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The Causal Relationship between Government Revenue and Expenditure in Sri Lanka

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Abstract

The fiscal policy is an important component of the macroeconomic stability in any country. Economies have to struggle with many economic challenges, when there are huge budget deficits over the period of time. Therefore, it is very much important to reduce the budget deficit while increasing revenue and reducing expenditure. In order to accomplish that purpose, identifying the interrelationships and interdependencies between revenue and expenditure is necessary. The main purpose of the study is to examine the causal relationship between government revenue and government expenditure in Sri Lanka over the period from 1980-2021 using Granger Causality test and Vector Error Correction (VEC) model. The empirical results show that there was no causal relationship between government revenue and expenditure, in other words, no unidirectional or bidirectional relationship between these two variables. Since this finding is contradictory with the previous findings further analysis has been suggested.

Keywords: Government Revenue, Government Expenditure, Vector Error Correction Model, Granger Causality Test

1. Introduction

The success of fiscal policy largely depends on the distribution of government expenditure and the amount of revenue collected. By comprehending the connection between government spending and revenue, it is possible to avoid persistent budget deficits. This relationship has been a widely researched subject in the field of public finance and is particularly crucial for countries in Asia, such as Sri Lanka, which have struggled with ongoing budget deficits for several decades. In fact, Sri Lanka has had budget surpluses in 1954 and 1955, but has otherwise faced persistent budget deficits for over seven decades (Ravinthirakumaran, 2011).

Considering the situation in Sri Lanka, as mentioned above it has been experiencing a budget deficit for more than seven decades and the deficit has widened over the period of time. Figure 1 shows the behavior of government revenue and expenditure in Sri Lanka from 1990-2021. It clearly shows that both government revenue and expenditure have increased and negative the gap between revenue and expenditure has widened over the period of time. Figure 2 represents the budget deficit in Sri Lanka from 1990-2021 which shows a drastic increment from 1990 to 2021.

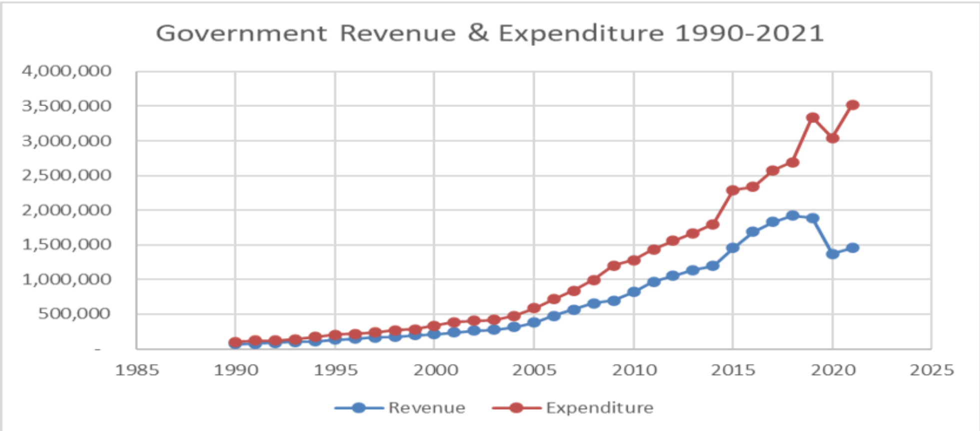

Figure 1: Government Revenue and Expenditure in Sri Lanka, 1990-2021

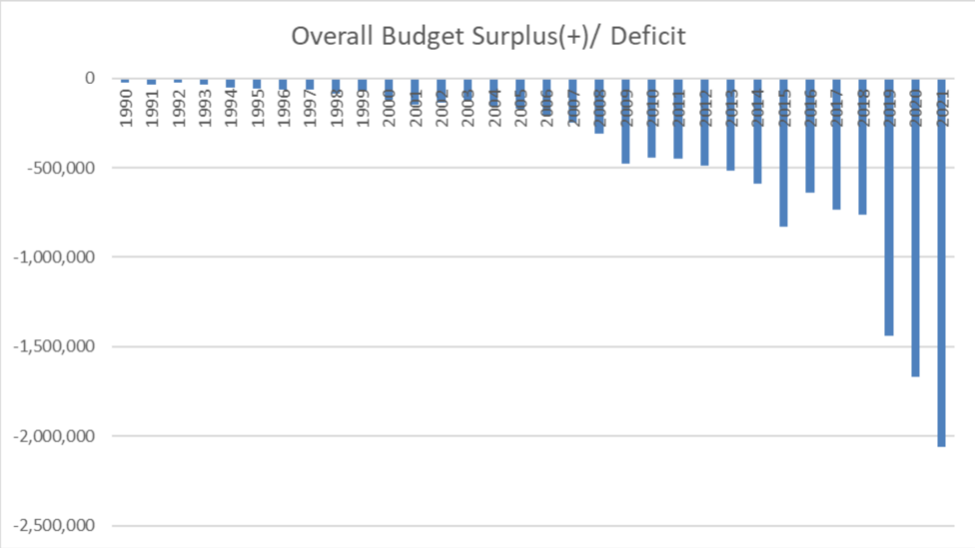

Figure 2: Overall Budget Surplus/ Deficit in Sri Lanka,1990-2021
(Source: Central Bank Data Library)

Not only in Sri Lanka budget deficit is one of the biggest economic challenges in many countries specifically in developing countries. As Arjomand et al. (2016) explains in the reviewed literature of their study these budget deficits lead to expanding activities of the government and increasing government expenditure which is a major part of the aggregate demand. On the contrary, in the side of revenue, the government does not have sufficient funds to recover these huge expenses. With that, it creates a persistent budget deficit. Even though the government spending increases, the supply may not response to these increments because of the structural issues and the supply unattractiveness. These consequences may lead to create inflationary situation in the economy. If the government finances this deficit by using the banking channel, it may cause to increase inflation further. In addition to that, with the increment of the aggregate demand which occurs due to increasing government purchases, it may also move to the external sector of the economy by having increasing imports and decreasing exports, which ultimately creates a deficit in the current account as well (Arjomand et al., 2016). Tanzi (1985) investigates the relationship between budget deficit and interest rate using empirical data from the United States, and as per his study findings there is a positive relationship between the budget deficit and interest rate; higher the budget deficit higher the interest rate. Higher interest rates may result in lower investments which negatively affects on the economic growth of the country.

In a summary as Eisner (1989) explains Budget deficits can lead to high inflation, increase interest rates, result in trade deficits, reduce investment, and represent an irresponsible burden on the future.

As a matter of fact, the budget deficit is harmful to any economy. Therefore, reducing the deficit is important. To accomplish this purpose, either the government should reduce the government expenditure or increase the government revenue, which requires to identify the interrelationships and interdependencies between government revenue and government expenditure. The causal relationship between government revenue and government expenditure has been empirically studied for different countries, and the same study has been conducted for Sri Lanka by Ravinthirakumaran (2011) using data from 1971 to 2009. It suggests a bi-directional relationship between government revenue and expenditure. This study is directed to confirm the result of the previous empirical study by expanding the dataset from 1980 to 2021 while introducing a new variable "Gross Domestic Product (GDP)" to capture other shocks. In addition to finding the causal relationship between government revenue and expenditure, this study aims to find the long-run relationship between those two variables and to establish an impulse response function to explain dynamic effects of the model among selected variables based on VECM approach.

2. Literature Review

Based on the previous literature three developed hypotheses can be extracted, namely, tax and spend hypothesis, spend and tax hypothesis and fiscal synchronization. The tax and spend hypothesis represent a unidirectional causal relationship which runs from government revenue to expenditure, which means an increase in tax revenue will lead to increase government expenditure (Buchanan & Wagner, 1977; Friedman, 1978). The spend and tax hypothesis show a unidirectional relationship which runs from government expenditure to government revenue (Baghestani & Mcnown, 1994; Barro, 1974; Peacock & Wiseman, 1979). The hypothesis implies that during a crisis, government spending and taxation become more entrenched, or firmly established. The reason for this is that the temporary rise in government spending that occurs during a crisis transforms into a long-lasting aspect of the government's budget. The crisis creates a requirement for extra public services and creates a view among the public that the government is more important for their well-being. This view then leads to a permanent increase in taxation to support the increased government spending. The hypothesis suggests that crisis events can act as a trigger for lasting changes in government financial policies and that the initial impact of the crisis can result in a larger and more established government. Fiscal synchronization is the third hypothesis which implies a bidirectional relationship between government revenue and government expenditure, further it explains that both revenue and expenditure decisions are jointly and simultaneously determined (Meltzer & Richard, 1981; Musgrave, 1966).

In the finance literature, there is a wide range of studies which have been conducted to comprehend the causal relationship between government revenue and expenditure. Sanjeev (2004) has conducted a study to examine the causal relationship between government revenue and government expenditure in Mauritius and as per their findings there is a unidirectional causal relationship which runs from revenue to expenditure in Mauritius. As Anderson et al. (1986) stated in their study that there was no indication that an increase in federal taxes would result in either an increase or a decrease in future federal spending, there was a compelling evidence that increased spending would result in higher tax rates in the future, which states there is a unidirectional relationship between government revenue and expenditure which runs from expenditure to revenue in United States of America (USA). Al- Zeaud (2015) has studied the same subject by using data from Jordan and the study has been concluded with the approval of fiscal synchronization, in other words bidirectional relationship between government revenue and expenditure in the case of Jordan. As per the findings of the study which has been done by Elyasi & Rahimi (2012), there is a bidirectional relationship between public revenue and tax in Iran in both short-run and long-run. Ndahiriwe & Gupta (2007) has investigated the causal relationship between government revenue and expenditure in South Africa by using both annual and quarterly data from 1960-2006 and they have incorporated two control variables; Gross Domestic Product (GDP) and public debt. As per their findings of quarterly data analysis, there is a bidirectional relationship between government revenue and tax, but for annual data it has not suggested any type of Granger Causality. The collection of studies has been carried out for different countries to enquire the relationship between government expenditure and government revenue, and those studies have proven that one of the above-mentioned hypotheses can be applied to the scenario of the respective country (Al-Quadair, 2005; Aslan & Taşdemir, 2009; Manage & Marlow, 1986; von Furstenberg et al., 1986).

Considering the Sri Lankan situation, Ravinthirakumaran (2011) has studied the causal relationship between government revenue and government expenditure by using data from 1971-2009. As per the findings, there is a bidirectional relationship between revenue and tax. This study aims to test the same subject by expanding the dataset from 1980-2021, while introducing a new variable; GDP. As a value addition to the previous article, this study establishes the impulse response function and variance decomposition to identify the dynamic effects of these three variables.

3. Methodology

As mentioned earlier, the main objective of this study is to find out the causal relationship between government revenue and government expenditure. Subsequently, this study is directed to identify the long-run impacts of these variables and to establish impulse response function to identify the short-run dynamics of these variables.

The selection of variables has been done by using previous literature articles. Referring to the existing literature, Sanjeev (2004) has used national income as a control variable which captures external shocks. Ndahiriwe & Gupta (2007) has investigated the causal relationship between government revenue and expenditure in South Africa by using annual and quarterly data from 1960-2006 and they have incorporated GDP as a control variable. Other than the main variables (government revenue and expenditure) this study uses GDP as a control variable. Government revenue excluding grants and total government expenditure in Sri Lanka have been taken for the analysis from the Central Bank Data Library. GDP values for Sri Lanka have been obtained from the World Bank Data Library. The study uses timeseries data covering the period from 1980 to 2021. Log values of all the variables have been taken to make the analysis simple while removing large numbers from the dataset.

The analysis commences with the unit root test by using both Augmented Dickey Fuller (ADF) and Phillips-Perron test. If the data set is stationary, Vector Autoregressive (VAR) model is applied, and if it is non-stationary with cointegration relationships Vector Error Correction (VEC) model is used for the analysis. Subsequently, the Granger Causality Test is used to test the causal relationship and impulse response function and variance decomposition to identify the dynamic effects of these three variables.

4. Data Analysis

4.1.Stationarity Test

The commonly used unit root tests: ADF and PP test to check the stationarity of *lge (log of government expenditure), lgr (log of government revenue)* and *lgdp (log of GDP)*. As per the test results in Table 1, *lge, lgr* and *lgdp* variables are not stationary at levels. As per the test results in Table 2, *lge* and *lgr* variables are stationary at the first difference based on results obtained from both ADF and PP tests. The *lgdp* variable is stationary at the first difference based on PP test, and based on ADF it is stationary at the second difference.

Table 1: Unit root test results at levels

Variable	ADF Level	PP Level
lge	-1.889197(0.3341)	-2.098870(0.2461)
lgr	-2.4114862(0.1439)	-2.202108(0.2086)
lgdp	-2.423128(0.1419)	-1.962132(0.3018)

Table 2: Unit root test results at first difference/ second difference

Variable	ADF Level	PP Level
lge	-4.745570(0.0004) *I(1)*	-7.309864(0.0000) *I(1)*
lgr	-4.563682(0.0007) *I(1)*	-4.563682(0.0007) *I(1)*
lgdp	-11.88422(0.0000) *I(2)*	-5.050635(0.0002) *I(1)*

4.2 Estimation of VAR Model

The first issue of the VAR model is to determine the number of optimum lag intervals. There are several methods to determine the optimum level of lags. This study uses the Maximum Lag Length Criteria and AR Roots Graph to determine the optimum lag length.

Table 3: Maximum Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	13.54059	NA	0.000114	-0.569761	-0.439146	-0.523714
1	155.2643	252.8045	8.72+08	-7.744019	-7.221559*	-7.559827*
2	160.3806	8.296588	1.09+07	-7.534085	-6.619780	-7.211750
3	169.5851	13.43361	1.11e-07	-7.545140	-6.238990	-7.084661
4	179.2383	12.52303	1.13+07	-7.580446	-5.882452	-6.981824
5	195.8282	18.83180*	8.16+08*	-7.990712*	-5.900873	-7.253946

According to Table 3, based on Akaike Information Criteria (AIC), Final Prediction Error (FRE) and sequential modified LR test statistic, it can be found that the optimal lag order for VAR model is 05. After determining the optimum lag structure, the VAR model is reestablished with 05 lags, and AR root graph has been obtained. As Figure 3 shows that mode of reciprocal of each characteristic root is inside the circle, which indicates that 05 is the optimum lag length.

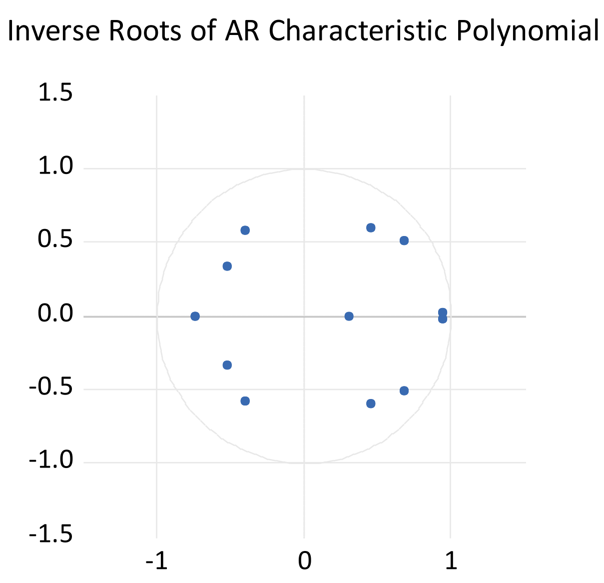

Figure 3: AR root graph

4.3 Cointegration Test

Since the dataset is non-stationary at levels, the Johansen cointegration test is applied to examine the existence of the cointegration relationships. As Table 4 and Table 5 present both Trace and Maximum Eigen value tests reject the null hypothesis which states that there is no cointegration relationship among *lge*, *lgr* and *lgdp* variables at 5% significance level. This indicates that there are stable and long run equilibrium relationships among these three variables. With the existence of cointegration relationships, VEC model can be developed further with respect to this study.

Table 4: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.674254	47.93937	29.79707	0.0002
At most 1	0.134397	6.438776	15.49471	0.6436
At most 2	0.029255	1.098592	3.841465	0.2946

Table 5: Unrestricted Cointegration Rank Test (Maximum Eigen Value)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.674254	41.50060	21.13162	0.0000
At most 1	0.134397	5.340184	14.26460	0.6984
At most 2	0.029255	1.098592	3.841465	0.2946

4.4 Estimation of VECM

Since the lag order VAR model is 05 the optimum number of lags for VEC model should be 04. Table 6 shows the estimates of the VEC model and based on the cointegration equation long- run relationship of these variables can be determined (Equation 1).

Equation 1

$$lge_{t-1} = 0.702160 lgr_{t-1} - 1.43425 lgdp_{t-1} - 1.192470$$

Equation 1, it can be seen that, when other things remain constant, each percentage point increase in government expenditure will cause to increase of 0.702160 percentage points in government revenue, and each percentage point increase in government expenditure will cause to decrease of 1.434253 percentage points in gross domestic product.

Based on the estimated results of VEC model, Equation 2, Equation 3 and Equation 4 have been estimated in order to calculate the speed of adjustment $(1 - \theta)$ of each variable. Respective estimations are given in Table 7.

Table 6: Vector Error Correction Estimates

Cointegration Equation

Variable	ADF Level
LGE(-1)	1.000000
LGR(-1)	0.702160 (0.17449)
LGDP(-1)	-1.434253 (0.14911)
C	-1.192470

Error Correction:	D(LGE)	D(LGR)	D(LGDP)
CointEq1	-0.808358	-0.875078	0.285915
	(0.32036)	(0.40907)	(0.24988)
D(LGE(-1))	0.434922	0.881251	-0.164457
	(0.36561)	(0.46684)	(0.28517)
D(LGE(-2))	0.482734	0.895962	0.168688
	(0.32830)	(0.41920)	(0.25607)
D(LGE(-3))	0.143682	0.327006	0.097091
	(0.34668)	(0.44267)	(0.27041)
D(LGE(-4))	-0.008397	0.435781	0.005959
	(0.25957)	(0.33145)	(0.20247)

D(LGR(-1))	0.139145	0.226097	-0.042580
	(0.19947)	(0.25470)	(0.15558)
D(LGR(-2))	0.166374	-0.349303	-0.355449
	(0.22971)	(0.29331)	(0.17917)
D(LGR(-3))	0.054154	0.005553	-0.274180
	(0.22897)	(0.29237)	(0.17859)
D(LGR(-4))	0.615881	-0.015292	-0.165961
	(0.23746)	(0.30321)	(0.18522)
D(LGDP(-1))	0.029784	-0.025166	0.168583
	(0.38522)	(0.49189)	(0.30047)
D(LGDP(-2))	-0.035165	0.038309	0.677635
	(0.30694)	(0.39193)	(0.23941)
D(LGDP(-3))	-0.696608	-0.446832	0.380095
	(0.38293)	(0.48896)	(0.29868)
D(LGDP(-4))	-0.747387	-0.624355	0.070917
	(0.40305)	(0.51466)	(0.31438)
C	0.072203	-0.029640	0.041837
	(0.06105)	(0.07795)	(0.04762)

Equation 2

D(LGE) = C(1)(LGE(-1) + 0.70215976621*LGR(-1) - 1.43425258409*LGDP(-1) - 1.19246999593) + C(2)*D(LGE(-1)) + C(3)*D(LGE(-2)) + C(4)*D(LGE(-3)) + C(5)*D(LGE(-4)) + C(6)*D(LGR(-1)) + C(7)*D(LGR(-2)) + C(8)*D(LGR(-3)) + C(9)*D(LGR(-4)) + C(10)*D(LGDP(-1)) + C(11)*D(LGDP(-2)) + C(12)*D(LGDP(-3)) + C(13)*D(LGDP(-4)) + C(14)*

Equation 3

D(LGR) = C(15)(LGE(-1) + 0.70215976621*LGR(-1) - 1.43425258409*LGDP(-1) - 1.19246999593) + C(16)*D(LGE(-1)) + C(17)*D(LGE(-2)) + C(18)*D(LGE(-3)) + C(19)*D(LGE(-4)) + C(20)*D(LGR(-1)) + C(21)*D(LGR(-2)) + C(22)*D(LGR(-3)) + C(23)*D(LGR(-4)) + C(24)*D(LGDP(-1)) + C(25)*D(LGDP(-2)) + C(26)*D(LGDP(-3)) + C(27)*D(LGDP(-4)) + C(28)*

Equation 4

D(LGDP) = C(29)(LGE(-1) + 0.70215976621*LGR(-1) - 1.43425258409*LGDP(-1) - 1.19246999593) + C(30)*D(LGE(-1)) + C(31)*D(LGE(-2)) + C(32)*D(LGE(-3)) + C(33)*D(LGE(-4)) + C(34)*D(LGR(-1)) + C(35)*D(LGR(-2)) + C(36)*D(LGR(-3)) + C(37)*D(LGR(-4)) + C(38)*D(LGDP(-1)) + C(39)*D(LGDP(-2)) + C(40)*D(LGDP(-3)) + C(41)*D(LGDP(-4)) + C(42)*

Table 7: Speed of Adjustment

Coefficient	Speed of Adjustment (Estimation)
C(1)	-0.808358 (0.0190)
C(15)	-0.875078 (0.0433)
C(29)	0.285915 (0.2643)

4.5 Granger Causality

The test for cointegration indicates that there is a stable long-term relationship between the two variables. However, to determine if there is a causal relationship between them, additional testing is required. If variable A is useful for forecasting variable B, meaning that past values of A are included in the regression of B along with past values of B, this can significantly improve the explanatory power of the regression. If A is a factor that precedes changes in B, it is considered a Granger cause of B; otherwise, it is considered a non-Granger cause. The p- value obtained is less than the predetermined significance level of 5%, which indicates that the null hypothesis of the existence of a Granger cause should be accepted. Based on this study, any of the variable does not Granger cause with other variables at 5% significance level. Considering government revenue and government expenditure in Sri Lanka, they do not show any unidirectional or bidirectional relationship for annual data taken from 1980 to 2021.

Table 8: Granger Causality Test Results

Null Hypothesis:	Obs	Prob.	Null Hypothesis
LGR does not Granger Cause LGE	42	0.4239	Do not reject
LGE does not Granger Cause LGR		0.4676	Do not reject
LGDP does not Granger Cause LGE	38	0.0727	Do not reject
LGE does not Granger Cause LGDP		0.2751	Do not reject
LGDP does not Granger Cause LGR	38	0.0618	Do not reject
LGR does not Granger Cause LGDP		0.2813	Do not reject

4.6 Impulse Response Function

To better understand how the model reacts to specific shocks and how those reactions affect the three variables, additional examination is conducted using VECM-based impulse response functions and variance decomposition. The outcomes of this analysis are obtained for a period of ten.

Response of lge to lge: When there is a shock in lge, lge will gradually decrease up to the fourth time period, then it will start to increase. It will reach to its maximum in the ninth time period.

Response of lge to lgr: When there is a shock of lge, lgr will not show any changes in the first period and will show a drastic increase in the second period, then it will show a slow increment in the third period. It will reach to its lowest (zero) in the fourth period and then again will start to increase.

Response of lgr to lge: When there is shock of lge, lgr will slowly increase and it will reach to its maximum in the ninth period and then will start to decline.

Response of lgr to lgr: When there is a shock of lgr, lgr will show an increment up to the second time period and will start to decrease sharply till the fifth time period and then againg start to increase.

Response of lgdp to lge: When there is shock of lgdp, lge will show slow increment up to the sixth time period, and then it will become much stable up to the eighth time period and the show very little decline.

Response of lgdp to lgr: When there is shock of lgdp, lgr will increase up to the third time period, and decline up to the fifth time period, that value will remain the same in the sixth time period. After the sixth time period it will start to increase and reach its maximum in the eighth time period and will decline later

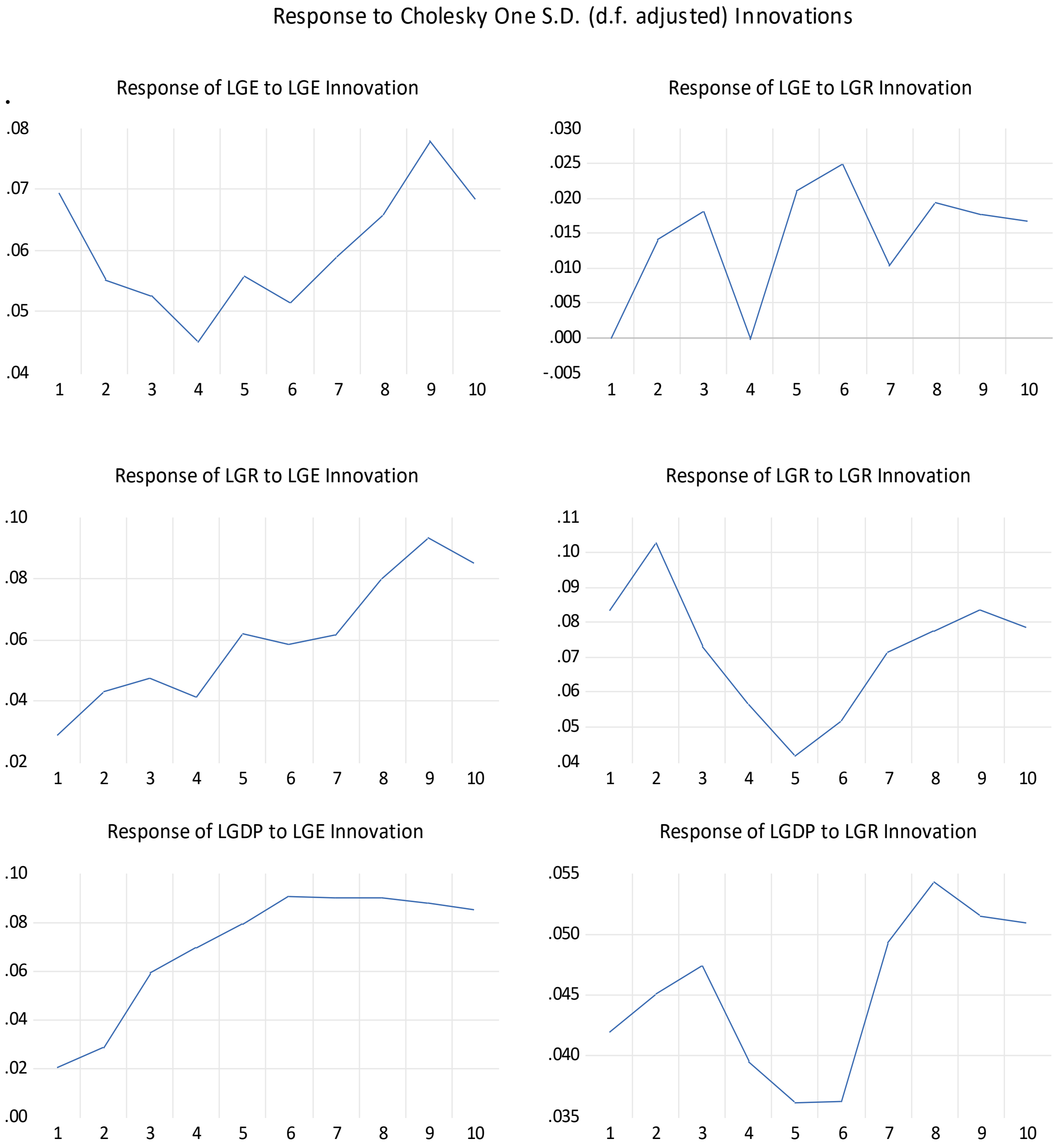

Figure 4: Impulse Response Functions

4.5 Variance Decomposition

The impulse response function is utilized to depict how a system's shock impacts an internal variable, while variance decomposition is the process of breaking down the mean square error into the individual contributions of each variable. Variance decomposition can be employed to examine how the update of each variable affects the others, revealing their relative effects.

According to Figure 5, contribution of *lge* in *lge* predicted variance declines from the first period, reaches around 76% in the seventh period and becomes stable. *lgr* and *lgdp* contributions respectively rise to 5.5% and 17.5% by the end of the 10^{th} period. In *lgr* predicted variance, contribution of *lgr* decline from the first period, reaches around 53.7% in the seventh period and becomes stable. *lge* and *lgdp* contributions respectively rise to 35.7% and 15.4% by the end of the 10^{th} period.

In summary, considering the situation in Sri Lanka there is a long run relationship among selected variables (government revenue, expenditure, and GDP), but any of variable does not show any causal relationship.

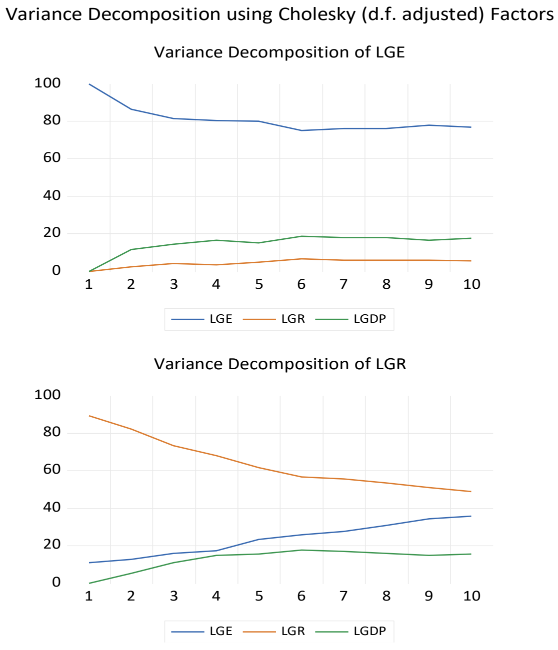

Figure 5: Variance Decomposition

5. Conclusion

In conclusion, this article established an econometric model to investigate the causal relationship between government revenue and government expenditure in Sri Lanka, using annual data from 1980 to 2021. Building upon the data analysis method employed by Ndahiriwe & Gupta (2007), this study introduced the variable GDP in addition to government revenue and government expenditure. The analysis employed a VEC model and Granger Causality test.

Contrary to the findings of a previous study conducted by Ravinthirakumaran (2011) for Sri Lanka, which suggested a bidirectional relationship between government revenue and expenditure based on data from 1971 to 2009, the results of this analysis indicate that there is no Granger Causality between Sri Lankan government expenditure, revenue, and GDP. Thus, it can be inferred that the growth of government expenditure does not necessarily promote government revenue, and the growth of government revenue does not lead to increased government expenditure.

Based on these research findings, two further avenues for investigation can be recommended. Firstly, conducting separate analyses for two distinct time periods, specifically from 1980 to 2000 and from 2001 to 2021, would enable a comparison and provide insights into any potential changes in the causal relationship between government revenue and expenditure in Sri Lanka over time. Secondly, considering the study by Ndahiriwe & Gupta (2007), which utilized both annual and quarterly data to examine the causal relationship, it is recommended that future research should incorporate quarterly data to better understand the dynamics of the relationship between government revenue and expenditure in Sri Lanka.

By expanding the scope of analysis and incorporating different time periods and data frequencies, further research can contribute to a more comprehensive understanding of the causal relationship between government revenue and expenditure in the context of Sri Lanka, providing valuable insights for policymakers and researchers alike.

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