Demand-Driven Factors of Inflation in Sri Lanka: An ARDL Approach

Tyrone De Alwis

PhD Student,
Department of Economics, University of Colombo, Sri Lanka
tyrdealwis@yahoo.com

Dewasiri, N. J.

Department of Accountancy and Finance, Faculty of Management Studies,
Sabaragamuwa University of Sri Lanka,
Belihuloya, Sri Lanka
jayantha@mgt.sab.ac.lk

Abstract

Inflation in Sri Lanka has been one of the country's major macroeconomic issues, especially since 1977. Inflation in Sri Lanka has been caused due to various factors. The present study analyses the demand-driven factors of inflation in Sri Lanka. The time-series data is used to identify such factors, applying the ARDL technique to determine the long-run and short-run relationships during the 1977-2019 sampling period. X. The demand-driven long-run factors were real GDP, fiscal deficit, 91-days treasury bills rate, and broad money supply. On the other hand, short-run factors were real GDP, imports, budgetary deficit, broad money supply, wages of the private sector and wages of the government sector. The findings suggest that both long-run and short-run determinants impact inflation in Sri Lanka. As such, real GDP, fiscal deficit, Treasury bill rate, and broad money supply explain the inflation in Sri Lanka in the long run. Real GDP has a significant impact on inflation in the long run than the treasury bills rate. In addition, wages of the private sector and wages of the government sector also significantly impact inflation in Sri Lanka. The findings would be helpful for policymakers in their efforts to control the country's inflation by maintaining the price stability in Sri Lanka sustainably.

Keywords: Inflation, ARDL, Co-integration, Money supply, Fiscal deficit, Central bank, Monetary policy

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Introduction

Inflation can be defined as the persistent rise in the general price level across the economy (Chaudhary and Xiumin, 2018). The word "inflation" comes from "inflate", which means a general rise in the price levels in the economy (Brooman and Jacoby, 1970). As Shapiro (1972) indicated, it is a constant increase in the general price level of goods and services. However, according to Mankiew (2010), inflation can be defined as "the rate of inflation—the percentage change in the overall level of prices". The term "inflation" is widely considered "a state in which general price level is rising persistently, and the market value of money is falling". The extreme inflation conditions in any country are not favourable to any economy. It is commonly accepted that a volatile inflationary situation in any economy is damaging to its growth and development in general and individuals, businesses, and consumers in particular (Mubarik, 2005; Weerasinghe, 2018). In addition, persistent inflation can bring about high social costs. It is generally perceived that inflation oils the wheels of the economy but too much oil can flood the engine. A lower inflation rate is generally accepted as healthy for the economy (KebretTaye, 2013). However, meagre inflation is also not ideally suited to the economy.

Periods of a high rate of inflation or hyper-inflation have negative repercussions, which can cripple the economy. It can lead to economic uncertainty, diverting scarce resources away from production and distorting financial performance (Vansteenkiste, 2009; Iya and Aminu, 2014). The challenge for policymakers is to maintain inflation at a low and stable level. Central Banks in many countries have emphasized the importance of maintaining price stability. Parallel to these objectives when formulating the monetary policy, these institutions geared their goals towards achieving low and stable inflation in their economies. Hence as Barro (2013) indicated and further confirmed by Coomaraswamy (Road Map of Sri Lanka, 2017), Central Banks and other decision-makers are of the view that "Price Stability" is a worthy objective because "Inflation is Costly". Price stability maintains inflation at a low and stable level (Coomaraswamy, 2017).

Inflation is interestingly a touchy issue in the macroeconomic discipline (Paudyal, 2011). It is the most discussed issue worldwide, especially among policymakers and academia, due to its far-reaching outcomes. High inflation complicates long-term economic planning, creating incentives for households and firms to shorten their horizon and spend their resources on managing inflation risk rather than focusing on the most productive activities. Therefore, inflation is one of the major concerns due to its direct impact on people, the economy and political ramifications. Further inflation brings down the actual value of the domestic currency by pushing domestic prices up. Accordingly, it has become a burning issue for policymakers. To tackle the problem of inflation, it is of paramount importance to understand the natural causes or what determines inflation (Vansteenkiste, 2009) because high inflation severely affects macroeconomic variables like consumption, savings, investments, and government expenditure. As a result, businesses and households perform poorly when inflation is high and unpredictable (Barro, 2013; Ruzima and Veerrachamy, 2015). On the other hand, low inflation positively impacts the economic variables.

Therefore, the main target of every nation's monetary policy, irrespective of whether the country is "Developed" or "Less Developed or Emerging", is to maintain a low and relatively

stable inflation rate. Inflation has been one of many developing countries' main macroeconomic challenges, including Sri Lanka.

This study attempts to identify the determinants of inflation in Sri Lanka and build up an appropriate policy framework to help contain inflation in the long term. The determinants of inflation are essential in building economic forecasts and planning for overall and sectorial development in the economy. The determinants of inflation vary within the economy itself and widely across countries (Gyebi and Boafo, 2013). Therefore, the present study mainly focuses on demand-side factors that have contributed much to the inflationary situation in Sri Lanka. This study fills the gap by identifying the demand-driven factors, especially in policy formulation and recognising which factors have the most significant contribution is much valued and needed. Before deciding on the action to tame inflation, the policymakers should understand the factors that have triggered inflation in the past and the new factors that are likely to affect inflation shortly to avoid prolonged inflation.

The paper is organized as follows: section 1 is the introduction, and section 2 provides the background situation of inflation in Sri Lanka. Section 3 gives details of the literature survey, followed by sections 4 and 5 with methodology and data analysis and empirical findings of the study. The final section provides the conclusion with some recommendations.

Background of the Study

In the aftermath of economic deregulation in 1977, Sri Lanka experienced a steady rise in the inflation rate, from around 2.2 percent in the 1960s to 12.1 percent in 1978 and 26.1 percent by 1980 (see figure 01). In addition to the oil price shock of 1979, the other contributory factors included the government policy of deficit financing, increased demand for credit by the private sector, relaxation of price controls, and removal of subsidies and continuing depreciation of the exchange rate. However, the demand management policies employed by the government to control inflation were successful in bringing down the rate of inflation to a single-digit level during the 1985-1987 periods. The late 1980s, however, noticed an acceleration in the rate of inflation, once again reaching a peak of 21.5 percent in 1990. The depreciation of the rupee, the upward revision of paddy's guaranteed price, and the rise in fuel prices due to the Gulf Crisis contributed to this increase.

From 1991 onwards, there was a decline in inflation and, by 1998, the inflation rate averaged 4 percent. One of the many explanations for the continuing increase in the price level was the monetarist's proposition of excessive growth in the money supply. Consequent to the financial deregulation in Sri Lanka, all monetary aggregates recorded high growth rates. The broad money supply rose threefold during the 1965-1977 period and rose to 23 fold during 1978-1996. T of fiscal restraint has been a prime factor underlying this monetary expansion. The large-scale investment programs that were primarily deficit-financed, and the eruption of the ethnic crisis from 1983 onwards, led to a progressive increase in the budget deficit. As a proportion of GDP, the budget deficit that averaged around 8.4 percent in 1977 rose to 24.5 percent in 1980 but gradually dropped to 9.2 percent by 1998. Adopting a floating exchange rate system and the liberalized trade and payment policies added further pressure on prices. Towards the latter part of 1977, Sri Lankan Rupee was devalued and allowed to float against a basket of currencies.

Inflation gradually declined from 1997 to 2004 except in 2001, when it reached 14.2 percent. The inflation rate dropped to its lowest in 1999, reaching 4.7 percent. Inflation in Sri Lanka during this period recorded a single digit from 4.7 percent in 1999 and 7.6 percent in 2004. This trend continued resulting in single-digit inflation from 2002 to 2004. The contributory factors for the lower values were the combined outcome of prudent monetary management, better fiscal discipline, and rationalized tax and tariff structures. In addition, prices of essential items were low in the world market, and the costs of those essentials declined.

The double-digit inflation period commenced in 2005 after several years of single-digit inflation. This upward inflation trend continued from 2006 to 2008, reaching the second-highest digit in Sri Lankan history, peaking at 22.6 percent. Both demand and supply factors impacted price changes. Further, due to wage increases, demand-side pressure emanated. There were also tariff increases, especially in 2006, contributing to consumer price inflation. Both external and domestic factors contributed to this situation. Paddy production dropped due to terrorism, bad weather conditions, supply shortages, and high distribution costs on the domestic front. The general price level continued to increase rapidly due to the upward revision of the fuel prices, which impacted the Colombo Consumer Price Index (CCPI). The contributory factors that pushed the price index were the low supply of domestically produced agricultural commodities and very high prices of imports, especially food items, oil and petroleum products.

Inflation has gradually increased since 2009, but it dropped rapidly from a peak of 22.6 percent in 2008 to 3.5 percent in 2009. The favourable developments emanated from supply and demand-side factors have contributed to this precise position in the country in 2009. The rapid slowdown of inflation in the country was due to the strict monetary policy measures adopted by the Central Bank of Sri Lanka (CBSL). The impact of demand pressures on rising inflation was apparent in the gradual increase in core inflation which reached 8.0 percent in February 2010. Inflation was expected to remain low in 2010, partly due to positive base and supply-side effects (additional agricultural production from the Northern part of Sri Lanka). However, towards the end of 2010, inflationary pressures started to build up due to the rise in global commodity prices.

Inflation in 2009 has dropped to a considerable low figure of 3.5 percent. The situation is somewhat different as it sharply dropped from a peak of 26.6 percent in 2008 and 15.8 percent in 2007. The implementation of the stringent monetary policy adopted by CBSL during the previous two years, together with a decline in commodity prices in the international market, with improved domestic supply conditions in the country (due to additional agricultural production from the Northern part of Sri Lanka with the cessation of war). Inflationary pressure exerted through increased wages of public and private sectors employees was contained through favorable developments in supply-side factors. The inflation situation in the country remained low as the figure in 2010 was recorded at the mid-single level of 6.2 percent as measured by CCPI (2002=100). The contributory factors for a relatively low and stable level of inflation during the year were mainly the improved domestic supply conditions and supportive fiscal policies.

As measured by the CCPI (2006/07=100), the general price levels increased in 2011 due to the combined effects of both demand and supply-side factors. Therefore, the inflation remained at the single-digit level (6.7 %) for the third consecutive year in 2011, but annual average inflation moved upward in 2011 compared to 2010 and 2009. In 2012 due to cost

pressure and supply-side shocks, inflation remained a single digit for the fifth consecutive year in 2013 at 6.9 per cent. CCPI portrayed a declining trend in 2013 (2006/07=100). However, inflation during 2014-2015 further declined to drop to 3.3 and 2.2 percent. Reasons were due to the combined impact of prudent monetary management, moderation in international commodity prices, relatively stable exchange rate, fiscal policy measures taken towards addressing supply-side disturbances and well-managed inflation expectations. Years 2015,2016, and 2017, on the contrary, indicated the opposite direction as the price levels measured using both the National Consumer Price Index(NCPI) (NCPI 2013=100) and CCPI (CCPI 2006/07=100) increased at a slow rate with mixed movements. The inflation is corporately higher when compared to the past few years.
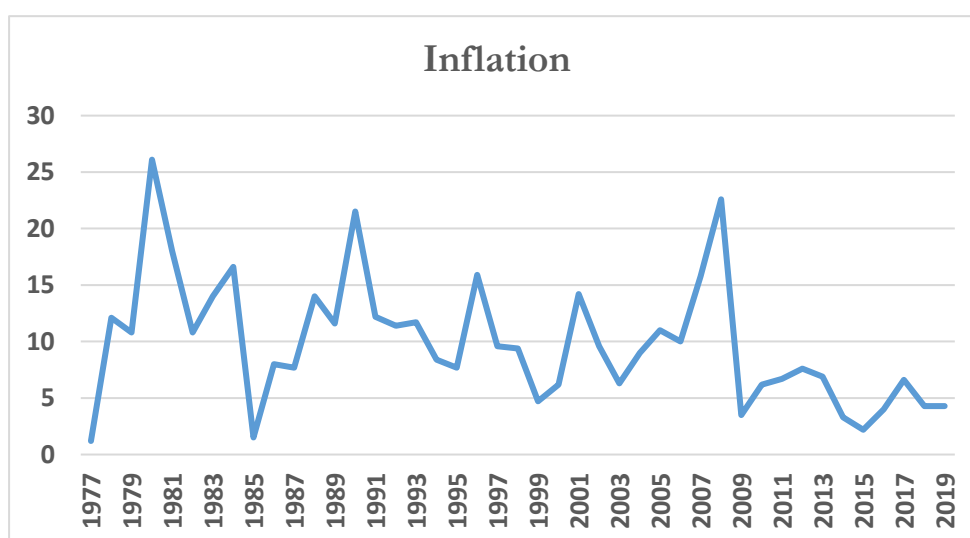

Figure 1. Inflation -1977-2019

Review of an Individual Country-Empirical Literature: Sri Lanka

In this context, research on determinants of inflation in Sri Lanka is limited to a few studies. Ratnasiri (2011) focused his study on the main determinants of inflation in Sri Lanka from 1980 to 2005 using the econometric tool of Vector Autoregression Analysis (VAR model). His findings were that the growth in money supply (M2) and the price increase in rice had been the significant factor for the inflationary situation in Sri Lanka in the long run during the specified period. Rice price has played an essential role in the short run as it was an endogenous variable. On the other hand, money supply and exchange rate were not considered necessary as they were shown to be weak in the adjustment process. In the short run, output was insignificant and did not affect inflation.

Ratnasiri (2011) identified money supply as the prime factor for inflation in Sri Lanka. An increase in money supply emanated from the high transaction demand that prevailed in the country during his study period. The inflation, which averaged 26.1 percent by 1980, was partly due to the 1979 oil shocks and the government's policy of deficit financing. Other factors also contributed positively to inflation in Sri Lanka, along with money growth. Large scale investment programs undertaken by the government have raised the Government of Sri Lanka (GOSL).

A study conducted by Cooray (2008) mainly used models, namely "An Open Economy Model" and "A Closed Economy Model", to estimate price equations in Sri Lanka. She has concentrated on the period 1978 to 2006. Between the two models, results have supported the Open economic model, which included those of Nicholas (1990), and Nicholas and Yatawara (1991). According to her findings, import prices and the exchange rate significantly impacted price levels with the open economic model. Therefore, the study discussed the importance of supply-side factors.

There are common findings that can be found in Ratnasiri (2011) and Cooray (2008). Both found that price increases are the main reason for inflation in Sri Lanka. However, the contrast findings were that while Ratnasiri (2011) found the exchange rate as a non-significant factor and as an essential variable. Cooray (2008) has used annual, quarterly and monthly data for CPI and has used two alternatives cases "a closed economy" and "an open economy". During the post-post-economic policy period, studying the Balance of Trade position in the country is vital as it can significantly impact inflation.

Luintel (2002) examined the role played by money stock in combating inflation in South Asia, including Sri Lanka. His findings implied that inflation could not be controlled via the money stock in South Asia. Madurapperuma (2007), who focused on Sri Lanka's monetary policy situation, has emphasized the positive relationship between monetary aggregates and prices. He used the correlation analysis for the 1950 to 2007 period.

Using the VAR framework, two comprehensive studies have been done by Amarasekera (2008) on the effectiveness of the monetary policy. Both researchers have gone well beyond the previous studies by trying to identify the monetary policy's influence on domestic output and inflation. Amarasekera (2008), covering the period from 1978 to 2005, has paid attention to the interest rate and is more minor on monetary aggregates. He indicated that inflation has declined due to increased interest rates following the correlation between interest rates and GDP growth. He further studied the effectiveness of the monetary policy, taking three sub-samples starting from 1978-1992, 1993-2000, and 2001-2005 to confirm his findings.

Further, the study of Vinayagathasan (2013) has highlighted, as opposed to Amarasekara (2008), that the reserve money should be better targeted in Sri Lanka than narrow or broad money target in taming inflation. The inconsistency that arose in these studies depended on a single policy standpoint. No single policy can measure the natural effect of monetary or fiscal policy; however, incorporating both approaches (fiscal and monetary) to some extent. Hence, when measuring the effectiveness of the monetary policy, fiscal consideration should be taken into account. On the other hand, economic variables need to be incorporated into the fiscal evaluation.

To understand the impact of petroleum prices on the price levels of Sri Lanka, Perera (2009) attempted Autoregressive Distributed Lag (ADL) model. His research indicated that the indirect impact of changes in diesel prices on the Colombo Consumer Price Index (CCPI) and Sri Lanka Consumer Price Index (SLCPI) was much more significant than the direct impact. His findings were firmly confirmed that a 10 percent price increase in diesel had changed the CCPI by 1.21 percent, and it was 1.01 percent for SLCPI.

Kesavarajah (2011) analyzed the inflation situation in Sri Lanka from 1978 to 2010. The researcher has used Johanson and Juselius's Co-integration and Vector Error analysis to conclude that money supply, exchange rate and budget deficit were co-integrated. Since they were co-integrated, the ultimate results indicated a long-run dynamic relationship. He justified that the money supply and inflation were positively related due to expansionary monetary policy. Further, the budget deficit was discussed as it was also favourable to each other. According to the author, such a correlation was indicated due to government expenditure and WAR expenditure structure. Annual data were used for this analysis. He concluded that maintaining stable price levels is necessary to decrease the inflation in Sri Lanka.

Another study similar to Ratnasiri (2011) and Kesavarajah (2011) was conducted by Duma (2008). The researcher investigated the pass-through of external shocks to inflation in Sri Lanka. The external shocks were the exchange rate, oil price and import price. He has used Vector Autoregressive Model (VAR) to base his findings and found an incomplete pass-through of external shocks to domestic inflation. Pass-through was 10 percent during the first month and rose to 40 percent in four (04) months. Concerning the oil prices, the impact was much smaller and even harmful. But, the effect of import prices was 4 percent to 28 percent within three (03) months. The researcher concluded that external shocks appeared to have less impact on the CCPI. Still, other surprises (supply constraints) were likely to impact explaining inflation in Sri Lanka. Perera (2009) and Duma (2008) both have estimated the effect of oil price changes on the general price levels in the country. While Perera (2005) confirmed diesel price impact was much more significant, Duma (2008) has captured the opposite result, a much smaller effect. These were contradictory to each other. Moreover, these findings completely opposed Ratnasiri (2011) and Kesavarajah (2011).

Bandara (2011) identified the inflationary situation in Sri Lanka as characterized by upward and downward swings in the economy and has investigated the trends from 1993 to 2008. He used Vector Autoregressive (VAR) model to conclude the findings. He found a positive relationship between money supply, exchange rate and GDP as it explained the behavioral changes in inflation in Sri Lanka.

Walpita (2015) attempted to estimate the inflation in Sri Lanka from 1960 to 2013. The researcher applied Vector Error Correction Model (VECM). Based on annual data, the analysis indicated that broad money supply, GNP, rising government budget deficit, and exchange rate depreciation behaved as major determinant factors that played a significant role in the long run of the Sri Lankan inflationary situation. Walpita (2015), in her study, has identified money supply (M2) as one of the main reasons for inflation from1960 to 2013.

Jayasooriya (2015) also found outcomes similar to Walpita (2015) regarding the VAR model. The author identified the macroeconomic variables (i.e. GDP, inflation and narrow money supply (M1) were the most critical variables during this period). Having analyzed the inflationary situation in Sri Lanka, it was found that expansionary monetary policy caused inflation. The reason for expansionary monetary policy was the monetization of the budget deficit. The researcher concluded that the little money and budget deficit were positive and statistically significant when correlated to inflation in Sri Lanka.

Is fiscal deficit inflationary? According to Jayasooriya (2015), it was. However, previous studies that targeted the same issue have provided mixed outcomes. Sargent and Wallace (1981) provided supportive evidence that the fiscal deficit was inflationary. In addition to them, Fischer et al. (2002), Habibullah et al. (2011) attempted to study the long-run relationship between budget deficit and inflation in thirteen (13) Asian developing countries, including Sri Lanka too. They confirmed the positive relationship between inflation and fiscal deficit. On the other hand, Tiwari, Bolat and Kocbulut (2015) did not find any positive association between budget deficit and inflation for nine (09) EU countries from 1990 to 2013. Studies concerning the inflation situation in Sri Lanka depended heavily on a single approach with few explanatory variables. But, Jayawardana and Jayasinghe (2016) adopted a new approach to the issue from 1977 to 2014 by carrying out a comprehensive study for Sri Lanka. Compared to previous studies, they have used two methods, namely; Autoregressive Distributed Lag (ADRL) approach and Error Correction Model (ECM) and have used a wide range of variables (money supply, exchange rate, prices of crude oil, budget deficit, real GDP, public wage index, private wage index). The findings suggested that increased money supply, domestic currency depreciation, and high public wages caused inflation. These results were expected in the short and long run.

The review of the relevant studies concerning the Sri Lankan context provides a strong base for the present study. Reviewing past and recent studies on the selected topic provides a valuable ground in identifying the fundamental factors for inflation in Sri Lanka and choosing the most appropriate methodology.

Methodology

Data Description

This study uses the rate of inflation as the dependent variable. The Colombo Consumer Price Index (CCPI). The CCPI series has been extrapolated to one year base (2013=100). The change of CCPI was taken as inflation. The CCPI is the most widely used inflation indicator for Sri Lanka even though it has some weaknesses, such as representing the entire country. Yet, it is based on a survey of working-class families in the Colombo district. National Consumer Price Index (NCPI) with the base (2013=100), which covers the entire country, has no complete series (available only from 2014). Therefore, in this study, CCPI is used.

The explanatory variables include Real GDP, imports, fiscal deficit, treasury bills rate -91 days, nominal wages_board, nominal wages_ government and broad money supply (M2). The data cover the period from 1977 to 2019 and are of annual frequency.

Methodological Discussion

Keeping the objective of finding out what are the demand-driven factors of inflation in Sri Lanka, the study used secondary data. Accordingly, a quantitative method is used in line with the objective (Dewasiri et al., 2018; Dewasiri et al. 2017) along with the following models.

Demand-Driven Model

The joint null hypothesis that there is no long-run relationship between the variables used in this study $H_0: \propto_1 = \propto_2 = \propto_3 = \propto_4 = \propto_5 = \propto_6 = \propto_7 = \propto_8 = 0$ tested against an alternative hypothesis that is, there is a long-run relationship between the variables. $H_1: \propto_1 \neq \propto_2 \neq \propto_3 \neq \propto_4 \neq \propto_5 \neq \propto_6 \neq \propto_7 \neq \propto_8 \neq 0$

The demand-driven model with inflation is presented as follows:

Inf = f(lnrgdp, lnimports, fd, tb-91, lnwages_board, lnwages_govt, lnm2) …….....……..… (01)

Equation (01) specifies 'Inflation' as the dependent variable with other explanatory variables.

Where:

Inf (inflation), lnrgdp (log of real GDP), lnimports (log of imports), fd (fiscal deficit), tb-91(treasury bills rate 91-days), lnwages_board (log of wages of the provate sector), lnwages_govt (log of wages government), lnm2 (log of the broad money supply)

When the equation (01) is converted to a regression model, it takes the following form:

$$\text{Inf}_t = \delta_0 + \delta_1 rgdp_t + \delta_2 imports_t + \delta_3\, fd_t + \delta_4 tb91_t + \delta_5\, wages\_board_t + \delta_6\, wages\_govt_t + \delta_7 m2_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (02)$$

δ_0 is the constant term, $\delta_1 - \delta_7$ are the coefficients of the equation 02 above and u_t is the scholastic error term.

ARDL Model

Auto-Regressive Distributed Lag (ARDL) co-integration procedure was employed to examine Equation (02) empirically.

The ARDL representation of equation (02) is formulated as follows:

$$\Delta\text{inf}_t = \delta_0 + \sum_{i=0}^{q} \delta_{1i}\, \Delta\text{inf}_{t-1} + \sum_{i=0}^{q} \delta_{2i}\Delta\text{lnrgdp}_{t-1} + \sum_{i=0}^{q} \delta_{3i}\Delta\,\text{lnimports}_{t-1}$$

$$+ \sum_{i=0}^{q} \delta_{4i}\, \Delta\text{fd}_{t-1} + \sum_{i=0}^{q} \delta_{5i}\, \Delta\text{tb91}_{t-1} + \sum_{i=0}^{q} \delta_{6i}\, \Delta\text{lnwages\_board}_{t-1}$$

$$+ \sum_{i=0}^{q} \delta_{7i}\Delta\text{lnwages\_govt}_{t-1} + \sum_{i=0}^{q} \delta_{8i}\, \Delta\text{lnm2}_{t-1} + \propto_1 \text{inf}_{t-1} + \propto_2 \text{lnrgdp}_{t-1}$$

$$+ \propto_3 \text{lnimports}_{t-1} + \propto_4\, \text{fd}_{t-1} + \propto_5\, \text{tb91}_{t-1} + \propto_6\, \text{lnwages\_board}_{t-1}$$

$$+ \propto_7 \text{lnwages\_govt}_{t-1} + \propto_8\, \text{lnm2}_{t-1}$$

$$+ \varepsilon_t\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{3})$$

Where Δ indicates the first difference operator, ε_t – random error term, δ_0 is the constant, $\delta_{1i} - \delta_{8i}$ Short-run coefficients and $\alpha_1 - \alpha_8$ long-coefficients estimated in the model.

Data Analysis and Empirical Findings

Unit Root Testing

When detailing with a time series analysis, visual examination of the stationarity of the variables is not appropriate. It is, therefore, necessary to scientifically ascertain that the series does not show a unit root to avoid obtaining spurious results. Hence used variables must be stationary

Realization and establishment of the presence of unit root can be done more efficiently through ADF and Phillip Perron test. Therefore, primarily under the test for unit root, two hypotheses are established in ADF and PP. The null hypothesis shows that the existence of a unit root means that the series is not stationary. On the other hand, the alternative indicates no unit root, meaning that the series is stationary. When the null hypothesis is rejected at level order (*=0), it must take the first difference of the series through which a stationary process can be achieved. If the null is rejected, meaning that the alternative hypothesis is accepted. This indicates that the series stands at the first difference I~ (I). Therefore, to determine the stationarity of the variables in this study, Augmented Dickey-Fuller and Phillips-Perron approaches are used to test the stationarity of the variables used in the study.

Table 1. Unit Root Test

| Variables | ADF | | PP | | Order of Integration |
	Levels	First Difference	Levels	First Difference	
Inf	-4.664979*** (0.0005)	-9.347774*** (0.0000)	-4.768232*** (0.0004)	-19.66441*** (0.0000)	I(0),I(I)
LnRGDP	-	-5.868135*** (0.0000)	-	-5.868135*** (0.0000)	I(I)
Lnimports	-	-2.738415 (0.0764)	-	--2.605826 (0.1000)	I(I)
fd	-	-7.612723*** (0.0000)	-	-7.609763*** (0.0000)	I(I)
TB-91	-	-6.269251*** (0.0000)	-	-7.749880*** (0.0000)	I(I)
LnWages_Board	-	-18.19338*** (0.0001)	-	-15.27947*** (0.0000)	I(I)
LnWages_govt	-	-5.131698*** (0.0001)	-	-5.140270*** (0.0001)	I(I)
LnM2	-	-2.738415 (0.0764)	-	-2.605826** (0.1000)	I(I)

Notes: inf(inflation),LnRGDP(log of real GDP),Lnimports(log of imports),fd (fiscal deficit),TB-91(treasury bill-91 days),Lnwages_board (log of nominal wages-board), Lnwages_govt (log of nominal wages-government), LnM2(log of broad money). P-values are in parenthesis. P-value, *p< 0.1,**p<0.01,***p<0.05 denotes rejection of the null hypothesis of a unit root at 10%,1% and 5% levels of significance respectively.

Source: Computed by Author using Eviews 10

All the variables became stationary after considering their first difference except inflation and GDP Deflator. However, currency depreciation and narrow money supply became stationary at levels and their first difference. Optimal lag lengths are determined by the Akaike Information Criterion (AIC). I (0) stands for the order of integration at order zero, while I (I) stands for integration at order one. The results of the unit root tests are presented in Table 01. All series except inflation, GDP Deflator, fd, tb-91and currency depreciation are converted into a log form. The table reveals that after taking the first differences of the variables, Real GDP, imports, wages_borad, wages_ govt, and M2   become stationary, meaning that they are all integrated of order I (I). The variable at the stationary level is inflation, which means that the variable is integrated of order I (0).

Information Criteria

Lag Selection Criterion

Since the results of the unit root testing (Table-01) reveals the variables are integrated into order at zero [I (0)] and one [I (I)] therefore ARDL technique could be applied with Akaike Information Criteria(AIC) using ARDL (5, 2, 3, 3, 3, 3, 3, 3: Figure 02).
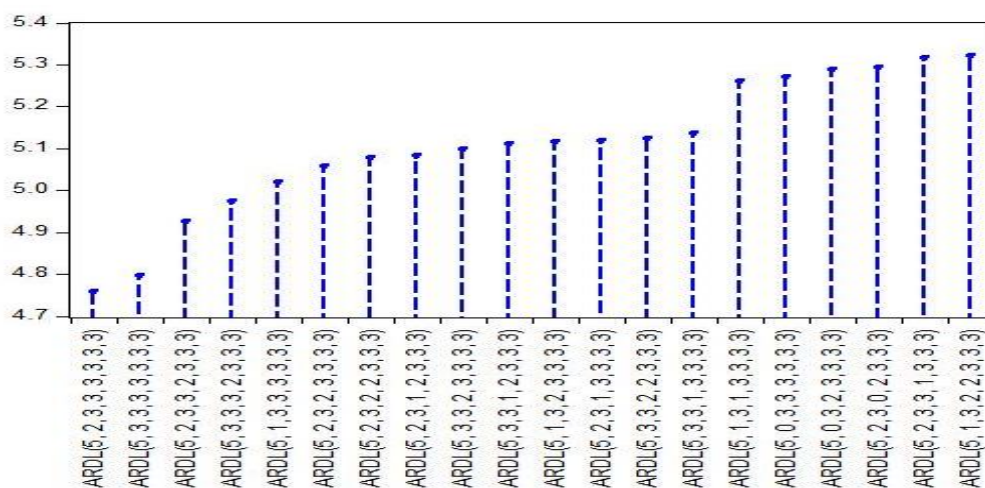

Figure 2. Akaike Information Criteria (AIC) for 20 Models

Bound Test Approach to Co-Integration

To study the co-integration relationship between variables, Autoregressive Distributed Lag (ARDL) bound test is used in this study. According to the bound test, if calculated F-statistics is greater than the critical value of the upper bound, co-integration among the variables can be found and confirmed in Table 02 below. If F-statistics is lower than the upper bound critical value, it lacks co-integration among the variables. (Raza, Shahbaz and Nyugen, 2015) Table 02 confirmed co-integrating relationships among demand-side factors determining inflation. Wald Test (F-statistics) is used in this study to check the existence of long-run relationships among the variables. Demand-driven aspects of elements in all four models provide evidence of long-run relationships among the variables.

Table 02. ARDL Bound Test

Significance Level	F-statistics	Critical Value		Conclusion
ARDL Bound Test Approach to Co-Integration				
Demand-Driven Factors of Inflation				
Model: Dependent Variable – Inflation				
		Lower Bound I(0)	Upper Bound I(I)	
5%	5.664807	1.96	3.18	Co-integration

Note: Demand-driven factors of inflation using Eviews 10

Source: Computed by the Author

Table 02 reveals the existence of co-integration at the 5% level of significance when the F-statistics for co-integration are compared with the F-test critical values. With the confirmation of the long-run relationship between the other explanatory variable in Sri Lanka from 1977-2to 019, the study estimated long-run and short-run dynamics to determine the determinants of inflation in the country

Demand Driven Factors of Inflation in the Long-Run

Table 3. ARDL Long Run Results

Variables	Coefficient	Std. Error	t-statistics	Probability
The Results of the ARDL Long Run Model				
Demand-Driven Factor of Inflation				
Model:Inf=f(lnrgdp,lnimports,fd,tb-91,lnwages_board, lnwages_govt , lnm2)				
ARDL (5,2,3,3,3,3,3,3)				
LNRGDP	40.69	19.00	2.13	0.0762
FD	-3.29E-05	1.39E05	-2.36	0.0559
TB-91	0.59	0.22	2.68	0.0361
LNM2	-60.88	19.96	-3.04	0.0225

Source: Computed by the Author using Eviews 10

ARDL long-run results are presented in Table 03. The 1st Column shows the names of the variables, long-run coefficients with their standard error, t-statistics and probability values are displayed in the 2nd, 3rd,4th and 5th columns, respectively. This study discusses the demand-driven factor of inflation is discussed. Real GDP is positively related to statistically significant inflation in Sri Lanka during the 1977-2019 period. Real GDP positively affects inflation in Sri Lanka as the estimated coefficient of real GDP takes the value of 40.69, indicating that a 1% increase in real GDP will increase inflation by 40.69 %. These results align with Kulatunge (2017), where the researcher has found similar results concerning Sri Lanka. Bandara (2011) and Bhattacharya (2014) have found that GDP is a key driver.

The study results show a statistically significant and negative relationship between fiscal deficit and inflation during the study period in the long run. The coefficient value indicates -3.29E-05 at 5% significant levels. Further, the study results show a statistically significant and positive relationship between treasury bills-91 days and inflation in Sri Lanka. The estimated coefficient of the TB-91 indicates that a 1% increase in the treasury bills rate can increase

inflation by 0.59 %. Simultaneously, the broad money supply shows a negative and statistically significant relationship with inflation in the long run as the estimated coefficient shows as -60.88 at a 1% significant level.

Demand-Driven Factors of Inflation in the Short-Run

Table 4. Results of the Estimated Short-Run Error Correction in the ARDL Approach

Estimated Short-Run Error Correction Model in ARDL Approach				
Model:Inf=f(lnrgdp,lnimports,fd,tb-91,lnwages_board, lnwages_govt , lnm2)				
ARDL (5,2,3,3,3,3,3,3)				
Variables	Coefficient	Std. Error	t-statistics	Probability
D(LNRGDP)	111.67	54.1	2.06	0.0849
D(LNRGDP)(-1)	154.89	49.43	3.13	0.0202
D(LNIMPORTS)(-2)	54.83	9.84	5.56	0.0014
D(FD)(-1)	6.22E-05	9.71E-05	6.4	0.0007
D(FD)(-2)	3.07E-05	8.31E-05	3.69	0.0101
D(LNNWRI-BOARD)	111.85	19.04	5.87	0.0011
D(LNNWRI-GOVT)	125.91	16.20	7.77	0.0002
D(LNM2)(-1)	312.06	45.26	6.89	0.0005
ECM(-1)	-2.701225	0.27	-9.90	0.0001

Note 1: R-squared : 0.96, D-W Statistics: 1.94 , Adj. R-squared: 0.89

Note:2: LNRGDP (log of real GDP), LNIMPORTS (log of imports), FD (fiscal deficit), LNWNRI_BOARD (log of nominal wage rate index_board), LNNWRI_GOVT (log of nominal wage rate index_govt.) LNM2 (log of the broad money supply). (2) D(LNRGDP)(-1), D(LNIMPORTS)(-2), D(FD)(-1), D(FD)(-2), D(LNM2)(-1)- stands for one year lag of real GDP, two years lag of imports, one year lag of fiscal deficit, two years lag of fiscal deficit, one year lag of broad money supply.

Source: Computed by the Author using Eviews 10

The fundamental feature in the short-run results is the speed of adjustment term. Speed of Adjustment term illustrates how much time will be required in an economy to recover from any external or internal shock and to reach a long-run equilibrium. Short-run determinants and their respective elasticities are tabulated in Table 04.

Short-run determinants and their respective elasticities are presented in Table 04 above. The short-run results reveal that the error term is negative and significant. More specifically, 2.7 % of any deviation from the long-run equilibrium following a short-run disturbance that occurred during the last period is corrected in the current period. A highly effective error correction term proves a stable long-term relationship.

The short-run result also shows that real GDP has a positive and significant effect on inflation in Sri Lanka at a 10% significant level. The coefficient of one year lagged real GDP depicts a positive and considerable nexus with inflation in Sri Lanka at a 5% level of significance. This can mean that the previous year's real GDP has increased the current inflation. These findings are consistent with the results of Kulatunge (2017).

The short-run results show that the imports of the two years lagged period describe positive and statistically significant developments in the short-run. Fiscal deficit in the short-term is positive and meaningful to inflation in one year and two years lagged, as shown in Table 11.5. This indicates that the previous year and the two-year fiscal deficit in Sri Lanka have caused more inflation. Earlier studies further confirmed these findings by Nguyen (2015), Ekanayake (2014) and Jayawardana and Jayasinghe (2016).

The estimated short-run coefficients of nominal wages _board and nominal wages_govt. Show statistically significant meaning that both types of wages impact the inflation in Sri Lanka in the short-run period than in the long run. It is an indication that wages in the private and government sectors play a more significant role to cause inflation in the country. Similar findings were obtained by Jayawardana and Jayasinghe (2016). The broad money supply in the economy makes the most significant impact in the short-run for inflation. The estimated coefficient value indicates 312.06 in the one-year lagged period. The previous year's broad money supply has a more significant impact on the current year's inflation in Sri Lanka at 312.06%. Kulatunge (2013), Jayawardana and Jayasinghe (2016) have confirmed the present findings through their studies.

Model Efficiency Test

Serial Correlation LM Test

Table 05 reports the results of the diagnostic test of autocorrelation. The null hypothesis (H0) claims no autocorrelation, while the alternative hypothesis (H1) should be rejected if the p-value of the observed R-squared is less than the 0.05 level of significance. Therefore, there is no serial correlation in the estimated model since the p-value of the probability is 0.2697, which is greater than the 0.05 level of significance. As the corresponding p-value of the Breusch–Godfrey serial correlation LM test given in Table 05 is more significant than at a 5% significance level, the estimated model in this study does not suffer from the autocorrelation issue.

Table 5. Results of Serial Correlation

Breusch–Godfrey Serial Correlation			
Model:-Inf=f(lnrgdp,lnimports,fd,tb-91,lnwages_board, lnwages_govt , lnm2)			
ARDL (5,2,3,3,3,3,3,3)			
Model	F-statistics	Obs*R-squared	Prob(3,3)
ARDL	2.17	26.03	0.2697

Source: Computed by the Author using Eviews 10

Heteroskedasticity Test: ARCH

The test is for heteroscedasticity, where the null hypothesis (H₀) claims that residuals are homoscedastic. The alternative hypothesis claims that the residuals are heteroscedastic, and thus the variance is not constant. The rejection rule states that the null hypothesis should be rejected if the probability value of observation R-squared is less than the 0.05 level of significance. Since the probability of Chi-Square of 0.1078 is more significant than 0.05, the test fails to reject the null

hypothesis of constancy of variance among the residuals in the model and thus is deemed to be homoscedastic.

Table 6. Results of Heteroskedasticity Test of ARCH

Heteroskedasticity Test: ARCH			
Model:Inf=f(lnrgdp,lnimports,fd,tb-91,lnwages_board, lnwages_govt , lnm2) ARDL (5,2,3,3,3,3,3,3)			
Model	F-statistics	Obs*R-squared	Prob(1,35)
ARDL	2.63	2.58	0.1078

Source: Computed by the Author using Eviews 10

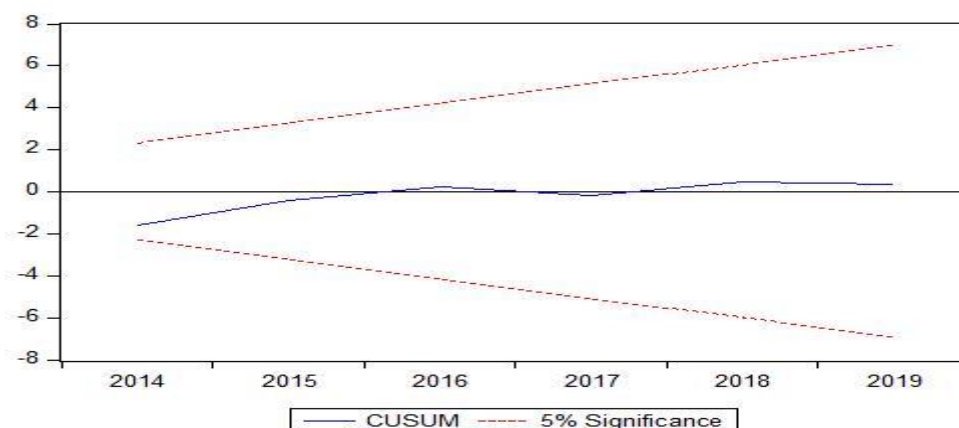**Stability Test**

CUSUM and CUSUM Squares

Stability and Residual Checking

They are centred on cumulative sums of scaled recursive residuals, the CUSUM test statistics map the cumulative sum along the 5% critical lines against time. If the total sum goes below the critical lines of 5%, the test reveals the volatility of the parameter. The cumulative sum (CUSUM) and the cumulative sum of squared (CUSUM-Q) were added to the analysis to measure the long-run coefficients' consistency and the short-run dynamics. The graphical illustration of the CUSUM AND CUSUM-Q is presented in Figure 03. The CUSUM test plot below is the limit and is thus statistically proved to be the consistency of the model's short-run and long-run coefficients. As it lies between the two borders, the model is stable. The dependent variable (inflation), in other words, has equilibrium and becomes a continuous variable.

The CUSUM-Q is presented below. The CUSUM-Q is also within the boundaries, although there is a deviation from the stability boundary during the 2014 period. However, the model becomes stable after that.


Figure 3. Plots of CUSUM Squares

The plots of both the CUSUM and CUSUM-Q are within the boundaries and hence statistically proven the stability of the short-run and long-run coefficients of the repressors that impact the level of inflation in Sri Lanka during the study period. Therefore, according to the CUSUM and CUSUM-Q, the model seems to be stale and correctly specified through marginal deviation in the CUSUM-Q. None of the two tests deviates from the 5% level significance bounds.

Normality Test for Demand-Driven Factors of Inflation
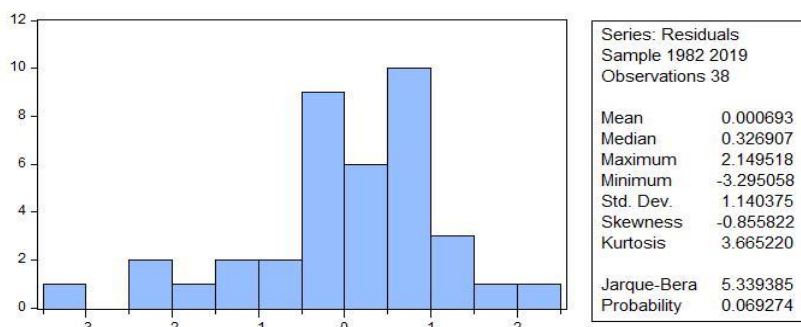
Figure 4. Normality Test-Model

Pairwise Granger Causality Test on Direction of Causality

Table 7. Results of Granger Causality Test (At Lag 2)

| Null Hypothesis	Observations	Probability	Conclusion
(1) H0: REAL GDP does not Granger Cause INFLATION	41	0.0162	Reject H0: because REAL GDP causes INFLATION
(2) H0: INFLATION does not Granger Cause REAL GDP	41	0.1191	Do Not Reject H0: INFLATION does not Granger causes REAL GDP
(1) H0: IMPORTS does not Granger Cause INFLATION	41	0.0124	Reject H0: because IMPORTS cause INFLATION
(2) H0: INFLATION does not Granger Cause IMPORTS	41	0.2103	Do Not Reject H0: INFLATION does not Granger causes IMPORTS
(1) H0: FISCAL DEFICIT does not Granger Cause INFLATION	41	0.0246	Reject H0: because FISCAL DEFICIT causes INFLATION
(2) H0: INFLATION does not Granger cause FISCAL DEFICIT	41	0.4835	Do Not Reject H0: INFLATION does not Granger causes FISCAL DEFICIT
(1) H0: TREASURY BILLS RATE does not	41	0.0745	Do Not Reject H0: TREASURY BILLS

Granger Cause INFLATION			RATE does not cause INFLATION
(2) H0: INFLATION does not Granger Cause TREASURY BILLS RATE	41	0.2432	Do Not Reject H0: INFLATION does not Granger causes TREASURY BILLS REATE
(1) H0: WAGES_BOARDS does not Granger Cause INFLATION	41	0.0500	Reject H0:because WAGES_BOARD causes INFLATION
(2) H0: INFLATION does not Granger Cause WAGES_BOARDS	41	0.1526	Do Not Reject H0: INFLATION does not Granger causes WAGES_BOARD
(1)H0: WAGES_GOVT does not Granger Cause INFLATION	41	0.0190	Reject H0:because WAGS_GOVT causes INFLATION
(2) H0: INFLATION does not Granger Cause WAGES_GOVT	41	0.9084	Do Not Reject H0: INFLATION does not Granger causes WAGES_BOARD
(1) H0: BROAD MONEY does not Granger Cause INFLATION	41	0.0022	Reject H0:because BROAD MONEY causes INFLATION
(2) H0: INFLATION does not Granger Cause BROAD MONEY	41	0.2242	Do Not Reject H0: INFLATION does not Granger causes BROAD MONEY

Source: Author's Computation

Table 07 depicts the Pairwise Granger Causality test results between inflation and its demand-driven factors with a single equation. The results show the direction of influence of the variables in model-01. The null hypothesis that real GDP does not Granger cause inflation is rejected at 5% significance levels as the corresponding p-value is less than 0.05. The null hypothesis that imports do not Granger cause inflation is not accepted at 5% significance levels as the p-value is less than 0.05. Similarly, the null hypothesis of fiscal deficit, wages board, wages of the government sector, and broad money are all rejected at a 5% significance level as the corresponding p-value of each variable is significantly lower than the 0.05 level. However, treasury bills do not Granger cause inflation, or inflation does not Granger cause treasury bills at a 5% significant level as the p-values are higher than 0.05. In model-01, real GDP, imports, fiscal deficit, wages of the private sector, wages of the government sector, and broad money supply may cause inflation in Sri Lanka during the 1977-2019 period. According to Table 07, all the variables except treasury bills show one-way causation (unidirectional causality) with inflation.

Impulse Response Function

This section analyzes the dynamic properties of the demand-driven factors of inflation using Impulse Response Functions (IRF). Figure 05 shows the IRF of the inflation to a standard deviation shock to the real GDP, imports, fiscal deficit, treasury bills rate, wages of the private sector, wages of the government sector and broad money supply. The x-axis gives the time horizon or the duration of shock, whilst the y-axis shows the direction and intensity of the IRF. In figure 06, the Impulse Response Function (IRF) results are presented. It shows a positive shock to inflation until the 2nd period followed by a negative impact, but it is positive from the 4th period and then negative until the 10th period. In response to real GDP to inflation, until the 2nd period, it shows a negative impact, but from the 3rd period and after that, it stabilizes. The imports have a negative effect till the 2nd period are followed by positive shocks to inflation reaching its peak in the 5th period and stabilizes after that. However, it is not in line with what is expected and observed. The shocks of treasury bills rate hurt inflation until the 4th period. However, the 4th-5th period indicates a positive impact and the rest of the periods with adverse shocks. Wages of the private sector mean positive IRF to inflation, reaching its peak and gradually settling down with negative results. On the contrary, wages of the government are in line with what is expected and observed as it has positive implications throughout the 10th period.
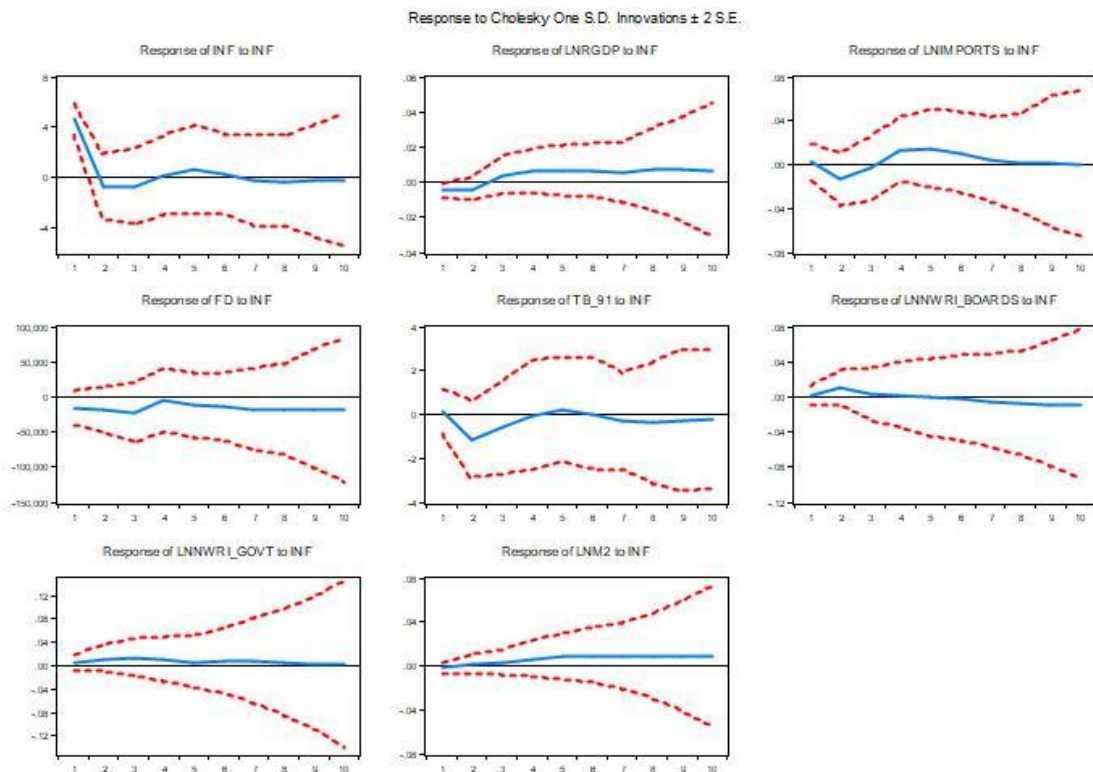
The broad money supply will have expansionary effects except for the 1st period, which is negative but shows positive shocks to inflation.

Figure 05. Impulse Response Function

Conclusion and Implications

It can be concluded that, real GDP, fiscal deficit, treasury bills rate, and broad money supply can explain inflation in Sri Lanka in the long run. Further. Real GDP has a more significant impact on inflation in the long run than the treasury bills rate. Therefore, the results emphasize the need to have a stable macroeconomic condition to promote growth, ensuring price stability. Further, it highlights that the policymakers should pay attention to the growth-inflation relationship. However, it is not desirable to bring down inflation to a shallow level (or zero inflation) as it might adversely impact economic growth too. Hence, it is a real challenge for policymakers to find the desirable growth rate consistent with its inflation condition. Moreover, in the short run, real GDP, imports, fiscal deficit, wages of the private sector and wages of the government sector significantly impact inflation in Sri Lanka.

Based on the conclusion of the study, several policy implications can be drawn. Sri Lanka, as a nation, has a small economy, so that demand-driven inflation may cause due to the impact generated through expansionary monetary and fiscal policies. Therefore, close coordination of the two policies is a must to ensure that the country enjoys a controlled inflationary situation. Policies such as controlled fiscal deficit and money supply could be helpful tools that policymakers can think of controlling inflation in Sri Lanka. The study found that an increase in money in the economy will increase prices in the country. Money supply indicated the highest impact on inflation. Thus, due to higher growth in money supply, investment opportunities will go up, and more employment opportunities will be generated in the country. This will cause the aggregate demand to rise and cause the domestic prices of goods and services due to higher demand. These results clearly show the money supply impacts the inflation through demand side.

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