***	641.735	243.493	976.954	226.539	8611.75*
t-statistics	1.805	0.701	0.553	1.402	0.598	3.064
R-squared	0.816	0.881	0.804	0.857	0.909	0.789
Adj. R-squared	0.656	0.778	0.635	0.734	0.831	0.607
F-statistic	5.122	8.569	4.748	6.953	11.546	4.333
Log likelihood	-262.844	-274.364	-253.168	-266.471	-248.806	-306.924
Akaike AIC	19.092	19.887	18.425	19.342	18.124	22.132

Source: Author's calculations using E-views software

Note: *, **, *** Represents significance at 1%, 5% and 10% critical value respectively.

Moreover, focusing on the short run coefficient of the variables, while agriculture and transport and communication expenditure are significantly influence on the long run real output, their short run impacts on real output are insignificant. Increasing expenditure on agricultural sector not only yields high returns to

agricultural production, but also has a large impact on poverty reduction since most of the poor still reside in rural areas and their main source of livelihood is agriculture. Hence, this type of spending not only promotes higher growth but also has a large impact on development in the long run. Moreover, the evidence in respect of education and defense expenditure reveals significant influence on real output both in the long run and short run. These results suggest that expenditure on defense does not necessarily leads to increase the economic growth, but can leads to reduce the long run economic growth.

Variance Decomposition Analysis

Variance decomposition analysis shows the amount of information that each variable contributes to the other variables in a vector autoregression (VAR) models. In order to determine how much of the forecast error variance of RGDP variable can be explained by exogenous shocks to the other variables, this section examines the variance decomposition analysis. The results are presented in table 9. The column gives the percentage of variance in RGDP that are associated with specified variables, with each row adding up to 100.

Table 9: Variance Decomposition of RGDP

Period	S.E	AGR	DEF	EDU	HEL	RGDP	TRC
1	1537.341	0.1563	0.0016	2.1950	16.4881	81.1588	0.0000
2	3713.529	3.5896	12.6560	47.3967	4.5118	19.1569	12.6886
3	4364.854	9.5333	16.6488	34.4616	9.5821	20.5089	9.2650
4	5360.033	7.1626	15.0850	27.0075	7.5911	30.9525	12.2010
5	5939.919	6.6460	19.4014	22.5003	7.4162	26.5046	17.5312
6	6752.511	10.6533	17.0098	20.3082	8.9647	25.2724	17.7913
7	7571.898	8.5168	16.6073	19.3911	18.6649	20.2817	16.5380
8	8022.362	12.2760	16.9757	18.0444	16.7208	19.5992	16.3836
9	9549.654	9.9475	15.8392	12.8918	12.5108	28.6090	20.2015
10	9960.946	11.3925	16.5541	11.9704	13.7798	27.1390	19.1639

Source: Author's calculations using E-views software

According to the above empirical results, within three years about 35 percentage of the variation in RGDP is due to variations in education expenditure (EDU). Further 21 percentage of the variation in RGDP is due to its own innovations, while defense expenditure, agriculture, transport and communication and health

expenditure were accounted 16.65, 9.5, 9.3 and 9.6 percent respectively. It is also noted from the above findings, from third year, the contribution from the transport and communication expenditure shows a continuously increasing trend. Therefore, the variation in RGDP is mainly explained by the variations in education expenditure (EDU) and its own innovations.

Evidence from Granger Causality Tests

The next analysis is to test for causality between public expenditure and economic growth in the long run. Table 10 reports the results of the causality tests between the selected components of of public expenditure and economic growth in Sri Lanka.

Table 10: Granger Causality Tests Results

Null Hypothesis	Lag	Obs	F-Stat	Prob
EG does not Granger Cause DEF	2	31	0.759	0.4781
DEF does not Granger Cause EG	2	31	5.472**	0.0103
EDU does not Granger Cause DEF	2	31	1.426	0.5275
DEF does not Granger Cause EDU	2	31	1.602	0.2205
HEL does not Granger Cause DEF	2	31	1.991	0.1567
DEF does not Granger Cause HEL	2	31	0.978	0.3892
TRC does not Granger Cause DEF	2	31	0.241	0.7870
EDU does not Granger Cause EG	2	31	2.672**	0.0403
EG does not Granger Cause EDU	2	31	1.187	0.3210
HEL does not Granger Cause EG	2	31	2.831***	0.0529
EG does not Granger Cause HEL	2	31	2.651**	0.0364
TRC does not Granger Cause EG	2	31	3.542**	0.0436
EG does not Granger Cause TRC	2	31	3.285***	0.0935
HEL does not Granger Cause EDU	2	31	2.122***	0.0851
EDU does not Granger Cause HEL	2	31	0.594	0.5589
TRC does not Granger Cause EDU	2	31	0.995	0.3833
EDU does not Granger Cause TRC	2 31	0.389	0.6814	
TRC does not Granger Cause HEL	2	31	0.642	0.5343
HEL does not Granger Cause TRC	2	31	0.696	0.5078
AGR does not Granger Cause EG	2	31	3.845**	0.0313
EG does not Granger Cause AGR	2	31	1.317	0.7313

Source: Author's calculations using E-views software
Note: *, **, **denotes rejection of the hypothesis at the 0.01 , 0.05 and 0.10 level

According to the above results, a change in the share of public expenditure has a statistically significant impact on changes in the growth rate of real GDP. Changes in the output growth rate, on the other hand, seem to be a factor explaining part of the movements in the share of public expenditure. The above causality test reveals the existence of unidirectional causality between public expenditure and economic growth. Particularly, the causality is running from defense expenditure to economic growth, education expenditure to economic growth, agriculture expenditure to economic growth. Further, the causality test also indicates the bidirectional causality between transport and communication expenditure and economic growth, health expenditure and economic growth. Therefore, the empirical results indicates the effect of public expenditure on economic growth is varying among different components of public expenditure in Sri Lanka.

Conclusion

This study examined the causality between public expenditure and economic growth in Sri Lanka over the period 1977 to 2009. To assess the responds of economic growth in increasing public expenditure, this study considered five components of public expenditure namely education, agriculture, defense, health, transport and communication. Empirical evidence in the paper shows that various types of public expenditure have differential impacts on economic growth, implying greater potential to improve efficiency of public spending by reallocation among sectors. Particularly, the results show, while the public expenditure on education, agriculture, and transport and communication has a positive significant impact on growth, the defense expenditure has a negative and significant impact on economic growth. Therefore, in order to improve the productivity and enhance the economic growth the government should increase its expenditure on education, health and transport and communication and also it should create supportive legal, institutional, infrastructure and stable macroeconomic environment that would facilitate the economic growth. Therefore, the findings provide an important implication to policy makers to improve the efficiency of public expenditure by reallocating among sectors in a growth context.

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