THE DETERMINANTS OF INFLATION IN SRI LANKA: 1979-2015

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ABSTRACT

Keeping a low inflation rate is one of objectives to ensure macroeconomic stability in an economy. This paper aims to establish the main determinants of inflation in Sri Lanka using data for the period spanning from 1979 t o 2015.Colombo Consumer Price Index, Real GDP, rice price, exchange rate, money supply and interest rate were used as the predictors of the model.Vector Autoregressive was used in the data analysis.

Study identified that money supply growth andrice price increases are the key determinants of inflation in Sri Lanka in the long run. Exchange rate depreciation andoutput gap have no statistically significant effect on inflation. In the shortrun, rice price is the most important variable. Outputgap does not have a statistically significant effect on inflation in both thelong run and the short run.

Keywords:- Inflation, Macroeconomic stability, Money Supply, Rice Price, Sri Lanka.

INTRODUCTION

Inflation refers the continuous rise of the general price level over the period. High and volatile inflation would make huge influence to the whole economy. Persistent inflation in goods and services generates high social costs. When inflation is volatile

from year to year it becomes difficult for economic agents to predict correctly the rate of price inflation in near future and get economic decisions correctly. If we can make accurate predictions of inflation, they can anticipate what is likely to happenand take steps to protect themselves. During this period, the trend of inflation recorded in Sri Lanka has been highly volatile and hasemerged as the most common problem all over the country. Colombo ConsumerPrice Index, which is the official price index to measure inflation in Sri Lanka, inflation rate increased to 21.5% in 1990 from 16.6% with respect to 1984.Between the mid of 1990s,it has decreased gradually and in 2002 the inflation rate was declined. However, after 2003, theinflation rate has been increasing gradually again until 2008 (Annual Report of CBSL,1984-2003). In year 2008, the inflation rate was recorded at a peak at 22.6 percent.Kesavarajah (2008) have pointed out the factors which affected to the behavior of inflation rate a s growth of money supply, interest rate, budget deficit and depreciation of the Sri Lankan currency against the dollar. From 2009 to 2015 the inflation rate has increased gradually and peak at 7.6% in 2012 and decline to 3.3% in 2014 (Annual Report of CBSL,2009-2015).

Research problem statement can be pointed out as macro- economic policies are aimed at having a low inflation rate and stable economic growth rate while inflation plays a si gnificant role as an indicator. Therefore, keeping these rates stable is a must to maintain the macroeconomic stability of an economy. Therefore, identification of determinants of inflationand forecasting accurately becomes necessary at this context as it helps both economic agents for decision making process as well as to predict ofinflation could also enable Central Bank to conduct its monetary policy effectively andefficiently to achieve its objective of price stability. This study is aimed at identifying themain determinants of inflation in Sri Lanka. The research question of this study is what determines the level of inflation in Sri Lanka. Objectives of this study are to investigate the relevant variables influencing inflation in Sri Lanka by using both theoretical and VAR based model over the period of 1978-2015 and to recommend appropriate policy actions that can be applied by the relevant authorities based on thefindings of this study.

THEORETICAL BACKGROUND

Inflation is a multidimensional phenomenon with different views of economists. Classical economists believed that there is an adverse and proportional relationship between money supply and general price level according to the quantity theory of money (Smith,1776). Therefore, money supply is the only factor that affects to the inflation.Keynesian has pointed out that inflation arises when there is an inflationary gap in the economy which comes to exit when aggregate demand exceeds the aggregate supply at full employment level of output (Keynes,1936).The theory on monetarism was brought forward by Friedman (1982) and the theory based on the quantity theory of money and linked spending to the total amount of money inthe economy. According to monetarism, inflation was as a result of an increase in the supply ofmoney in the economy. He concludes that inflation occurs if the growth of money supply inthe economy supersedes the economic growth(Friedman,1956).

New structuralistsí views hold that inflation results from the worker ñ capitalist conflict over the distribution of income between real wages and profits. The new structuralistsí approach links between stresses the importance of the inflation, food supply and competing claims for the distribution of income. According to their model of inflation, monetary policy accommodates changes in the price level. In this model, the link between prices, money supply, and fiscal deficits are captured by introducing foodsubsidies, which account for the government budget constraint (Ahuja, 1998).

LITERATURE REVIEW

Various researches have examined the determinants of inflation in an economy. This section, analyzes how the previous researches have given their contribution towards examine the key determinants of inflation of a country. Several attempts have been made to investigate the determinants of inflation in several countries.

Bandara(2000) investigated the short run dynamics of the inflation in Sri Lanka by using a cointegration approach. He found that exchange rate depreciation and the foreign price levels have significant effects on domestic inflation. Finally researcher concluded that both money supply and exchange rate movements have significant effect on de ciding the rate of inflation in the long run. Based on t he Error Correction Model he indicated that money supply doesnot have any significant impact on the rate of inflation.

Chaudhry and Chaudhry (2005) examined the determinants of inflation in Pakistan using ARDL approach to cointegration using Price level, reap output,money supply and unit price of imported goods. They concluded that growth rate of import prices as the most important determinant of inflation in Pakistan both in short and long run. The effect of Money supply on inflation is negligible and statistically insignificant.

Samuel and Ussif (2001) investigated determinants of inflation in Tanzania based on the OLS estimation and Error Correction Model. They found that in Tanzania, output and monetary factors are themain determinants of inflation.

Kesavarajah (2008) studied the determinants of inflation with respect to Sri Lanka after economic liberalization. With that purpose the researcher employed an econometrics analysis based on co-integration analysis over the period spanning from 1977 to 2008 by taking money supply, budget deficit, interest rate, real GDP and exchange rate on the inflation rate. He indicated that increasing broad money supply, rising government budget deficit and exchange rate depreciation as the key determinants of inflation. Also it reveals that there is a stable inflation function in the long run in Sri Lanka and pointed out the reliability of forecasting inflation by using money supply growth, budget deficit and exchange rate depreciation.

Kirimi (2014) investigated the determinants of inflation in Kenya for the period1970-2013 by using both theoretical and empirical literature. Study employed ordinary least squares (OLS)and variables that used are annual inflation rate, Central Bank rates, money supply, Exchange rates, oil price, wages, food prices,

Political instability and corruption. Study revealed that, there was a negative relationship between food price and inflation level. Central Bank rates of Kenya was found to be statistically significant incausing the variation in inflation rate. Money supply and exchange rate had a positiverelationship with the inflation rate. GDP growth rate and the corruption perception had anegative relationship with inflation. Wage rate coefficient was found insignificant in causingthe changes in inflation with political instability having no effect on inflation.

Likukela (2007) examined the determinants of inflation in Namibia from 1993 to 2003 by employing various econometric techniques. Research variables are Namibian price, as the dependant variable, and the Real Gross Domestics Product,Broad money supply, interest rate, and South African Price index as well as the UnitedStates price index, being the explanatory variables. Inflation equations that were estimated using quarterly datafrom 1993 to 2003 for Namibia, South Africa and United States, and it was found that inthe short run, domestic prices are influenced by the level of economic growth andforeign prices, in particular South Africa. This conclusion is consistency with results from Goamab (1996) and Odada etal (2000).

Ruzima and Veerachamy (2013) have done a study on determinants of Inflation inRwanda from 1970-2013.They investigated theinfluence of government spending, import of goods and services, population growth, agricultureoutput and foreign direct investment on inflation. Time series data for the period of 1970-2013 have been used.OLS method was employed to estimate theregression model. Findings indicated that agriculture output and import of goods and services are the key determinants of inflation in Rwanda. Population growth is statistically significant and negatively correlated with inflation. Therefore, government spending and foreign direct investment have aninsignificant negative and positive impact on inflation respectively. Policy implications of thefindings have been discussed.

Lim and Papi (1997) have done an econometric analysis of the determinants of inflation in Turkey. Analysis is based on the multi sector macroeconomic model

during 1970-1995.The main findings are that monetary variables (money and exchange rate) play a significant role for deciding key factors of inflation.

Ratnasiri(2005) examined the main determinants of inflation in Sri Lanka using Vector Autoregressive analysis. The results indicated that money supply growth andrice price increases are the main determinants of inflation in Sri Lanka inthe long run and exchange rate depreciation andoutput gap have no statistically significant effect on i nflation. In the shortrun, rice price is the most important variable as it is a totally endogenousvariable. But, money growth and exchange rate are not so importantvariables as t hey are weakly exogenous in the adjustment process. Outputgap does not have a st atistically significant effect on inflation in both long and short runs.

METHODOLOGY

Data and Empirical Model

This paper attempts to examine the main determinants of inflation in SriLanka over the period 1978 ñ 2015 using Vector Autoregressive analysis. The data used in this analysis is quarterly data over the sample period, January 1978 through December 2015. The software employed in this analysis is EViews 7.0 and the variables used for model are Colombo Consumers Price Index (CCPI), Gross Domestic Product (GDP), money supply, exchange rate, rice price and interest rate.

Model Specification

$$A0 \; yt = c + A1 \; yt\text{-}1 + Ap \; yt\text{-}p + \bar{R}t$$

Where yt is a (6) dimensional vector of variables: Output gap, Colombo Consumer Price Index ,money supply, Rice Price, Interest rate, Exchange rate depreciation. A0 is a (6*6) dimensional matrix with contemporaneous coefficients, c i s a (6) dimensional vector of constants and A1Ö Ö Ap are (6*6) dimensional autoregressive coefficient matrices. $\bar{R}$is a vector of pair wise uncorrelated structural innovations with unit variance.

Estimation Techniques

Several statistical methods and econometric tests were done to explore the determinantsof inflation in Sri Lanka as Vector AutoRegressive model, variance decomposition, impulse response function, and Vector ErrorCorrection Model (VECM).

Researchers can test the unit root by performing the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and Phillips Perron Test for identifying the stationarity of the variables. Stationary of the series confirmed by Inverse Roots of AR characteristic Polynomial. Also impulse response and variance decomposition employed to capture the impact of variables on inflation.

RESULTS AND DISCUSSION

The results of the Unit Root Tests

Augmented Dickey fuller test (ADF) under Schwartz information criteria and the Philip Perron (PP) test under Bartlett Kernel and newly west bandwidth were conducted to test the stationary of the series. The log value of all series except Treasury bill rate was considered for stationary and unit roots. ADF used to test the unit roots using the null hypothesis that the series has a unit root. The results of the ADF test and PP test are presented in table 1.

Table 1:Results of unit root tests

Series	ADF Test		Philip Perron Test	
	Level	First Difference	Level	First Difference
ln GDPSA	2.488369	-12.31365**	2.539363	-12.36103**
ln M2	-0.486187	-3.766748**	-1.398794	-12.11058**
ln CCPI	-1.487328	-12.58576**	-1.469103	-12.58576**
ln Rice Price	-1.504805	-11.77392**	-1.508510	-11.40707**
ln Exchange rate	-1.817839	-9.147005**	-1.886818	-9.067932**

TB_91	-3.211232**	-13.01977	-3.100614**	-13.02393

* 1% critical value - 3.473   ** 5% critical value -2.880   *** 10% critical value - 2.577

According to the ADF and PP test it shows that TB_91 at its level and all the other variables at their first differenceare stationary at 5% significant level.

 Figure A shows that gdpsa, ccpi , m2 , Rice_p , Usd_rs are integrated of order one andTb_91 is integrated at level. Stationarity of the series is confirmed by the graph of the inverseroots of AR characteristic polynomial as well. According to theory, the estimated VAR isstable (stationary) if all roots have modulus less than one and lie inside unit circle.Figure 1 shows that all roots of AR characteristics polynomial of the series lieinside the unit circle.

CO-INTEGRATION

With the stationary of variables, the presence of long run cointegration among variables is tested by a pplying Johanson Cointegration for the series that are integrated at first difference. It hasbeen shown by the Johanson Cointegration test that there is a one co- integration vectorin the series. Linear deterministic trend was assumed in the test.

Table 2: The Results of the Co-integration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.437657	100.0213	69.81889	0.0000
At most 1	0.165429	37.85173	47.85613	0.3085
At most 2	0.099859	18.32131	29.79707	0.5424

At most 3	0.057809	6.959245	15.49471	0.5824
At most 4	0.004878	0.528159	3.841466	0.4674

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

At the first stage, the null hypothesis of H_0 :Rank=0 and the alternative hypothesis of H_1 :Rank>0,was tested. The trace statistics (100.02) is greater than the corresponding critical value (69.819) at the 5% significance level.Therefore, we reject the null hypothesis and conclude the existence of co-integration. The second test indicates that the trace statistics (37.851) is less than the corresponding critical value (47.856) at the 5% significance level to accept the null hypothesis and conclude the non-existence of co-integration. In 1st stage corresponding p-values (0.0000) is smaller than the 5% significance level further supporting the rejection of null hypothesis. At the third level of the test with H_0: Rank=2 and the alternative hypothesis of H_1 :Rank >2,were tested.So,the null hypothesis can be rejected; because the trace statistics (18.321) is less than the corresponding critical value (29.797) at the 5% significance level, and p-value is also greater than the 5% significance level.Therefore,there is one co-integration relationships exit. Thus,the Vector Error Correction Model (VECM) was used to further analyze the determinants of inflation.

LONG RUN RELATIONSHIP

The results of the unrestricted co-integration rank test confirmed that there is a long run significant relationship among CCPI, money supply, exchange rate, and rice price. All the series are in natural logarithmic form. The coefficients measure the long run income, money supply, exchange rate and rice price elasticity respectively. Compared to the economic theory, these tests pointed out that in the long run, Inflation in Sri Lanka is positively related money growth, and rice price. However,

the relationship between inflation and exchange rate depreciation and GDP is not significant.

The findings of this study relating to Money supply growth and exchange rate depreciation are broadly in line with the findings of Bandara(2000) and Ratnasiri (2005). However we have observed that inconsistent of findings with the results for exchange rate depreciation with Bandara(2000) and Kesavarajah (2008).

Bandara (2000) and Kesavarajah (2008) found that exchange rate depreciation has a significant long run impact on inflation where as our study reveals that has no statistically significant impact. Both results of Bandara and Ratnasiriconfirmed that money supply growth has a significant effect on inflation in Sri Lanka as our study found.

The findings of effect of real GDP on inflation in this study are consistent with the findings of Kesavarajah and Ratnasiri (2005).It reveals that real GDP has a negative effect on inflation and statistically insignificant in long run.

The findings of this study with respect to the effect on rice price on inflation in long run are consistent with the findings of Ratnasiri (2008) as showing positive and statistically significance. But it is inconsistency with the results of Kirimi (2014) that he concluded that food price and inflation level has a negative relationship.

Table 3: Cointegrating relationship-Dependent variable: CCPI

Regressor	Coefficient	Standard error	t-ratio
lnM2	0.503253	0.08740	-5.75805*
ln Exchange rate	0.094237	0.09282	-1.01529
ln GDPSA	-0.082102	0.24856	0.33031
ln Rice Price	0.334051	(0.06122)	-5.45677*
Constant	-0.918426		

* Significant at 1 per cent level.

UNRESTRICTED VECTOR AUTOREGRESSIVE MODEL

The Unit root test results show that variables are integrated at first difference and level. Thus we can apply VAR method for estimation.

Unrestricted Vector Autoregressive Model was estimated by using the following variables.

CCPI ñ point-to-point growth (ccpi_p_p)

Output gap : Derived from Seasonally adjusted log form GDP ñ Using HP filter(Output gap)

Money Supply ñ M2 ñ point-to-point growth (m2_p_p)

Interest rate ñ 91-day Treasury bill yield (tb_91)

Rice price ñ point-to-point growth (rice_p_p)

Exchange rate depreciation ñ quarter-on-quarter growth (usd_rs_q_o_q)

IMPULSE RESPONSE

This section analyses the dynamic property of the model using variance decomposition andimpulse response functions. Figure 1 shows the response of the inflation rate to a standarddeviation shock to the output gap, money supply, rice price, 91 day treasury bill rate,and exchange rate. The xñaxis represents the time horizon or the duration of shock whilst theyñaxis shows the direction and intensity of the impulse or the per cent variations dependentvariable.
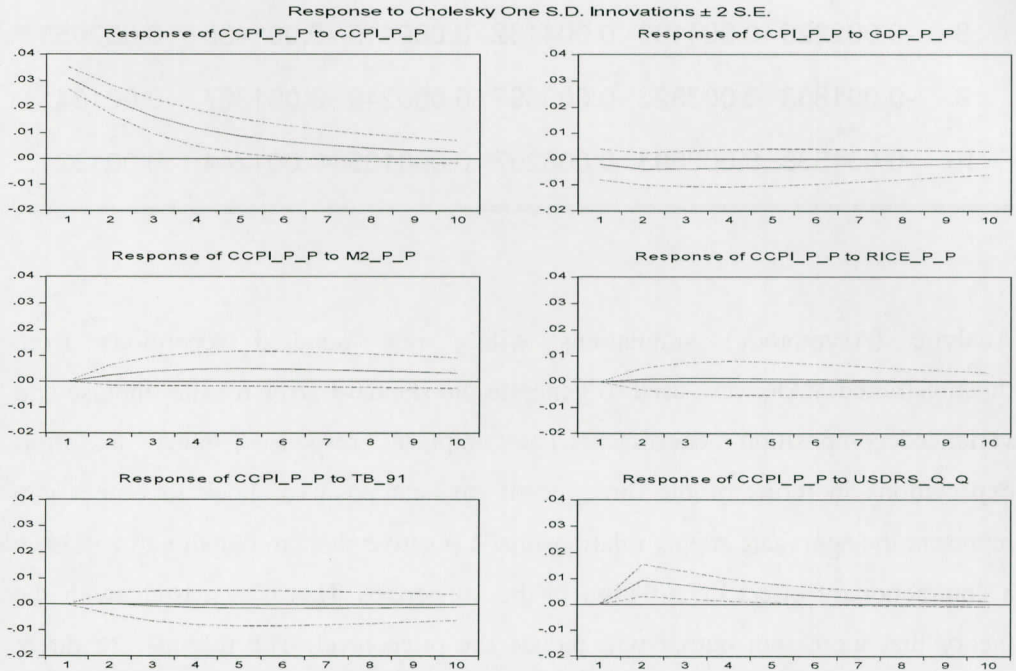
Figure 1:Response to One S.D. Innovations ± 2 S.E.

Table 4: Response to One S.D. Innovations ± 2 S.E.

Period	GDP_P_P	CCPI_P_P	M2_P_P	RICE_P_P	TB_91	USDRS_Q_Q
1	-0.002112	0.031013	0.000000	0.000000	0.000000	0.000000
2	-0.003889	0.022735	0.002483	0.000990	0.000219	0.009344
3	-0.003773	0.016230	0.004037	0.001400	-0.000741	0.007429
4	-0.003553	0.011809	0.004773	0.001389	-0.001304	0.005601
5	-0.003280	0.008798	0.004974	0.001178	-0.001557	0.004272
6	-0.002955	0.006709	0.004848	0.000903	-0.001621	0.003306
7	-0.002596	0.005224	0.004536	0.000637	-0.001580	0.002591

8	-0.002226	0.004139	0.004132	0.000415	-0.001485	0.002053
9	-0.001868	0.003323	0.003697	0.000249	-0.001367	0.001641
10	-0.001538	0.002693	0.003267	0.000135	-0.001244	0.001321

Analytic (Asymptotic) simulations within one hundred repetitions from theunrestricted VAR were used to generate the standard error for the impulse and variancedecomposition coefficients.The impulse responses meet a priori expectations in terms of the directive of impacta positive shock to output gap represent the aggregate supply relationship. A positive shockto output gap will have a contractionary effect on inflation in the 10 periods This is consistent with the theory that increasein output will reduce the price level. The response of direct shock (CCPI) to the inflationwill have a significant effect in inflation high in the first and second quarterthen it declines gradually. The response of inflation (CCPI) to money supply (M2_P_P)shows that the effect of one standard deviation shock to money supply on the CCPI occurafter first period and reached its peak between 4-7 periods after and stabilizes thereafter.The impact of the rice price has a p ositive effect on allperiods. Increase in 91 day Treasury bill rate will have a contractionary effectafter 3rd period .The impact of the exchange rate is ratherimmediate and reaches its peak during 2nd period and decline here after.

VARIANCE DECOMPOSITION

Figure 2 shows that the variance decomposition over the 10 Quarters. The statistics andgraphs indicate the percentage contribution of innovations in each of the variables in thesystems of the variance of inflation. About 90% of the variance in inflation is fromitself. This variance is partly reflecting the impact of variables not included in the model suchas prices of imported goods etc. The results show inflation itself and the USD-Rs exchangerate depreciation account for over 8% of

the variability in the inflation overallhorizons. About 6% of the variance in inflation is from money supply.

Variance Decomposition

Percent CCPI_P_P variance due to GDP_P_P

Percent CCPI_P_P variance due to CCPI_P_P

Percent CCPI_P_P variance due to M2_P_P

Percent CCPI_P_P variance due to RICE_P_P

Percent CCPI_P_P variance due to TB_91
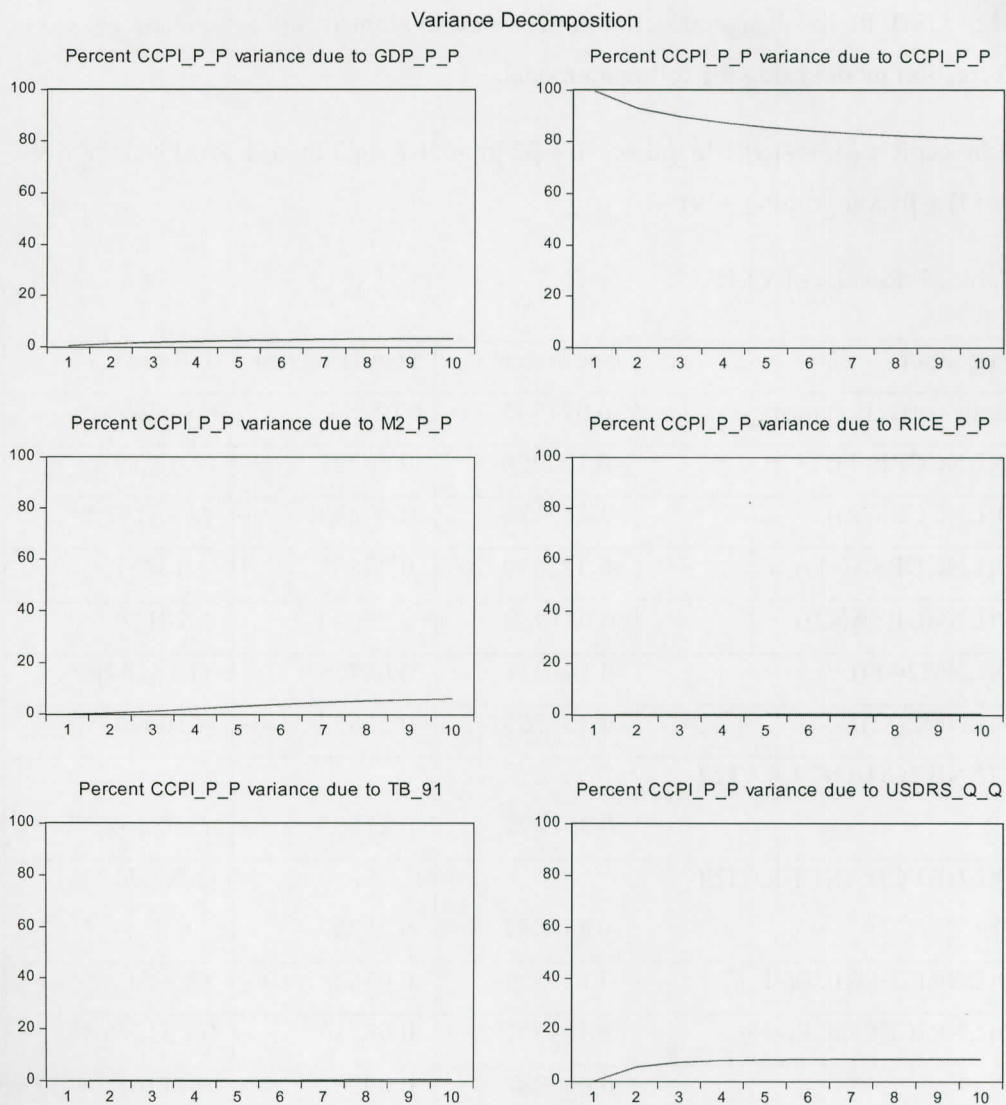
Percent CCPI_P_P variance due to USDRS_Q_Q

Figure 2:Variance Decomposition

VECTOR ERROR CORRECTION MODEL (VECM)

VECM shows the short-run properties of the model using log form of ccpi, gdp, M2, USD_Rs exchangerate, rice price was examined by estimation of error correction model using the followingmodel.

Δ ln_ccpit = $\delta 1$ + $\gamma 1$ ($\beta 1$ ln_gdpsat-1 + $\beta 2$ ln_m2t-1 + $\beta 3$ ln_usd_Rst-I + $\beta 4$ln_rice-pt-i I) + $\beta 5 \Delta$ ln_ccpit-1 + Vt

Table 5 :Results of VECM

Regressor	Coefficient	Standard error	T-Ratio
Error correction term	-0.091745	0.05611	(-1.63499)*
D(LNCCPI(-1))	-0.174990	0.10721	-1.63219
D(LNCCPI(-2))	0.412328	0.09238	(4.46357)**
D(LNGDPSA(-1))	-0.322470	0.28421	-1.13461
D(LNGDPSA(-2))	0.081980	0.29094	0.28178
D(LNM2(-1))	0.101024	0.08755	(1.15384)**
D(LNM2(-2))	0.363765	0.08857	4.10690
D(LNEXCHANGERATE(-1))	0.391099	0.11552	(3.38562)**
D(LNEXCHANGERATE(-2))	-0.126087	0.11787	-1.06974
D(LNRICEPRICE(-1))	0.119528	0.03588	(3.33101)**
D(LNRICEPRICE(-2))	-0.151571	0.03754	(-4.03776)**
C	0.000881	0.00782	0.11261
R-squared	0.535658		
Adj. R-squared	0.482452		
Sum sq. resids	0.055560		
S.E. equation	0.024057		
F-statistic	10.06765		
Log likelihood	255.6656		

Akaike AIC	-4.512326		
Schwarz SC	-4.214311		
Mean dependent	0.026718		
S.D. dependent	0.033440		

* Significant at 10 per cent level. ** Significat at 1 per cent level

Table 5 indicates the increase in therice price has strongest effect on inflation in the short-run which is followed by growthin money supply and exchange rate depreciation. The coefficient of the error correctionterm has correct sign and significant at 10% level. The coefficient ofthe ECM term gives an impression that adjustment is quite slow. Approximately 9% of theprevious quarterís disequilibrium in inflation from its equilibrium path will be corrected inthe current year. The R^2 at 53% indicate a fairly good fit. Only lag 1of Money growth and lag 2 of exchange rate depreciation are significant. Rice price isa totally endogenous variable. Therefore, it r eveals that inflation in Sri Lanka is mainly determined by money growth, increases in rice price and exchange rate depreciation in the long run and short run. Output growth is not animportant determinant in the short run and the long run. Bandara (2000) foundthat exchange rate depreciation has a significant impact on inflation and moneysupply growth has an insignificant effect.This study reveals both money supply growthand exchange rate depreciation have significant impact on inflation in short run.These findings are broadly in line with the findings of Ratnasiri (2005) and Kesavarajah (2008).

CONCLUSION.

The purpose of this study was to investigate the factors that determined inflation in the Sri Lankaneconomy using a VAR based co- integrationapproach analysis over the period 1978 to 2015.Identification and forecasting of inflation play significant role for Central Bank of Sri Lanka due to its implication for conducting the monetary policy efficiently and effectively. The analysis indicates thatmoney

supply growth andthe rice price as the key determinants of inflation in Sri Lanka in both short and long run. Therefore, it indicates the reliability of forecasting inflation in Sri Lanka using money supply growth, and rice price as key determinants.According to the estimated model, effect of GDP growth and exchange rate depreciationon inflation is negligible and statistically not significant. The short run effect of moneygrowth, rice price and exchange rate effect on inflation is statistically significant. But GDP growth is not significant in short run too. Being the rice price as a k ey determinant of inflation in Sri Lanka we can conclude that inflation in Sri Lanka is affected both demand and supply side factors in both short and long run.

The results of the study have met with crucial policy implications to deal with the existing inflation in Sri Lanka.First, money supply is tobe maintained at desired level. Also, if the supply of rice can be increased price inflation willcome down. Because food accounts for more than 60% of the weight used inthe Colombo Consumer Price Index. Therefore, it is important to control the unnecessary fluctuations of the rice price by imposing appropriate price controlling policies to maintain the stability of general price level in long & short run.

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