Analyzing Economic Growth of Sri Lanka Using Geometric Distributed Lag Approach

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A B S T R A C T

The purpose of this research study is to examine the contributions of macro-economic various variables on economic growth of Sri Lanka, using the geometric distributed lag model. The analysis was carried out for the annual data from 1980 to 2018 of variables: Gross Domestic Product (GDP), Consumption, Consumer Price Index (CPI), Investment, Expenditures, Trade balance and Foreign Direct Investment (FDI).Stationary properties were checked by ADFunit root test and the Granger causality test were performed to assess the causal relationship between variables.The test results revealed that, consumption, expenditure, consumer price index and investment have positively and significantly impact on economic growth of Sri Lanka. Whereas foreign direct investment has negatively and significantly impact on the economic growth of Sri Lanka. The causality results confirmed that the existence of unidirectional causality from economic growth to expenditure, CPI, FDI, investment and trade balance. However, the existence of bidirectional causality between economic growth and consumption.

Keywords: GDP, Economic Growth, Geometric Distributed Lag Model, Koyck Mode

1. Introduction

Sri Lanka is a lower-middle income developing country. In the past Sri Lanka's economy was affected by natural disasters, insurrections and the civil war.The government during from1970 to 1977 period applied pro-left economic policies and practices. Between 1977 and 1994 the country came under United National Party (UNP) rule in which under President J.R Jayawardana Sri Lanka began to shift away from a socialist orientation in 1977. Since then, the government has been deregulating, privatising and opening the economy to international competition, between 1994 and 2004 under Sri Lanka Freedom Party (SLFP) rule. In 2001, Sri Lanka faced bankruptcy, with debt reaching 101% of Gross Domestic Product (GDP). The impending currency crisis was averted after the country reached a hasty ceasefire agreement with the Liberation Tigers of Tamil Eelam (LTTE) and brokered substantial foreign loans. After 2004 the United People's Freedom Alliance (UPFA) government has concentrated on mass production of goods for domestic consumption such as rice, grain and other agricultural products. However, twenty-five years of civil war slowed economic growth, diversification and liberalisation and the political group Janatha Vimukthi Peramuna (JVP) uprisings, especially the second in the early 1980s, also caused extensive upheavals.

Following the quelling of the JVP insurrection, increased privatisation, economic reform and a stress on export-oriented growth helped improve the economic performance, increasing GDP growth to 7% in 1993. Economic growth has been uneven in the ensuing years as the economy faced a multitude of global and domestic economic and political challenges. Overall, average annual GDP growth was 5.2% over 1991-2000.

In 2001, however, GDP growth was negative 1.4% the first contraction since independence. The economy was hit by a series of global and domestic economic problems and affected by terrorist attacks in Sri Lanka and the United States. The crises also exposed the fundamental policy failures and structural imbalances in the economy and the need for reforms. The year ended in parliamentary elections in December, which saw the election of United National Party to Parliament, while Sri Lanka Freedom Party retained the Presidency.

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During the short-lived peace process from 2002 to 2004, the economy benefited from lower interest rates, a recovery in domestic demand, increa sed tourist arrivals, a revival of the stock exchange and increased foreign direct investment (FDI). In 2002, the economy experienced a gradual recovery. During this period Sri Lanka has been able to reduce defence expenditures and begin to focus on getting its large, public sector debt under control. In 2002, economic growth reached 4%, aided by strong sector growth. The agricultural sector of the economy staged a partial recovery. Total FDI inflows during 2002 were about $246 million.The Mahinda Rajapakse government halted the privatisation process and launched several new companies as well as re-nationalizing previous state-owned co-operations. As a result, many state-owned corporations became overstaffed and less efficient making huge losses. During this time European Union (EU) revoked (Generalized System of Preferences (GSP)) GSP plus preferential tariffs from Sri Lanka due to alleged human rights violations, which cost about USD 500 million a year at the time.

The resumption of the civil war in 2005 led to a steep increase defence expenditures. The increased violence and lawlessness also prompted some donor countries to cut back on aid to the country. A sharp rise in world petroleum prices combined with economic fallout from the civil war led to inflation that peaked 20%. However, as the civil war ended in May 2009 the economy started to grow at a higher rate of 8.0% in the year 2010 and reached 9.1% in 2012 mostly due to the boom in non-tradable sectors. However, the boom didn't last and the GDP growth for 2013 fell to 3.4% and only slightly recovered to 5% in 2014. From 2015 to 2018 the GDP growth was 5%, 4.5%, 3.1% and 3.2% Respectively.

The factors affect economic growth is one of the most important issue in that economists study since several years. Therefore, the main purpose of the paper is to establish the empirical link between some determinants of economic growth of Sri Lanka, using geometric distributed lag model. Also highlight the impacts of various factors to the economic growth. This paper iscomposed of five sections. Section two illustrates literature review, section three explains research methodology, section four reveals results and discussion and the last section conclusion is given.

2. Literature Review

Many researchers have carried out on the topic of economic growth using distributed lag structure and the impact of various factors to the economic growth.Lukman et. al., (2015) conducted a study to examine the relationship between government expenditure and economic growth in Nigeria using annual data from 1970 to 2011 collected from the Statistical Bulletin of the Central Bank of Nigeria. The autoregressive distributed lag cointegration (ARDL) bound test approach was used to analyze the data for this study. ARDL bound test was revealed that the variables are cointegrated. The long run estimates revealed that recurrent and capital expenditure have a positively significant effect on GDP. The error correction mechanism has a negative sign and is significant.

Athukorala (2003) conducted the study on the topic of “The Impact of Foreign Direct Investment for Economic Growth: A Case Study in Sri Lanka” to examine the relationship between foreign direct investment (FDI) and GDP for Sri Lankan economy. The model was estimated u sing annual data for the period 1959-2002. Augmented Dickey-Fuller (ADF) unit root testreveals that the variables are non-stationary in level but stationary in first-differences. Johansen trace test was used to check the cointegration relationship and the results show that the existence of cointegration. The error correction model provides a generalization of the partial adjustment model and permits the estimation of short-run and long-run elasticities. This long-run association show the elasticities of GDP with respect to FDI, domestic investment and trade liberalization. Results of Engle-Granger method as alternative techniques of estimation to see the direction of causality suggested that the direction of causality is from GDP to FDI is significant at the 5% level and there is no reverse causation from FDI to GDP. And also, causality observed from domestic investment and trade liberalization to GDP as well as from GDP to domestic investment and trade liberalization.Srinivasan et. al., (2012) conducted the research to examine the impact of tourism on economic growth in Sri Lanka through the Autoregressive Distributed Lag (ARDL) bounds testing approach, for the period from 1969 to 2009. The results revealed that the tourism has a positive impact on economic growth in Sri Lanka both in the short-run and long-run.

Sehrawat and Giri (2015) conducted a research to examine the relationship between financial development and economic growth in India using annual data from 1982 to 2012. The autoregressive distributed lag (ARDL) approach to co-integration confirms a long-run relationship in financial development and economic growth for India.Chaudhry et. al., (2013) conducted the study to find the relationship between foreign direct investment (FDI) and economic growth and also highlighted the relationship status between the variables included in the model, either long-run or short-run in case of China. An autoregressive distributive lag (ARDL) approach to co-integration was used to analyze the data. The results provide evidence that there is an empirical relationship among FDI and economic growth.

Fouda (2010) conducted a research study to examine the effects of various economic variables on the Cameroonian economic growth using distributed lag models for the period of 1960 to 2006. The results obtained from Geometric Lag Model, found that 50% of the total effect of variables used is accomplished in less than half of a year and results of polynomial distributed lag, show that even if investment has a positive impact on growth in the current year, but in the presence of government expenditures, this effect becomes negative after one year due probably to the eviction effect. Furthermore, found that the consumption causes economic growth after three years whereas economic growth causes the consumption after only one year.

Shahbaz et. al., (2008) investigated the relationship between stock market development and economic growth in case of developing economy such as Pakistan using annual times series data from 1971 to 2006. To find integrating order of the variables, DF-GLS and Ng-Perron tests are employed for this study. To test long-run robustness, co-integration method proposed by Johansen and Juselious and ARDL bounds testing techniques are applied. To investigate long-run causal linkages and short-run dynamics, Engle-Granger causality and ARDL tests are applied respectively. Findings suggested that there exist a very strong relationship between stock market development and economic growth. Engle Granger-Causality estimation confirms in the long-run, there is bi-directional causality between stock market development and economic growth and for short-run, there exists only one-way causality.

3. Research Methodology

3.1 *Geometric Distributed Lag Models (GDLM)*

In regression analysis involving time series data, if the regression model includes not only the current but also the lag (past) values of the explanatory variables, it is called a distributed lag model. If the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an autoregressive model.

The GDLM was first introduced by Koyck (1954). This model is an infinite distributed lag model. The general form of the infinite distributed lag models is:

$$y_t = \alpha + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \cdots + e_t \quad (1)$$

where e_t is an uncorrelated error variable with mean $E(e_t) = 0$, $Var(e_t) = \sigma^2$ and $Cov(e_t e_k) = 0$. Koyck(1954) assumed that all theβ's have the same sign and decline geometrically as follows.

$$\beta_k = \beta_0 \lambda^k; \qquad |\lambda| < 1 \text{ and } k = 0, 1, \ldots \quad (2)$$

where λ is the rate of decay while 1- λ represents the speed of adjustment. This model supposes that the most recent past weights are more heavily than the most distant past. By substituting equation (2) into equation (1);

$$y_t = \alpha + \beta_0 x_t + \beta_0 \lambda^1 x_{t-1} + \beta_0 \lambda^2 x_{t-2} + \cdots + e_t. \quad (3)$$

This model has three parameters, α-intercept, β_0-a scale factor and λ-controls the rate at which the weight's explanatory variables declines. Koyck multiplies the one period lag of equation (3) by λ and subtracts that result from the same equation (3) as follows:

$$y_t - \lambda y_{t-1} = \begin{bmatrix} \alpha + \beta_0 x_t + \beta_0 \lambda^1 x_{t-1} + \beta_0 \lambda^2 x_{t-2} + \cdots + e_t \\ -\lambda(\alpha + \beta_0 x_{t-1} + \beta_0 \lambda^1 x_{t-2} + \beta_0 \lambda^2 x_{t-3} + \cdots + e_{t-1}) \end{bmatrix} \quad (4)$$

After rearranging, it can be obtained

$$y_t - \lambda y_{t-1} = \alpha(1-\lambda) + \beta_0 x_t + (e_t - \lambda e_{t-1}) \quad (5)$$

Koyck form of the geometric lag to solve y_t is:

$$y_t = \alpha(1-\lambda) + \beta_0 x_t + \lambda y_{t-1} + u_t \quad \text{,where } u_t = (e_t - \lambda e_{t-1}) \quad (6)$$

The long-run multiplier or long-run elasticity is$\beta_0(1 + \lambda + \lambda^2 + \cdots) = \frac{\beta_0}{1-\lambda} = \sum_{k=0}^{\infty} \beta_k$

The median lag is the time required for the first half or 50 percent, total change in y follows a unit sustained change in x. For the Koyck model the median lag is as follows:

$$\text{Median lag} = -\frac{ln\ 2}{\ln \lambda} \quad (7)$$

3.2 *Empirical Strategy*

The purpose of the is study is to estimate the spread (year after year) of the economic policy's variables on economic growth. The independent variables used for this study are Consumption (Cons), Investment (Inv), Expenditures (Expe), Trade balance (Trad) and Consumer Price Index (CPI). Foreign Direct Investment (FDI) is used as moderator variable and Gross Domestic Product (GDP) is used as dependent variable. It is decided to use FDI in the model building because this variable can effect economic growth in the short run.Due to the problems of multicollinearity among the economic policy's variables Koyck (1954) suggested Polynomial distributed Lag Models (PDLM) to reduce multicollinearity issues. PDLM model of this study is given in equation (8). AlsoKoyck proposed the first difference of GDP is dependent variable.

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The empirical pattern of Koyck model is:

$$\Delta \ln(\text{gdp})_t = \begin{bmatrix} \alpha(1-\lambda) + \beta_{1,0}\, ln(\text{Cons})_t + \beta_{2,0}\, ln(\text{CPI})_t \\ +\beta_{3,0}\, ln(\text{Expe})_t + \beta_{4,0}\, ln(\text{FDI})_t + \beta_{5,0}\, ln(\text{Inv})_t \\ +\beta_{6,0}\, ln(\text{Trad})_t + \lambda\Delta(ln(\text{GDP}))_{t-1} + u_t \end{bmatrix} \quad (8)$$

where $\alpha(1-\lambda)$is the intercept, GDP is the real GDP (dollar of ten million) and u_t is the random disturbance term of classical linear regression model.

3.3 *Research Study Data Set*

The data set that used for this study is mainly quantitative and secondary and collected from Central Bank Annual Report of Sri Lanka and the Annual Report of World Bank. The collected set of data is the annual data from1980 to 2018.

3.4 *Data Analysis*

All the variables are divided by GDP except consumer price index and expressed in logarithm. Due to the presence of negative values in foreign direct investment and trade balance, both variables are transformed before using the logarithm function. Fouda (2010) used a transformation method to convert negative values into positive values. The equation that used to transform the variable is $X_t^{Tr} = X_t + | k | + 1$ with $k = \min (X_t)$ if $X_t \in [0, -\infty]$.

4. *Results and Discussion*

First difference of GDP was used as the dependent variable. Consumption, Consumer Price Index, Expenditure, Foreign Direct Investment, Investment, Trade balance and first lag of first difference of GDP are used as independent variables.

Before fitting the model, first the correlation between the variables should be checked and resolved it by using proper techniques. If ran a regression with correlated variables, it will lead to get the estimators that are biased.

Many studies have found that the economic variables are often non-stationary. In regression analysis non-stationary variables may lead to the spurious results. Szeto (2001) noted three solutions to the problem of spurious regression. The first approach is to determine the stationarity of the variables before estimating. The second approach is to add the lagged value of the dependent variable. The last method is to consider the cointegration approach.

4.1 *MulticollinearityAnalysis*

Multicollinearity among independent variables were studied by correlation analysis and variance inflation factor. Correlation matrix among independent variables is given in table1. from the correlation matrix it is confirmed that strong multicollinearity present among the independent variables.

Table 1 - Correlation matrix of regressors

	GDP	FDI	Trd.Bal	Cons	Inv	Exp	CPI
GDP	1.000						
FDI	0.939	1.000					
	(0.000)						
Trd.Bal	-0.940	-0.913	1.000				
	(0.000)	(0.000)					
Cons	0.999	0.943	-0.939	1.000			
	(0.000)	(0.000)	(0.000)				
Inv	0.989	0.923	-0.962	0.982	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)			
Exp	0.992	0.926	-0.928	0.995	0.971	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
CPI	0.984	0.936	-0.925	0.988	0.962	0.988	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Table 2 reveals variance inflation factor (VIF) of independent variables. If any of the VIF is greater than 5 is an indication of multicollinearity. From the VIF table values except ln(Trad) others are greater than 5, so it is confirmed that independent variables highly correlated. Hence to fit suitable model for this data set is distributed lag model.

Table 2 - Variance Inflation Factor Values of Independent Variables

Variables	VIF
ln(Cons)	461.55
ln(CPI)	49.96
ln(Expe)	202.62
ln(FDI)	11.44
ln(Inv)	98.10
ln(Trad)	1.22

4.2 Stationary of the Variables

In prior information and many research studies experience it was found that the economic variables are often non-stationary. Regression model involving non-stationary variables may result in spurious results. Augmented Dickey-Fuller (ADF) unit root test was employed to test the stationarity of the variables and test results are given below table 3. It was found that consumer price index and trade balance are I(0) whereas GDP, consumption, expenditure, FDI and investment are I(1).

Table 3 - ADF stationary test results

	Levels		**First Difference**	
Variables	**Intercept**	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
ln(GDP)	0.1839	-3.1838	-4.8794***	----------
ln(Cons)	0.2488	-3.1482	-5.2678***	----------
ln(CPI)	-2.9892**	----------	----------	----------
ln(Expe)	0.4127	-2.3629	-6.4823***	----------
ln(FDI)	-0.8362	-4.8463***	----------	----------
ln(Inv)	0.3109	-2.0915	-5.3612***	----------
ln(Trad)	-.3983***	----------	----------	----------

Note: ***, ** and * denotes significance at 1%, 5% and 10% level, respectively.

4.3 *Estimates based on Distributed Lag Model*

Using the distributed led model (Koyck model) it is decided to fit two regression models, in the first model (Model-1) exclude expenditure variable. In the second model (Model-2) exclude consumption variable. Due to the presence of legged dependent variable such as explanatory variables, it has performed the Durbin h-test to analyse the serial correlation of the error term. The estimators of distributed lag model-1 and model-2 are given in table 4.

Table 4 - Parameter Estimate using Koyck Model-1 and Model-2
Dependent variable = Δ(*ln*(GDP))

	Model -1			**Model-2**		
Variables	**Estimates**	**Std.Error**	**Probability**	**Estimates**	**Std.Error**	**Probability**
Intercept	0.84699	0.49455	0.0968	2.47193	0.81679	**0.0049**
$(ln(Cons))_0$	0.67497	0.05992	**0.0000**			
$(\ln(Exp))_0$				0.35070	0.08035	**0.0001**
$(ln(CPI))_0$	0.04488	0.01919	**0.0260**	0.12869	0.02926	**0.0001**
$(ln(FDI))_0$	-0.01300	0.00784	0.1073	-0.00465	0.01442	0.7495
$(ln(Inv))_0$	0.18755	0.02933	**0.0000**	0.30852	0.04558	**0.0000**
$(ln(Trad))_0$	0.00098	0.00091	0.2887	0.00022	0.00161	0.8938
$(ln(GDP(-1)))_0$	-0.87913	0.04252	**0.0000**	-0.74103	0.06994	**0.0000**
Prob.>F	0.0000			0.0000		
No. Obs	37			37		
R^2	0.9352			0.7979		
Adj.R^2	0.9235			0.7587		
Glesjer LM(P>F)	0.1824			0.3476		
Durbin h(P>Z)	0.0000			0.0000		

Model-1: F-statistics probability value of the fitted model is 0.0000 it is less than the critical value of 0.05,hence, the model is significant at 5% of significance level. The R^2 value of the model is 0.9353. It indicates that the model can explain the 93.53% of the variability of the system.

The Glesjer LM test was performed to test the constancy of error variance. F-statistics probability value of LM test is 0.1824,it is greater than the critical value of 0.05. Therefore, the null hypothesis of constant error variance has been accepted in the model. The Durbin h-test was performed to test the serial correlation of the disturbances due to the presence of lagged dependent variable. Probability value of the test statistic is 0.0000. It is less than the critical value of 0.05. It is an evidence to reject the null hypothesis of no serial correlation for the fitted model. But in this model lag of dependent variable was included and it is also a remedy for serial correlation issue. Due to the purpose of fitting the Koyck model, further adjustments cannot apply to solve the serial correlation. It suggests that the Ordinary Least Square method can be used.

Variable consumption has positive impact on economic growth and it is significant at 1% critical level. Consumer price index is positively correlated with economic growth. Therefore 1% increase in consumer price index is leads to 4.5% increase of economic growth. The negative and not significant effect of

foreign direct investment is observed from the model. The investment has the significantly positive impact on economic growth and the effect of the ratio of investment to GDP on economic growth is 18.75%. Trade balance does not have significant impact on economic growth. The growth effect of previous period (lagged independent variable) has the significant and negative impact on present economic growth. The growth effect of previou s period (lagged independent variable) on present economic growth is -87.91%.

Model2: From the above Table 3, F-statistics probability value of the fitted model is 0.0000. It is less than the critical of 0.01. Therefore, the model is significant at 1% of significance level. The R^2 value of the model is 0.7979. It indicates that the model can explain the 79.79% of the variability of the system.

F-statistics probability value of Glesjer LM test for the constancy of error variance is 0.3476. It is greater than the critical value of 0.05. Therefore, the null hypothesis of constant error variance has been accepted in the model. Probability value of Durbin h-test for serial correlation is 0.0000. It is less than the critical value of 0.05. Therefore, the null hypothesis of no serial correlation has been rejected for the fitted. But in this model lag of dependent variable is included and it is also a remedy for serial correlation issue. Due to the purpose of fitting the Koyck model, further adjustments cannot apply to solve the serial correlation. It suggests that the Ordinary Least Square method can be used.

Expenditure has positive impact on economic growth and it is significant to the model at 1% critical level. The 1% increases of the ratio of expenditure to GDP increase the growth rate about 35.07%. Significantly positive effect of CPI to economic growth was captured by the model and the 1% increase of the ratio of CPI to GDP runs up the growth rate about 12.87%. Variable FID does not impact on GDP because probability value of FDI is greater than 0.05. The investment has the significantly positive impact on economic growth that is 1% increase of the ratio of investment to GDP increase the growth rate about 30.85%. Probability value of coefficient of trade balance show that the effect of trade balance is not significant to the model. Therefore, trade balance does not have significant impact on economic growth. The growth effect of previous period (lagged independent variable) has the significant and negative impact on present economic growth. The growth effect of previous period (lagged independent variable) on present economic growth is -74.1%.

4.3 Long-run Elasticity

Table 5 - Long-run elasticity values

Variable	Model-1 Estimates	Model-2 Estimates
$(ln(\text{Cons}))_0$	0.3592	
$(ln(\text{Exp}))_0$		0.2014
$(ln(\text{CPI}))_0$	0.0239	0.0739
$(ln(\text{FDI}))_0$	-0.013	-0.0027
$(ln(\text{Inv}))_0$	0.0998	0.1772
$(ln(\text{Trad}))_0$	0.0005	0.00013

The above table 5 shows that the long-run elasticity or the long-run multiplier of fitted model's regressor variables. In model-1, consumption, CPI, FDI, Investment and Trade Balance have the long-run elasticity are35.92%, 2.4%, -1.3%, 9.98% and 0,05% respectively. Therefore, consumption has the higher long-run elasticity in Model-1 whereas FDI has negative long-run elasticity. In model-2, expenditure, CPI, FDI, Investment and Trade Balance have the long-run elasticity are20.14%, 7.4%, -0.27%, 17.72% and 0,01% respectively. Therefore,expenditure has the higher long-run elasticity in Model-1 whereas FDI has negative long-run elasticity.

4.5 *Granger Causality Test*

To assess the causal relationship between variables, Granger causality test was performed. It used to test the relationship between the variables that are stationary.

4.5.1 *Causality between Economic Growth and Consumption*

Table 6 shows that the results of Granger causality test between economic growth and consumption.

Table 6 - Causality results of Economic Growth and Consumption

Number of Lags	*ln*(Cons) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(Cons)	
	F-Statistic	Probability	F-Statistic	Probability
1	2.80201	0.1031	0.02985	0.8638
2	5.78920	**0.0071**	4.38424	**0.0208**

The above test results revealed that, the economic growth cause the consumption and the consumption cause the economic growth after two years.

4.5.2 ***Causality between Economic Growth and Expenditure***

Granger causality test results between economic growth and expenditure are given below table 7.

Table 7: Causality results of Economic Growth and Expenditure

Number of lags	*ln*(Exp) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(Exp)	
	F-Statistic	**Probability**	**F-Statistic**	**Probability**
1	0.39216	0.5352	14.9481	0.0005
2	0.34879	0.7082	6.69272	**0.0037**
3	0.75709	0.5273		

Results of the above table show that the expenditure does not Granger cause economic growth whereas after two yearseconomic growth Granger cause expenditure.

4.5.3 ***Causality between Economic Growth and CPI***

Table 8 shows that the results of Granger causality test between economic growth and CPI.

Table 8 -Causality Results of Economic Growth and CPI

Number of lags	*ln*(CPI) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(CPI)	
	F-Statistic	**Probability**	**F-Statistic**	**Probability**
1	3.15863	0.0842	2.17237	0.1494
2	1.84444	0.1745	1.20255	**0.3136**
3	2.20826	0.1084		

According to theabove test results, the CPIdoes not Granger causes economic growth but, after two years but economic growth Granger causes CPI.

4.5.4 Causality between Economic Growth and Foreign Direct Investment

Granger causality test results between economic growth and foreign direct investment are given below table 9.

Table 9 - Causality results of Economic Growth and Foreign Direct Investment

Number of lags	*ln*(FDI) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(FDI)	
	F-Statistic	**Probability**	**F-Statistic**	**Probability**
1	0.03881	0.8450	12.9575	**0.0010**
2	0.39934	0.6741		
3	0.36473	0.7789		

Results of the above table show that the foreign direct investment does not Granger cause economic growth but, economic growth Granger cause FDI after one period.

4.5.5 ***Causality between Economic Growth and Investment***

Table 10 shows that the Granger causality test results between economic growth and investment.

Table 10 - Causality results of Economic Growth and Investment

Number of lags	*ln*(Inv) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(Inv)	
	F-Statistic	**Probability**	**F-Statistic**	**Probability**
1	0.52538	0.4734	7.24786	**0.0108**
2	0.59501	0.5575		
3	0.83065	0.4879		

From the above testresults revealed that the investment does not Granger cause economic growth but, economic growth Granger cause investment after one period

4.5.6 Causality between Economic Growth and Trade Balance

Granger causality test results between economic growth and trade balance are given below table 11.

Table 11: Causality results of Economic Growth and Trade Balance

Number of lags	*ln*(Trad) does not Granger Cause *ln*(GDP)		*ln*(GDP) does not Granger Cause *ln*(Trad)	
	F-Statistic	**Probability**	**F-Statistic**	**Probability**
1	0.50186	0.4834	3.87103	0.0571
2	0.32417	0.7255	9.16147	**0.0007**
3	1.56506	0.2191		

Results of the above table show that the economic growth does not Granger causes trade balance, whereas economic growth Granger cause investment after two years.

5. Conclusion

This paper examined the effects of various variables on economic growth of Sri Lanka, using the annual data over the period of 1980 to 2018. The methodology employed to analyse the data in this study is known as Koyck model.Form the distributed lag structure, it was found that, consumption, expenditure, consumer price index and investment have significantly impact on economic growth. However, it shows that foreign direct investment has significantly negative impact to the economic growth.

Granger causality test was performed to assess the causal relationship between two variables econometrically. The Granger causality results confirmed that the existence of unidirectional causality from economic growth to expenditure, economic growth to CPI, economic growth to FDI, economic growth to investment, and economic growth to trade balance. And also, the existence of bidirectional causality between economic growth and consumption.

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