International Journal of Economic Behavior and Organization
2023; 11(1): 17-25
http://www.sciencepublishinggroup.com/j/ijebo
doi: 10.11648/j.ijebo.20231101.13
ISSN: 2328-7608 (Print); ISSN: 2328-7616 (Online)

Macroeconomic Variables That Influence the Determination of Interest Rate: Evidence from Sri Lanka

Balasoooriya Mudiyanselage Wasanthi Shyamika Balasoooriya

Department of Business Economics, University of Colombo, Colombo, Sri Lanka

Email address:
bmwsb25@gmail.com

To cite this article:
Balasoooriya Mudiyanselage Wasanthi Shyamika Balasoooriya. Macroeconomic Variables That Influence the Determination of Interest Rate: Evidence from Sri Lanka. *International Journal of Economic Behavior and Organization*. Vol. 11, No. 1, 2023, pp. 17-25.
doi: 10.11648/j.ijebo.20231101.13

Received: March 31, 2023; **Accepted**: April 25, 2023; **Published**: May 10, 2023

Abstract: The interest rate is one of the main tools used to governor monetary policy in Sri Lanka. The main objective of this research was identifying the Macroeconomic variables that Influence to determine the Interest Rate: Evidence from Sri Lanka. Changes in macroeconomic variables affect to determine interest rate. At present, there are some consensus on the answers to these questions. This paper examines to identify Macroeconomic variables that influence the determine the interest rate in Sri Lanka and identify the relationship between interest rate and macro-economic variables. The model of this study was estimated using quarterly data from 2004:Q1 to 2015:Q4. This study uses Macro-economic variables such as money supply, budget deficit, inflation, and economic growth. This study uses Average Weighted Prime Lending Rate (AWPR), and 3-month T bill rate as benchmark interest rates in Sri Lanka. Variables were initially tested for stationery and autocorrelation, and both inflation and budget deficit were found as non-stationary, the first difference of these variables was considered. There was no autocorrelation amongst any of the variables. Granger causality tests use for finding the interrelationships between the variables in the model. looking at the overall models, it was seen that both models was significantly represented by their F-values, only the first difference of inflation and real GDP were significant in both models. There was no direct causation of interest rates from changes in inflation and real GDP. It was observed that collectively both money supply and budget deficit had a significant impact on the level of interest rates. The R-squared values are in the range of 25%. The conclusion of the study is the explanatory variables are weakly affected to determining interest rates in Sri Lanka during the reference period. Further found that all the macro-economic variables showed a positive linear relationship with the T bill rate and AWPR in Sri Lanka.

Keywords: Determination, Evidence, Stationery and Autocorrelation, Average Weighted Prime Lending R

1. Introduction

The interest rate is one of the main tools used to control monetary policy in Sri Lanka. Loanable funds theory explain that interest rates are determined by the supply and demand for loanable funds in the markets. Further long term and short-term rates are determined by financial and monetary conditions in the economy. In Sri Lanka, all banks and all other financial institutions dealing with different interest rates. The Average weighted prime lending rate (AWPR) is one of the benchmarks interest rates in Sri Lankan market. Rate of interest play an important role in our day today lives and its significantly affect the buying power of the people. Consequently, the overall trend of interest rates has a major effect on investments. Further, behavior of the investor is highly important to determine these trends.

The Keynesian theory fiscal policy suggests that budgetary expansions and declining tax rates are the best ways to stimulate aggregate demand and short-run economic growth. Increase in aggregate demand in the short run under price stickiness both inflation and nominal short-term interest rate will increase. In contrast, the argument of neoclassical economists was focused on crowding out effect. That's mean government borrowing leads to higher interest rates and that offset the stimulate impact of spending. The government spending ultimately decreases private sector spending. When the government runs a budget deficit, and government need to finance the deficit through public borrowings and external

borrowings. Government borrowing creates higher demand for credit in the financial market. Classical and Neoclassical economists generally emphasis crowding out effect and Keynesian economists argue due to the liquidity trap crowding out is minimal.

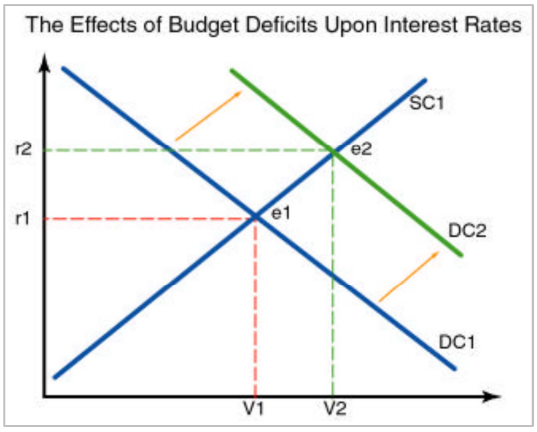

Figure 1. *The effect of budget deficit upon interest rate.*

Source: Patterson Ben and et al. (1999)
SC - Supply of Credit, DC - Demand for Credit

Further, the Loanable Funds economic theory explains the determination of real interest rates. The rate of interest is the price of the loans or credit and it is determined by the demand and supply of loans. As explained in Figure 1, the budget deficits tend to push interest rates up and it might discourage private investment (Crowding out). When the government runs a budget deficit and it can be finance through sale of government securities and external sources. As shown in Figure 1, demand for credit is shifted from DC_1 – DC_2. The obvious result is higher interest rate.

Interest is treated in different ways by different specialists. For the economist, interest is a price, paid for the use of credit or money. It follows that the theory of interest rate determination is a subset of price determination theory. According to classical economists, the rate of interest was determined by the interaction between the demand for investment capital and the supply of savings. Whereas classical theory, savings are generally invested through an interest rate mechanism. One of the major policy instruments in the classical theory is interest rate. It assumes a positive relationship between interest rate and savings whereas an inverse relationship between the interest rate and investment. The liquidity preference theory states that interest rates change to equate the demand for money with the supply. If demand for money rises, people prefer cash and they sell bonds and then bond prices will fall and interest rates will rise. Likewise, if the supply of money rises people will move into bonds, the price of bond will rise and then interest rates fall.

2. Statement of Problem

The determination of the rate of interest has been much controversy among the economists. There are two main competitors' theory in the field. One is the loanable fund theory and the other one is the Keynesian liquidity preference theory. According to the loanable funds theory, the rate of interest is determined by the demand and the supply of funds in the economy are equated. According to Keynes, rate of interest is a purely monetary phenomenon which is determined in the money market by the demand and supply of money. This is in sharp contrast can be seen in the loanable fund theory.

Discussing the historical behavior of interest rates in Sri Lanka and explains the interest rate policy "Prior to 1977, a low interest rate policy was pursued, and interest rates were infrequently adjusted, thus resulting in negative real rates. In 1977, as part of the open economic policy package, a high interest rate policy was pursued with the longer-term objective of deregulating interest rates". This explanation emphasizes, that the open economic policy forced a change in the interest rate behavior in Sri Lanka [10].

Considering some empirical evidence, some economic the decision-making process was made based on the social and political factors rather than the economic point of view, especially in less developed countries like Sri Lanka and Bangladesh. Under this condition, interest rate movements and other macro-economic variables will not change according to the theory. However, finding economic factors that influence interest rate and fitting a model to determine the interest rate behavior is not an easy task. In an open market system, there are several internal and external factors are affected to determine interact rate and it is extremely difficult to predict macroeconomic variables behavior how to effect of to determine interest rate. At present under this controversial condition, there is no consensus on the answers to these questions. It is a must to examine the macroeconomic variables that influence the determination of interest rate evidence from Sri Lanka those who are dealing in financial markets.

3. Research Objective

In the event studying of there are many economics factors that influence the interest rate is vital in order to reach this objective. Further, it is useful to examine empirically, the actual relationship among these variables to facilitate the formulation of necessary policy measures.

Accordingly, this study aims to achieve the following objectives:

1) To identify the Macroeconomic variables that influence the determine the interest rate in Sri Lanka.
2) To identify relationship between interest rate and macro-economic variables.

Based on 15-year (1999: Q1– 2013: Q4.) quarterly data.

4. Literature Review

This chapter review the empirical and theoretical evidence on interest rate behavior and its relationships with

macroeconomic economic variables.

4.1. Monetary Policy, Money Supply and Interest Rate

Many researchers have investigated the effect of monetary policy actions on interest rate for different countries, however they cannot find firm conclusion. This study presented contradictory views about monetary policy relationship between money and interest rates. The empirical evidence reveled that relationship between changes in money and interest rates. The model reveled that the nominal interest rate is determined by current and expected future money growth rates. Further, an increase in the current rate of money growth, causes the nominal interest rate to fall. However, if an increase in current money growth will affect to rise the nominal interest rate. Only increase in expected future money growth rates will also raise the nominal interest rate. The monetary transmission mechanism the reliable relationship between monetary policy actions and market interest rates. In conclusion, there is significant evidence that monetary policy has a large impact on short-term interest rates. Further, the connection between policy actions and long-term rates appears weaker and less relationship [14].

There are numerous factors which are influence the monetary policy actions and long-term interest rates. However, substantially long-term rates appear to anticipate policy changes. Market expectations play an important role in the response of long-term rates to monetary policy actions. standard view of the monetary transmission mechanism. Monetary policy actions are likely to be most effective in changing long-term rates. Consequently, investors' views say that the determination of monetary policy actions change over the business cycle, the ability of monetary policy to influence long-term rates may fluctuate over time [18].

The study investigates determinants of the overnight interest rate in Euro region. The overnight interest rate is the equilibrium outcome of supply and demand for bank reserves. The overnight rate responds to predict the future changes in the policy rate and permanent changes in supply of reserves. In fact, a substantial liquidity effect is estimated. A change in reserve supply of one billion euro, expected to prevail until the end of the maintenance period and changes the inter-bank rate eight basis points into the opposite direction. Interestingly, banks do not respond immediately to supply changes. This sluggish reaction to supply changes is not easily explained for rational agents. Temporary supply changes have no effect on the overnight rate [15].

4.2. Inflation and Interest Rate

Significant empirical evidence is available to support the hypothesis that inflation influences nominal interest rate. The fisher equation suggested that there is one-to-one relationship between the nominal interest rate and expected inflation, while the real interest rate is constant. However, this suggestion has been challenged in various platforms.

Identification of key empirical determents of short-term interest rates study revealed that the short-term nominal rates is dominated by the outlook for inflation, the funds rate, and the state of the economy. A one percentage point rise in inflation then raises the short-term interest rate by 70 to 90 basis points, whereas a similar increase in the real funds rate raises by 10 to 60 basis points in the short run [12].

The econometric analysis on connection between the nominal interest rate and the inflation rate. This relationship is closely associated with the Fisher hypothesis which bears his name on the adjustment of the nominal interest rate to the inflation. According hypothesis, results reveled that a one percent increase in the expected rate of inflation leads to a one percent increase in the nominal interest rate [4].

The change in expected inflation is likely to alter expected returns on physical assets. The rise in expected inflation as lowering the real interest rate on bonds, and the resulting decline in the relative expected return on bonds. An increase in the expected rate of inflation lowers the expected return on bonds, causes their demand to decline and the demand curve to shift to left. When expected inflation rises, interest rate will rise. This result has been equal to Fisher effect [15].

The institutional interest rates in the Philippine and Thailand were held below their competitive, free market equilibrium levels over the years. One importance is the disequilibrium has been excess demand for institutional credit. The monetary authorities in the Philippine and Thailand have been very slow to change nominal institutional interest rates in the face of changes in the inflation rate. Typically accelerated inflation has been accompanied by a decline in the deposit rates of interest. Higher inflation led to greater disequilibrium between demand and supply of institutional credit [7].

4.3. Budget Deficit and Interest Rate

Budget deficit occurs when government expenditures exceed revenues from taxes and other sources. the government will sell the bonds to mobilize funds for meeting the gap between government revenue and expenditure. Theoretically an increase in the budget deficit would lead to a rise in the rate of interest. The growth of the budget deficit, changes in the debt composition and interest rate movements on debt were observed in the past. Empirical evidence in other countries on the relationship between interest rate and public debt has led to mixed conclusions.

The government can influence the supply of bonds in several ways. Most of countries issues bonds to finance government deficits, to minimize gap between government's expenditure and its revenues. If the government budget deficit is large, the treasury sells more bonds, and quantity of bonds supplied at each bond price and interest rate increases. The higher government deficits increase the supply of bonds and shift the supply curve to right thereby increasing interest rates [13].

The empirical study on identification the relationship between budget deficits and interest rates for both 60 advanced and emerging economies applying Generalized Method of Moment (GMM) system using fiscal data over the period of 1970 - 2006. They found that 1 percentage increase

in fiscal deficit to GDP ratio increases the interest rate by 44 basis points. However, study stated that the positive relationship basically depends on the conditions such as high deficits, mostly domestically financed or interact with high domestic debt and low financial openness [1].

The impact of the federal primary budget deficit on nominal seven- and ten-year treasury note interest rate yields over the period 1992 to 2003 to measure the budget deficit. In this study, strong empirical evidence supports to provide the primary budget deficit affected to elevate the nominal interest rate yields on both seven- and ten-year treasury notes [2]. The growth of large budget deficit in Euro area increasingly important influence on long-term interest rates. In many economies the available traded bonds have been overpoweringly "sovereign debt" that is, borrowing by governments to fund budget deficits. Where governments decide to fund budget deficits by borrowing, they must issue new debt: i.e. increase the supply of bonds. This may depress bond prices: i.e. increase interest rates [16].

The analysis on the relationship between public debt and interest rates in Sri Lanka reveals that there is no significant relationship between public debt stock and nominal interest rates. However, Treasury bill stock has shown a positive relationship with its own interest rate particularly since early 1980s, when interest rates became market oriented. Treasury bond stock also influence on the determination of its own interest rate. The study shows that domestic debt issue is significant impact on determination of interest rates [5].

4.4. Economic Growth and Interest Rate

Empirical results are available to support the hypothesis that the economic growth had a substantial effect on nominal interest rate. The relationship between economic growth and nominal interest rate are positive.

With positive population growth and robust productivity growth, has higher real interest rate country like Japan. The long-term population decline has lower productivity growth than in the United States. Nor it is surprising capital flowing from Japan, where the returns and capital requirements are relatively low. The United States where returns and requirements are relatively high. In short, the higher population growth and the higher productivity growth will be the higher equilibrium real rate of interest. The result is that the real rate of interest is exactly equal to the sum of population and a productivity growth rate, but the general qualitative result makes a lot of intuitive sense [17].

The expansion of business cycle with growing wealth, the demand for bonds rises and the demand curve for the bonds shifts to the right. In a recession, when income and wealth are falling, the demand for bonds falls and the demand curve shifts to the left. The decline in savings means that the wealth of American households is lower. This smaller amount of wealth decreases the demand for bonds and then prices bond will decrease. These results indicate that increase in the interest rate of bonds [13].

Recent literature on this subject suggests that there are some economic variables act as a determinant of the interest rate. No empirical evidence, except public debt stock, explaining a clear relationship between interest rates and macro-economic variables for Sri Lanka.

Therefore, this study attempts to apply Regression Model on examine the relationship among the Money, Budget deficit, GDP growth rate and inflation rate on interest rate in Sri Lanka. To the best of my knowledge no previous studies found in recent literature on this research area with reference to Sri Lanka and no previous regression empirically analysis to examine, the actual relationship among these variables to facilitate the formulation of necessary policy measures. Accordingly, this study aims to:

i Identify the selected macro-economic variables how to affect the determine the interest rate in Sri Lanka. And;

ii Find out the relationship between selected macroeconomic variables and interest rates in Sri Lanka.

during the selected period. Therefore, this study attempts to fill this gap in the literature.

5. Research Methodology

The paper uses quarterly data covering a maximum 15-year time period (1999:1–2013:4-). Three months treasury bill rate is used as benchmark interest rate in model -1 and average weighted prime lending rate (AWPR) is used as benchmark interest rate in model-2. This study to analyze Macro-economic variables that influences to determine the interest rates in Sri Lanka. The dependent variables in this empirical analysis are Money supply, Inflation rates, Real GDP growth rate and Government budget deficit. For the purpose of this analysis annual and quarterly data used and all the data got from Central Bank publications. Both models are used to quantify the impact of Macroeconomic economic variables to determine the interest rates in Sri Lanka and find out the relationship between selected macroeconomic variables and interest rates in Sri Lanka.

5.1. Model-1

Dependent variable is 3-months Treasury bill rate. Treasury bill rate partly determined market and partly government intervened. It is not clearly reflecting market interest rate reason is partly government intervened. Then we used model-2 also further clarify interest rate.

5.2. Model-2

Dependent variable is Average weighted prime lending rate (AWPR). It is calculated by the Central Bank weekly based on commercial bank's lending rates given to their major customers during the week. It is reflecting market interest rate A country's nominal interest rate should be a negative function of the domestic real money supply. Annual change of broad money supply (MS) will be used to measure the impact of monetary policy on interest rate. Inflationary adjustment accounts for a substantial part of the increase in the interest rates. An increase in the inflation will cause an

increase in average interest rates in an economy. In contrast, a decrease in the inflation will cause a decrease in average interest rates in an economy. The inflation rate based on the Colombo Consumer Price Index will be used in this study. An increase in GDP will raise the demand for money because people will need more money to make the transactions necessary to purchase the new GDP. The real money demand rises due to the transaction demand effect. Thus, an increase in real GDP will cause an increase in average interest rate in an economy. The government budget deficit (BD) becomes larger there is possibility of offering high interest rates for government debt instruments to progressively attract funds. Therefore, government would necessitate including as an explanatory variable. It is expressed relative to GDP. We used two models to quantify the impact of above Macroeconomic economic variables that influence to determine the interest rate in Sri Lanka.

Model-1

(3-months Treasury bill rate is used as benchmark interest rate)

$$* TBR_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 I_t + \alpha_3 RGDP_t + \alpha_4 BD_t + e_t$$

Where.

TBR_t =3- months Treasury bill rate
α_0 =Intercept
α_1 =Slope coefficient of Growth of Money supply
MS_t = Growth of Money supply (M2b)
α_2 =Slope coefficient of Inflation rates
I_t, =Inflation rate
α_3 =Slope coefficient of GDP growth rate
$RGDP_t$ =Real GDP growth rate
α_4 =Slope coefficient of budget deficit as a % of GDP
BD_t = Budget deficit as a % of GDP
e_t = Random error term.

Model-2

(Average Weighted Prime Lending Rate is used as benchmark interest rate)

$$* AWPR_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 I_t + \alpha_3 RGDP_t + \alpha_4 BD_t + e_t$$

Where.

$AWPR_t$ =Average Weighted Prime Lending Rate
α_0 =Intercept
α_1 =Slope coefficient of Growth of Money supply
MS_t = Growth of Money supply (M2b)
α_2 =Slope coefficient of Inflation rates
I_t, =Inflation rate
α_3 =Slope coefficient of GDP growth rate
$RGDP_t$ =Real GDP growth rate
α_4 =Slope coefficient of budget deficit as a % of GDP
BD_t = Budget deficit as a % of GDP
e_t = Random error term.

This research depends on secondary (2004:1 to 2015:4) data covers 15 years and collected from Monthly Bulletins and Annual Reports of the Central Bank of Sri Lanka.

6. Statistical Analysis and Findings

This chapter presents the analysis and the interpretation of the findings of this study.

This research depends on secondary data from 1999 to 2013 total number of 60 observations. The period thus covers 15 years. All the data in percentages. The dataset obtained from Central Bank publications (Annual reports and monthly bulletin).

6.1. Augmented Dickey Fuller (ADF) Test

Augmented Dickey Fuller (ADF) test is apply to determine the nature of the time series to find stationary or non-stationary. The results are presented in Table 1.

Table 1. *Augmented Dickey Fuller (ADF) test.*

Level						First difference				
Description	**Variable name**	**Lag**	**t-stat**	**Probability**	**result**	**Variable name**	**Lag**	**t-stat**	**Probability**	**result**
3-Months Tbill rate	3_MTS_T_BILL	10	-2.3	0.1836	NS	D(_3_MTS_T_BILL)	10	-4.916	0.0001	I (1)
Weighted average Prime Lending rate	AWPR	10	-2.7	0.0758	NS	D(AWPR)	10	-3.645	0.0077	I (1)
Budget deficit as a% of GDP	BUDGET_DEFICIT	10	-2.4	0.1459	NS	D(BUDGET_DEFICIT)	10	-4.778	0.0002	I (1)
Real GDP Growth Rate	GDP_GROWTH	10	-3.3	0.0213	I (0)	D(GDP_GROWTH)	10	-9.233	0.0000	
Inflation Rate	INFLATION	10	-1.7	0.4029	NS	D(INFLATION)	10	-4.062	0.0024	I (1)
Growth of Money supply	M2B	10	-3.2	0.0246	I (0)	D(M2B)	10	5.144	0.0001	

The summary of the unit root tests are as follows:

Variable	Stationarity	Autocorrelation
TBR	Non-stationary	No
AWPR	Non-stationary	No
MS	Stationary	No

6.2. Johansen Cointegration Test

Since, some variables are non-stationary at their levels and others are stationary at their first differences, the Johansen Cointegration test was performed to determine whether there is a relationship among these variables. The lag length of 3 was selected based on Akaike Information Criterion (AIC). The trace statistics reveal that the existence of at least two co-integrating vectors between 3-months T-bill, AWPR and its determinants. The result of the cointegration test is given below.

Model 1

Table 2. *Unrestricted Cointegration Rank Test (Trace).*

Hypothesized (No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.776376	170.1687	69.81889	0.0000
At most 1 *	0.572752	83.29685	47.85613	0.0000
At most 2 *	0.273881	33.97424	29.79707	0.0156
At most 3	0.163213	15.41184	15.49471	0.0515
At most 4 *	0.083814	5.077049	3.841466	0.0242

Trace test indicates 3 cointegrating equation at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3. *Unrestricted Cointegration Rank Test (Maximum Eigenvalue).*

Hypothesized (No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.776376	86.87181	33.87687	0.0000
At most 1 *	0.572752	49.32262	27.58434	0.0000
At most 2 *	0.273881	18.56240	21.13162	0.1102
At most 3	0.163213	10.33479	14.26460	0.1909
At most 4 *	0.083814	5.077049	3.841466	0.0242

Max-eigenvalue test indicates 2 cointegrating equation at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Model 2

Table 4. *Unrestricted Cointegration Rank Test (Trace).*

Hypothesized (No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.754011	145.9936	69.81889	0.0000
At most 1 *	0.395082	64.65055	47.85613	0.0006
At most 2 *	0.278341	35.49618	29.79707	0.0099
At most 3	0.160528	16.57644	15.49471	0.0342
At most 4 *	0.104899	6.427496	3.841466	0.0112

Trace test indicates 5 cointegrating equations at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5. *Unrestricted Cointegration Rank Test (Maximum Eigenvalue).*

Hypothesized (No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.754011	81.34308	33.87687	0.0000
At most 1 *	0.395082	29.15437	27.58434	0.0312
At most 2 *	0.278341	18.91974	21.13162	0.0992
At most 3	0.160528	10.14894	14.26460	0.2023
At most 4 *	0.104899	6.427496	3.841466	0.0112

Max-eigenvalue test indicates 2 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

6.3. Causality Test (Appendix-III)

The below tables represent the pair wise Causality tests for Model 1 and Model 2. Considering two variables Y_t and X_t, testing for Granger causality yields four possibilities.

1) Unidirectional Granger causality from variable Y_t to variable X_t
2) Unidirectional Granger causality from variable X_t to Y_t
3) Bi-directional causality
4) No causality

The test is based on the p-value where $p<0.05$ results in not rejecting the null hypothesis of no causality. In effect this means that there is no causality between the two variables.

Model 1

Table 6. *Granger Causality Tests (Dependent Variable: D(TBR)).*

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision	Type of causality
MS does not Granger Cause TBR	45	0.87870	0.5980	DNR H_0	No causality
TBR does not Granger Cause MS	45	1.16085	0.3926	DNR H_0	No causality
I does not Granger Cause TBR	45	0.71809	0.7341	DNR H_0	Uni-directional causality
TBR does not Granger Cause I	45	4.15959	0.0055	Reject H_0	Uni-directional causality
RGDP does not Granger Cause TBR	45	0.16583	0.9993	DNR H_0	Uni-directional causality
TBR does not Granger Cause RGDP	45	4.07939	0.0060	Reject H_0	Uni-directional causality
BD does not Granger Cause TBR	45	0.90686	0.5750	DNR H_0	Uni-directional causality
TBR does not Granger Cause BD	45	2.83031	0.0295	Reject H_0	Uni-directional causality
I does not Granger Cause MS	45	0.97435	0.5218	DNR H_0	No causality
MS does not Granger Cause I	45	1.52184	0.2193	DNR H_0	No causality
RGDP does not Granger Cause MS	45	0.42320	0.9450	DNR H_0	No causality
MS does not Granger Cause RGDP	45	1.30692	0.3110	DNR H_0	No causality
BD does not Granger Cause MS	45	0.68864	0.7591	DNR H_0	No causality
MS does not Granger Cause BD	45	2.25087	0.0688	DNR H_0	No causality
RGDP does not Granger Cause I	45	0.62984	0.8076	DNR H_0	No causality
I does not Granger Cause RGDP	45	0.66380	0.7798	DNR H_0	No causality
BD does not Granger Cause I	45	0.69733	0.7517	DNR H_0	No causality
I does not Granger Cause BD	45	1.18538	0.3777	DNR H_0	No causality
BD does not Granger Cause RGDP	45	0.51398	0.8933	DNR H_0	No causality
RGDP does not Granger Cause BD	45	0.31188	0.9839	DNR H_0	No causality

Note: DNR – Do Not Reject

Model 2

Table 7. *Granger Causality Tests- Dependent Variable: D(AWPR).*

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision	Type of causality
MS does not Granger Cause TBR	45	0.80849	0.6568	DNR H_0	No causality
TBR does not Granger Cause MS	45	1.01608	0.4905	DNR H_0	No causality
I does not Granger Cause TBR	45	1.20792	0.3645	DNR H_0	No causality
TBR does not Granger Cause I	45	0.84681	0.6245	DNR H_0	No causality
RGDP does not Granger Cause TBR	45	0.43258	0.9405	DNR H_0	Uni-directional causality
TBR does not Granger Cause RGDP	45	3.86915	0.0077	Reject H_0	Uni-directional causality
BD does not Granger Cause TBR	45	0.35013	0.9737	DNR H_0	No causality
TBR does not Granger Cause BD	45	2.14069	0.0815	DNR H_0	No causality
I does not Granger Cause MS	45	0.97435	0.5218	DNR H_0	No causality
MS does not Granger Cause I	45	1.52184	0.2193	DNR H_0	No causality
RGDP does not Granger Cause MS	45	0.42320	0.9450	DNR H_0	No causality
MS does not Granger Cause RGDP	45	1.30692	0.3110	DNR H_0	No causality
BD does not Granger Cause MS	45	0.68864	0.7591	DNR H_0	No causality
MS does not Granger Cause BD	45	2.25087	0.0688	DNR H_0	No causality
RGDP does not Granger Cause I	45	0.62984	0.8076	DNR H_0	No causality
I does not Granger Cause RGDP	45	0.66380	0.7798	DNR H_0	No causality
BD does not Granger Cause I	45	0.69733	0.7517	DNR H_0	No causality
I does not Granger Cause BD	45	1.18538	0.3777	DNR H_0	No causality
BD does not Granger Cause RGDP	45	0.51398	0.8933	DNR H_0	No causality
RGDP does not Granger Cause BD	45	0.31188	0.9839	DNR H_0	No causality

Note: DNR – Do Not Reject

6.4. Model Correction

Based on the above test results we can modify our original regression models so that they reflect the pattern of data.

Model 1

Table 8. *Model Correction - Dependent Variable: D(TBR).*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.839411	0.923570	-1.991631	0.0515
MS	-0.054009	0.061611	-0.876611	0.3846
D(I)	0.213017	0.083698	2.545064	0.0138
RGDP	0.166604	0.064296	2.591221	0.0123
D(BD)	0.001107	0.055186	0.020068	0.9841
R-squared	0.269702	Mean dependent var		-0.071864
Adjusted R-squared	0.215606	S.D. dependent var		1.538681

Variable	Coefficient	Std. Error	t-Statistic	Prob.
S.E. of regression	1.362749	Akaike info criterion		3.537823
Sum squared resid	100.2826	Schwarz criterion		3.713885
Log likelihood	-99.36577	Hannan-Quinn critter.		3.606551
F-statistic	4.985603	Durbin-Watson stat		1.589828
Prob(F-statistic)	0.001709			

$$TBR_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 d(I_t) + \alpha_3 RGDP_t + \alpha_4 d(BD_t) + e_t$$

1) Here, the Durbin-Watson statistic is closer 2 indicating that there is no autocorrelation amongst the variables as was not the case with the original model. Also, the F-statistic is less than 0.05 indicating that the model is significant. The adjusted R^2 value is 0.22, which means that the independent variables only explain 22% of the variation in the dependent variable.

Model 2

Table 9. *Model Correction- Dependent Variable: D(AWPR).*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.147223	0.979026	0.2466	0.0515
MS	-0.009957	0.064845	0.8786	0.3846
D(I)	0.259389	0.087771	0.0047	0.0138
RGDP	0.166386	0.067073	0.0164	0.0123
D(BD)	0.032814	0.057207	0.5687	0.9841
AR(1)	0.036902	0.145731	0.8011	0.8011
R-squared	0.036902	Mean dependent var		-0.073103
Adjusted R-squared	0.281698	S.D. dependent var		1.564324
S.E. of regression	0.212630	Akaike info criterion		3.591425
Sum squared resid	1.388085	Schwarz criterion		3.804574
Log likelihood	100.1926	Hannan-Quinn critter.		3.674451
F-statistic	-98.15132	Durbin-Watson stat		1.973282
Prob(F-statistic)	4.078582			
Inverted AR Roots	0.003372			

$$AWPR_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 d(I_t) + \alpha_3 RGDP_t + \alpha_4 d(BD_t) + e_t$$

2) Here, the Durbin-Watson statistic is closer 2 indicating that there is no autocorrelation amongst the variables. The F-statistic is less than 0.05 indicating that the model is significant. The adjusted R^2 value is 021, which means that the independent variables only explain 21% of the variation in the dependent variable.

7. Conclusion

The model was estimated using secondary data for the period 1999: Q1 to 2013: Q4. This study found that economic variables such as money supply, inflation, budget deficit and economic growth affected the determination of interest rates. Two types of interest rates were considered as part of this study, Treasury bill rate (TBR) and the Average Weighted Prime Lending Rate (AWPR).

Since the nature of the study involves time series, it was vital to test nature of the time series variables, in otherworld whether the series were stationary or non-stationary. Also, autocorrelation of the variable's values with past values of the same variable had to be determined. It was concluded that Money Supply and Real GDP were stationary time series, whilst all other variables had a unit root (non-stationary). As such the first difference of the variables Inflation and Budget Deficit were considered for the revised model for estimation. Furthermore, it was concluded that none of the variables depicted autocorrelation.

Granger causality tests were applied to understand the interrelationships between the variables in the model. It was possible to note that both the Treasury bill rate and the AWPR had a direct impact on the economic growth is measured by real GDP, however, the converse was not true. This is in line with the fact that economic growth in developing countries is largely dependent on the level of interest, as lower interest rate would encourage greater economic activity and investment. Furthermore, Treasury bill rate was found to have a direct effect or causation on the level of inflation and level of budget deficit. This is consistent with expansionary fiscal policy, since the T-bill rate is the benchmark interest rate. Hence, when TBR rise it would encourage savings and investment. This would lead to higher consumption and finally it leads to inflation. The budget deficit would reduce in such an event as an active economy requires less government spending as opposed to a sluggish one. However, this relationship did not hold regarding the Lending rate as measured by AWPR, which means that the lending rate or private borrowing rate did not have a direct impact on inflation or budget deficit. It could also be concluded that none of the variables; money supply, inflation, real GDP, and budget deficit had a direct impact or causation on either the T-bill rate or the Lending rate.

When looking at the overall models, it was seen that both models as a whole was significant depicted by their F-values, only the first difference of inflation and real GDP were

significant in terms of individual variables for both models. Thus, even though there was no direct causation of interest rates from changes in inflation and real GDP as per the causality test it was observed that collectively with money supply and budget deficit these two variables had a substantial impact on the level of interest rates. Also, R-squared values were in the range of 25% for both models indicating that there were other variables which had an impact on interest rates which were not part of the model considered for this study.

The outcome of the study revealed that the explanatory variables weakly affected in determining interest rates in Sri Lanka during the reference period. All, economic variables showed a positive linear relationship with the T bill rate and AWPR. Low R-squared values also tend to lower correlation coefficients, and as all variables had a positive coefficient, we could conclude that the relationship with interest rates was indeed a weak one. Further, it should be mentioned that the less developed government securities market is largely influenced by two or three state owned direct participants. In view of this, the decision-making process was made based more on the social and political factors rather than on the economic factors. Certainly, under this condition, fund movements and other macro-economic variables will not react according to theory. Hence, it would be useful to consider as part of a future study the impact of political changes, performance in the interbank market and open market operations (OMOs) on the interest rate.

References

[1] Ari Aisen; David Hauner February 1, 200, Budget Deficits and Interest Rates: A Fresh Perspective.

[2] Cebula, R. J., (2005); 'Recent empirical evidence on the impact of the primary budget deficit on nominal longer-term treasury note interest rate yields', Global Business and Economics Review, Vol. 7, No. 1, pp. 47–58.

[3] Central Bank of Sri Lanka; Several Issues of the Annual Report (1997-2014).

[4] Deutsche Bank Research (2001), "Real Interest Rates: Movements and Determinants", Deutsche Bundesbank Monthly Report July 2001.

[5] Dheerasinghe, Rupa., (19990, "The Impact of Public Debt on Interest Rates in Sri Lanka", Staff studies, Central Bank of Sri Lanka.

[6] Fernando, D. J. G., (1991); "Financial Reforms in Sri Lanka 1977-1987", Central Bank of Sri Lanka.

[7] Fry, Maxwell J., (1991); Money, Interest, and Banking in Economic Development, The Johns Hopkins University Press.

[8] Gujarati, Damodar N, (1988); Basic econometrics: McGraw-Hill Book Company.

[9] Gupta, Suraj B., (1998); Monetary Economics-Institutions, Theory & Policy, S. Chand & Company Ltd.

[10] Jayamaha, R., (1989), "The Monetary Transmission Mechanism in Sri Lanka", Central Bank of Sri Lanka.

[11] Karunathilake, H. N. S., (1986); The Banking and Financial System of Sri Lanka, Centre for Demographic and Socio-Economic Studies.

[12] Mishkin, Frederic S., (1997); The Economics of Money, Banking & Financial Markets, Addison Wesley.

[13] Mehra Yash P (1995), Some key empirical determinants of short-term nominal interest rates. Economic Quarterly issue Sum, 33-51.

[14] Monnet, Cyril., and Weber, Warren E., (2001), "Money and Interest Rates", Federal Reserve Bank of Minneapolis Quarterly Review, Fall 2001, Vol. 25, No. 4, pp. 2-13.

[15] Mehra (1995):" Determents of short-term interest rates over the period 1995:1 to 1994:3. Federal ReserVE Bank of Richmond Economic Quarterly Volume 81/3 Summer 1995.

[16] Moschitz, Julius., (2004), "The determinants of the Overnight interest Rate in the Euro Area", European Central Bank, Working Paper Series No. 393 September 2004.

[17] Patterson, G. B., (1999): "The Determination of Interest Rates", European Parliament, Economic Affairs Series ECON-116EN, December 1999.

[18] Poole, William, (2003), "Economic Growth and the Real Rate of Interest", Federal Reserve Bank of St. Louis.

[19] Roley, V. Vance., and Sellon, Gordon H. Jr., (1995); "Monetary Policy Actions and Long-Term Interest Rates", Federal Reserve Bank of Kansas City, Economic Review.