Determinants of Inflation in Sri Lanka: An Econometric Analysis based on VECM Approach

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ABSTRACT

The paper analyzes the determinants of inflation in Sri Lanka using monthly data from January-2003 to December-2010. Vector Error Correction Model employed as the main analytical tool along with ARIMA model. The results suggest that the long-term inflation in Sri Lanka is mainly driven by the rice price, monetary expansion and depreciation of the domestic currency. Additionally, industrial production and Treasury bill rate are also important determinants of domestic inflation. However, the inflation expectation of the public is the key factor of short run inflation. The current study recommends to control the monetary expansion which exceeds the capacity of the economy and at the same time to maintain the stability of the domestic currency. Moreover, it is essential to have asystematic pricing policy for rice as it is the staple food of the majority in Sri Lanka.

KEYWORDS: *Vector Error Correction Model, ARIMA, Inflation, Sri Lanka*

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1 INTRODUCTION

1.1 Background of the Study

One of the main objectives of the Central Bank is to maintain the internal and external price stability of the country. However, it has been commonly recognized that maintaining the internal price stability; avoid unnecessary fluctuations in the general price level, is the most- challengeable objective for all the Central Banks, globally. Consequently, Central Banks apply appropriate policies such as inflation targeting as the price stability significantly influences on most of the micro and macro level economic variables. According to both theoretical and empirical literature, neither deflation nor inflation is favorable for the smooth functioning of the economy. Nevertheless, both economists and policy makers have been addressing the phenomenon of price stability merely focusing on inflation as deflation is a unique problem for a few countries such as Japan. In the context of Sri Lanka, inflation has emerged as the most-volatile macroeconomic variable in the recent past. Therefore, the current study attempts to examine the main determinants of inflation in Sri Lanka based on the monthly data in which most of the previous studies have failed to compile.

Currently, the Central Bank of Sri Lanka and Department of Census and Statistics use Colombo Consumers' Price Index (CCPI) as the official price index to measure the inflation. Figure 01 illustrates the behavior of CCPI during the period of 2000 – 2010. According to the graph, the CCPI was just below 50 units at the beginning of the 2000, and it has doubled by 2007. The increasing pattern of the CCPI has become steadier after 2007, and it has continued up to the middle of 2008. However, after mid-2008, CCPI has started to decline gradually due to the lesser demand that is created by global economic crisis. During the recovery period of the financial crisis, CCPI has started to increase again and reached to the peak recording the highest value (147.2) in the history until 2010.

The volatile behavior of inflation in Sri Lanka during the period of 2000 – 2010, as measured by the changes in the CCPI, has depicted in Figure 02. As the graph illustrates, the inflation rate was highly fluctuating during the period of 2000 – 2004 between 17% and 0%.

Conversely, the inflation rate has continued to increase steadily after 2006 and it reached the highest value (28.3%) ever by July 2008. Thereafter, the inflation rate has declined sharply due to the contraction of the economy as a result of world economic crisis. From the beginning of the 2010, the inflation rate was aging approaching two-digit values with the reawaking of the global economy.

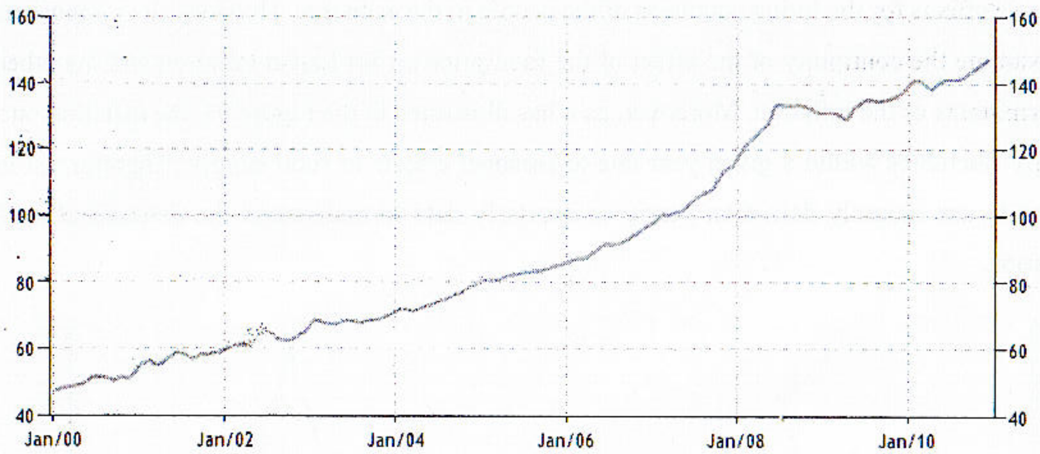

FIGURE 1: Sri Lanka Consumer Price Index from 2000 to 2010

Source: Created by the Authors based on the Data from Central Bank of Sri Lanka

The sharp increase of both CCPI and inflation during the period of 2008 – 2009 is mainly due to the world food price hick. During that period Sri Lankan economy highly depended on imported foods such as wheat flour, rice, milk and other food items. The world market prices of those goods were at very higher level during the mentioned period. At the same time, domestic rice production and other agricultural production were also affected by the unfavorable weather conditions. Consequently, the domestic food prices climbed up more than ever before letting people feel the severity of the "foodflation".

The Figure 3 illustrates the monthly food inflation in Sri Lanka in 2009. The year started with the highest food inflation of the year, 10.06%, and thereafter; it declined to -1.66 by April. However, after July, it has restarted to increase and continued until the year end.

Therefore, inflation in Sri Lanka highly depends on the food prices. Especially, in January-2008 food inflation was 25% while the non-food inflation was just only 12.5%. However, by May 2009 the food inflation has increased up to 43% while the non-food inflation declined down to 11%. As a result of the severe food inflation, the overall inflation in May 2008 has exceeded 24%, and it has further increased and reached the highest value in the history, 28.3%, by July 2008. Therefore, this increment of the headline inflation has brought many adverse effects for the living condition of the people in the economy. However, it is important to examine the continuity of the effect of the food price on Sri Lanka inflation and the other determinants of the inflation. Moreover, as it has illustrated in the Figure 03, the inflation rate highly fluctuates within a given year due to seasonal effects of food supply. Therefore, it is better to use monthly data than yearly or quarterly data to understand the determinants of inflation.

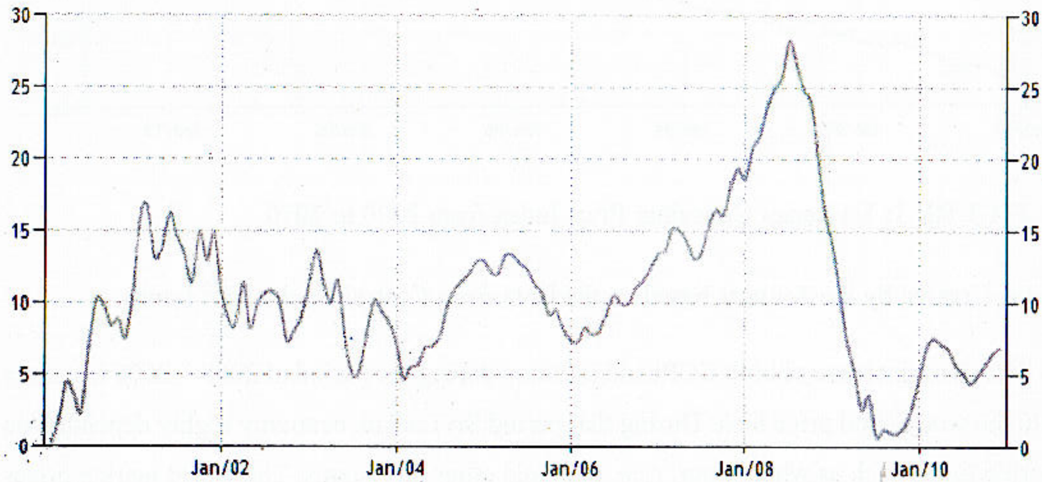

FIGURE 2: Inflation Rate of Sri Lanka from 2000 to 2010

Source: Created by the Authors based on the Data from Central Bank of Sri Lanka

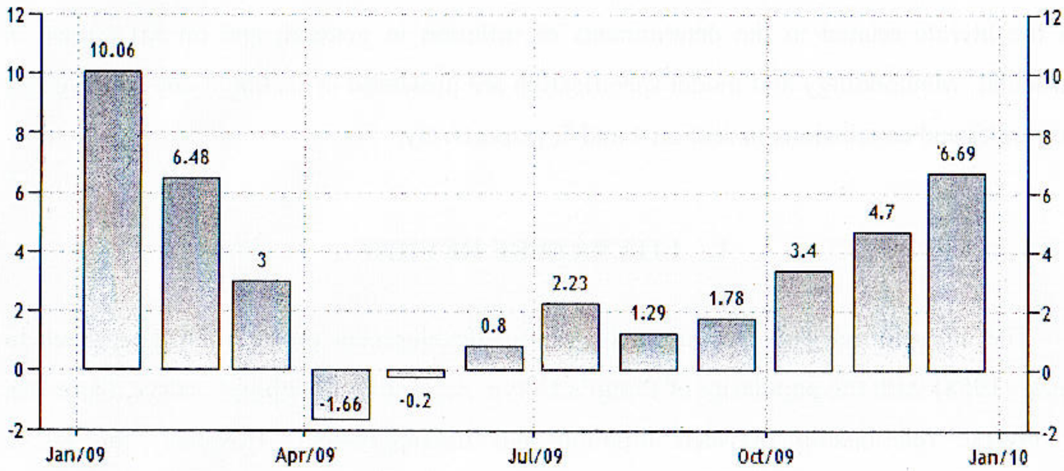

FIGURE 3: Food Inflation in Sri Lanka in 2009

Source: Created by the Authors based on the Data from Central Bank of Sri Lanka

1.2. Objectives of the Study

Several studies have been conducted to examine the determinants and the behavior of the inflation in Sri Lanka, especially using the annual and quarterly data (Mallik & Chowdhury, 2001). However, it is difficult to find the study, which is based on the monthly data. Usage of monthly data is highly important to examine the behavior of inflation since the inflation expectation and the other determinant of inflation such as food prices, exchange rate and interest rates are highly volatile. In addition, some of the studies have ignored the prices of agricultural products such as rice price that has currently become more important determinant of inflation. Consequently, the current study has two main objectives.

1. To identify the short run and long run determinants of inflation in Sri Lanka
2. To examine the short run dynamic and adjustment process of the inflation in the context of Sri Lanka.

The rest of the paper is structured as follows. The section 2 provides a brief discussion on the literate related to the determinants of inflation in general, and on Sri Lanka, in particular. Methodology and model specification are presented in section 3 and followed by the results and conclusions in section 4 and 5, respectively.

1. LITERATURE REVIEW

The more formal and recognized theoretical development on inflation dated back to Philip (1958) with the popularity of Philip's Curve. According the Philip's curve, there was an inverse relationship between inflation and unemployment. However, the initial development of this theoretical concept was amended according to the results of the past studies. An alternative approach for the initial Philip's curve was established by Phelps (1967) introducing "Natural Rate Hypothesis". Friedman (1968) has also supported this argument, and they were able to differentiate the long run and short run behavior of the Philip's curve. After that, the role of expectation on inflation was examined based on the different types of expectations. First, the adaptive expectation was documented by Lucas (1973) followed by Sargent and Wallace (1975). The further development of the theory successfully extended the role of expectation up to rational expectation hypothesis Sargent (1987) which overcome the weakness attached to the both Natural Rate Hypothesis and adaptive expectations. The evolution of the concept of expectation also resulted to extend the Philip's curve analysis forming the "Expectation Augmented Philip's Curve". However, among all other theoretical views; Freidman's view on long-term inflation still has a global recognition. According to him "Inflation always and everywhere is a monetary phenomenon" (Freidman, 1970). His notion was also supported by Laidler and Parkin (1975) and they mentioned that unnecessary expansion of money supply causes the inflation. Apart from that, Blanchard and Summers (1988) have come up with another hypothesis called "Hysteresis Hypothesis" and this hypothesis highlighted the dependency of Non-Accelerating Inflation Rate of Unemployment on the actual level of employment.

In addition to the theoretical literature, a small number of empirical works has addressed the price stability focusing on the inflation in Sri Lanka. In early 1990s, several empirical studies conducted by Nicholas (1990), Weerasekara (1992) and Rupananda (1994) have emphasized the effect of supply shocks on inflation in Sri Lanka. Further, Cooray (2007) has applied Error Correction Model to analyze inflation in Sri Lanka during the period of 1998-2006. The findings have emphasized the importance of supply shocks in determining the inflation in Sri Lanka. In addition, Cooray (2007) has indicated the existence of cointegration between the price level and the foreign exchange rate, real GDP and import prices. Similarly, Anand *et al.*, (2010) have tried to forecast the changes of Sri Lanka price level using Bayesian approach. Their analysis has based on the quarterly data from 1996 to 2010. Both Cooray (2007) and Anand *et al*, (2010) have stressed the effects of monetary expansion and exchange rate flexibility on inflation in Sri Lanka. Deerasinghe (2002) has conducted an empirical investigation on region wise inflation referring to the disparity of provincial household spending in Sri Lanka. Further, this study has attempted to develop sub-price indices for different districts of Sri Lanka. Despite the several studies have been conducted to analyze the inflation in Sri Lanka, the findings remain indecisive, hence, need further analysis. Especially, most of the studies have based on annual or quarterly data. However, the price changes are highly volatile and sensitive to both internal and external shocks. Consequently, the current study has taken the monthly data account to provide a more precious result together with the appropriate econometric tools.

2. METHODOLOGY

3.1 Data and Empirical Model

The study based on the monthly data over the period from January 2003 to December 2010 that collected from the series of annual reports of Central Bank of Sri Lanka. New Colombo Consumers' Price Index (CCPIN), which is the official consumer price index in Sri Lanka, was selected to measure the changes in price level. Chirtofferson and Wescott (1999) have suggested monetary aggregate, interest rate, exchange rate and real activity variable as the leading indicators of inflation. Accordingly, five main variables, namely, Broad Money Supply (M2b), Exchange Rate(ER), Treasury Bill (TB) rate as a proxy for the interest rate, Industrial Production Index (IPI) as proxy for the GDP and Rice Prices (RP) as a sensitive component, were included in the model.

The more general empirical model for this study can be stated as follows.

$$CCPIN_t = +\beta_1 M2B_t + \beta_2 ER_t + \beta_3 TB_t + \beta_4 IPI_t + \beta_5 RP_t + u \tag{1}$$

The above general model was estimated by applying appropriate econometric tools, and a brief discussion of the estimation technique has presented in the next section.

3.2 Estimation Techniques

3.2.1 Testing for the Unit Roots

It is a well-known fact that the non-stationary variables lead to spurious regressions in many time series analysis. Hence, the stationarity of the variables was checked to avoid the mentioned issue. Therefore, we tested the unit root by performing the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test (Kwiatkowski, Phillips, Schmidt & Shin, 1992).

ADF Unit Root Test

In the context of ADF test, the following models are constructed to test for the stationarity of the variables.

$$\Delta Y_t = \alpha_0 + \theta\, Y_{t-1} + \alpha_1 t + \sum_{j=1}^{p} \delta_j \Delta Y_{t-j} + \varepsilon_t \tag{2}$$

$$\Delta Y_t = \alpha_0 + \theta\, Y_{t-1} + \sum_{j=1}^{p} \delta_j \Delta Y_{t-j} + \varepsilon_t \tag{3}$$

Where Y_t denotes the index at time t, $\Delta Y_t = Y_t - Y_{t-1}$ the t is a time trend term and α_0 is the constant, the Coefficient for the trend term is α_l and δ_j are coefficients that are to be estimated by the model. P is the number of lagged terms and ε_t is the error term that is white noise.

The null hypothesis of unit root (H_0; θ_l=0), against the alternative hypothesis of no unit root (H_a; $\theta_l < 0$) were considered. If a series is found to have non-stationary, then the series is differentiated and tested for higher order integration.

KPSS Unit Root Test

. The theoretical concept of the KPSS unit root test is mainly base on the following models.

$$y_t = \beta' D_t + \mu_t + e_t \quad (4)$$

$$\mu_t = \mu_{t-1} + u_t \quad (5)$$

$$\text{Where } u_t \sim WN(0, \sigma_u^2)$$

In the above equation, D_t represents the deterministic part while u_t is stationary at level; *I(0)*. Further, μ_t follows the random walk with the variance ofσ_u^2. H0 gives the null hypothesis which indicates that y_t is stationary at the level form (H_0: $\sigma_u^2 = 0$) contrast to the alternative hypothesis (H_a: $\sigma_u^2 > 0$).

$$KPSS = \left(T^{-2} \sum_{t=1}^{T} S_t^2\right) / \lambda^2 \quad (6)$$

The above KPSS test statistic has used to test the null hypothesis against the alternative hypothesis.

3.2.2 Estimation of Auto Regressive Integrated Moving Average (ARIMA)

According to the ADF unit root test, all the variables have unit roots at the first difference level. The lag effect of LCCPIN was tested using the following ARIMA model. ARIMA (p, 1, q) was investigated using different values for p and q based on the following model.

$$\Delta LCCPIN_t = \mu + \rho_1 \Delta LCCPIN_1 + \ldots + \rho_p \Delta LCCPIN_{t-p} + \varepsilon + \gamma_1 \varepsilon_{t-1} + \ldots + \gamma_q \varepsilon_{t-q} \qquad (7)$$

The best ARIMA model can be selected based on AIC and SC values. The lowest values for the AIC and SC are always attached with the best ARIMA model.

3.2.3 Cointegration Test and Vector Error Correction Model (VECM)

In order to verify whether there is long run equilibrium in the economy, economists usually check the cointegration among the variable after the order of integration of the time series is tested. This is highly demanding when dealing with macroeconomic non-stationary data, since those data are normally known to be cointegrated. Therefore, in a way to check the integration among the variables, we are able to cope up with either Engle – Granger test (1987) or Johansen test (1988). Since, the Engle – Granger test limits only to one cointegration vector, we applied the Johansen test that has especially designed to capture even multiple cointegartion vectors among the non-stationary variables.

Assume a Vector Auto Regression (VAR) of order *P* as follows;

$$y_t = \lambda_1 y_{t-1} + \ldots\ldots + \lambda_p y_{t-p} + e_t \qquad (8)$$

Where *Yt* is a *n x 1* vector of non-stationary I(1) variables and et is a *n x 1* vector of innovations. We can rewrite the VAR as follows.

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} G_i \Delta y_{t-i} + e_t \qquad (9)$$

Where,

$$\Pi = \sum_{i=1}^{p} \lambda_i - I \text{ and } G_i = -\sum_{j=i+1}^{p} \lambda_j$$

If the coefficient matrix Π has the reduced rank G < n, then there exists *n x G* matrices α and β each with rank G such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. G is the number of cointegration relationships, the elements of α are known as adjustment parameters in the f and each column of β is a cointegrating vector. If Π has full rank, all variables are stationary. It can be shown that for given G, the maximum likelihood estimator of β defines combinations of y_{t-1} that yields the G largest canonical correlation of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Further, the Trace test suggested by Johansen was used to measure the cointegration among the variables.

By examining the cointegration, one can identify the long run equilibrium. However, VECM can also be applied to take short run adjustment process into account. In fact, VECM is a restricted VAR that has cointegration restrictions built into the specification. Further, the error correction term indicates the time period that takes to correct the short run dynamics towards the long run equilibrium.

$$\Delta y_{1t} = \lambda_1 (y_{2(t-1)} - \beta y_{1(t-1)}) + e_{1t} \quad (10)$$
$$\Delta y_{2t} = \lambda_2 (y_{2(t-1)} - \beta y_{1(t-1)}) + e_{2t} \quad (11)$$

According to the above model, the right side terms represent the error correction terms. The error correction terms are equal to zero at the long run equilibrium. Moreover, the estimated coefficients λ_1 and λ_2 indicate the speed of adjusting toward the long run equilibrium.

3. RESULTS AND DISCUSSION

4.1 The Results of the Unit Root Tests

The log value of all series except TB was considered for stationary and unit root tests. Both KPSS test under Bartlett kernel and newly west bandwidth, and ADF with Schwarz criterion were used to test the stationary and unit roots respectively. KPSS test employs the null hypothesis that is the time series is stationary, against the alternative hypothesis of "time series are not stationary". If the estimated test statistic is greater than the critical value, we will reject the null hypothesis to conclude that the series is non-stationary. ADF used to test the unit roots using the null hypothesis that the series has a unit root. If the p value is less than 0.05, we can reject the null hypothesis at 5% significance level. The results of the KPSS test and ADF test has presented in table 1.

TABLE 1: Stationary and Unit Root Test

Series	KPSS		ADF	
	Levels	**1st Difference**	**Levels**	**1st Difference**
LCCPIN	1.2862	0.1577***	0.9118	0.0000***
LIPIS	1.3015	0.5000*	0.9912	0.0000***
LRP	1.0074	0.0751***	0.6925	0.0000***
LM2b	1.3031	0.0890***	0.9786	0.0000***
LER	1.1708	0.0990***	0.5752	0.0000***
TB	0.3576***	0.1751***	0.7586	0.0001***
KPSS: critical values	1% ***(0.739000)	5% ** (0.463000)	10% *(0.347000)	
ADF: Significance level (p value)	1% ***	5% **	10% *	

Source: Calculated by the authors based on the data from Central Bank of Sri Lanka

*** - Significant at 1% level
* - Significant at 10% level

As the second column of the table 1shows, the results of the KPSS stationary test and it confirmed that all the variables, except TB, are non-stationary at their levels, because the t statistics of LCCPIN, LIPIS, LRP and LM2b are greater than the critical value (0.463) at 5% significance level. Therefore, we can reject the null hypothesis to conclude that those series are non-stationary. TB at its level and all the other variables at their first difference are stationary at 5 percent significance level, except LIPIS. Therefore, 2nd difference of LIPIS was tested using KPSS, and it is significant at 1 % level (t statistic is 0.189332).

4.2 The Results of the ARIMA Model

ARIMA (p, 1, q) was investigated using different values for p and q. The summary statistics of the estimated models have presented in the table 2 and the detail outputs are available in annexure 01.

TABLE 2: ARIMA model of LCCPIN of Sri Lanka

Model	Variable	Statistic(Q)	P value	AIC	SC
ARIMA(1,1,1)	C	0.0088*	0.000	-6.6999	-6.6187
	AR(1)	0.7681*	0.000		
	MA(1)	-0.4883*	0.007		
ARIMA(2,1,1)	C	0.0089*	0.000	-6.6856	-6.5766
	AR(1)	1.0239*	0.004		
	AR(2)	-0.1654	0.416		
	MA(1)	-0.6817	0.036		
ARIMA(2,1,2)	C	0.0090*	0.000	-6.6753	-6.5391
	AR(1)	0.5467	0.403		
	AR(2)	0.2075	0.665		
	MA(1)	-0.1770	0.783		
	MA(2)	-0.2787	0.334		

Source: Calculated by the authors based on the data from Central Bank of Sri Lanka

The * shows the significant coefficients at 5% significant level

Accordingly, ARIMA (1, 1, 1) can be selected as the most suitable model because all the coefficients in the model are significant at 5 percent significant level, and it gives the lowest value in both AIC and SIC test statistics. The estimated model is given below.

$$\Delta LCCPIN_t = 0.008892 + 0.768183\Delta LCCPIN_1 - 0.488325\varepsilon_{t-1} \tag{12}$$

The forecasting ability of the model was tested using the January-2003 to Decembe-2008 data to forecast for January-2009 to Decmber-2010. Annexure 02 exhibits the forecasted figure and, an increasing trend of inflation is clearly visible in the figure. Actual values of the inflation are closely coincided with the forecasted values; therefore, model seems to be a reflective model of the current economic behavior. Residual also fluctuate around zero as visible in annexure 03. Therefore, it further confirmed the validity of the model.

4.3 The Results of the Cointegration Test

With the stationary condition of variables, the presence of long-run co-movement or co-integration among variables is tested by applying Johansen co-integration test, and the results are summarized in.

TABLE 3: The Results of the Cointegration Test

Hypothesized No. of Cointegration Vectors	Eigenvalue	Trace Statistic	Critical Value	Prob.
None *	0.3839	116.9849	95.7536	0.0008
At most 1 *	0.2832	71.9284	69.8188	0.0336
At most 2	0.2093	40.9532	47.8561	0.1902
At most 3	0.1125	19.1086	29.7970	0.4851
At most 4	0.0778	8.0038	15.4947	0.4650
At most 5	0.0049	0.4638	3.8414	0.4958

Source: Calculated by the authors based on the data from Central Bank of Sri Lanka

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

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 (116.985) is greater than the corresponding critical value (95.75) at the 5% significance level. Therefore, we reject the null hypothesis and conclude the existence of co-integration. The second rank test also indicates that the trace statistics (71.93) is greater than the corresponding critical value (69.82) at the 5% significance level to reject the null hypothesis and conclude the existence of co-integration. In both instances corresponding p-values (0.0008 and 0.0336) are smaller than the 5% significance level further supporting the rejection of the 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. However, the null hypothesis cannot be rejected; because the trace statistics (40.95) is less than the corresponding critical value (47.86) at the 5% significance level, and p-value is also greater than the 5% significance level. Therefore, there are two cointegration relationships exist. Thus, the Vector Error Correction Model (VECM) was used to further analyze the determinant of the inflation.

4.4 The Results of the Cointegration Equation

The cointegration equation based on VECM explains the long run equilibrium of Sri Lanka inflation; in particular, the factors that affect the changes in general price level in the long run. The following table and equation indicate the long run determinants of the inflation based on VECM.

TABLE 4: Results of Cointegration Equation

Variables	Coefficients	Standard Error	t-Statistics
CCPIN(-1)	1.0000	-	-
TB(-1)	- 0.0664	1.7366	- 3.2336
RP(-1)	0.7707	0.4539	3.7840
ER(-1)	0.1384	0.3121	1.6571
IPI(-1)	0.1610	0.2766	6.3461
M2B(-1)	0.0001	0.4203	2.0927
C	22.6031	-	-

$$CCPIN = -22.6031 - 0.0664TB_{t-1} + 0.7707RP_{t-1} + 0.1383ER_{t-1} + 0.1610IPI_{t-1} + 0.0001M2B_{t-1} \quad (13)$$

Source: Calculated by the authors based on the data from Central Bank of Sri Lanka

According to the above equation, it is apparent that the long run inflation in Sri Lanka is mainly driven by the considered variables in the model. Specifically, rice price has become the key determinant of long run inflation, which has statistically significant positive relationship with the inflation. In fact, rice is the staple food in Sri Lanka and hence the rice price has a considerably higher impact on general price level through the headline line inflation. TB rate was used as a proxy for the interest rate, and TB has a negative effect on long run inflation in Sri Lanka. It seems that when the Treasury bill rate or interest rate is increasing, people prefer to go for the investment decisions or deposit the money in the banks rather than spending on consumable goods. As a result of that, inflation may lower with higher Treasury bill rates. Apart from that, increasing exchange rate in the previous month has caused to increase the present inflation. Increasing exchange rate in the sense, depreciation of the domestic currency and it results to increase the prices of importing goods that include crude oil and other consumable goods, in particular, the price hick of oil and other importing consumable goods reasons to higher inflation at the present.

According to the cointegration equation, IPI positively related with the inflation of Sri Lanka during the sample period. Sri Lanka does not have a well-established or expanded industrial sector but the export-oriented industries such as garments. This export-oriented industry production has been unable to create a considerable impact to lower the domestic price level. However, the industry sector has generated a considerable amount of employment opportunities especially for the low educated people. Consequently, they have been creating an increasing demand for the goods and services ever before causing the price level to hike. In addition, the money supply has become another key determinant of long run inflation in accordance with the economic theory. Many theoretical and empirical researchers have proved a direct relationship between money supply and the inflation and this study confirmed the same link between broad money supply and the general price level in Sri Lanka.

4.5 The Results of the Error Correction Model

VECM provides a clear understanding about the short run adjustment process of inflation and its pathway towards the long run equilibrium. Further, it provides the speed of the adjustment process as well. According to the VECM estimates, it is apparent that the importance of inflation expectation on the present inflation. In particular, the public inflation expectation leads to increase the inflation in the next month significantly but not the following month.

In addition, the increase of IPI has a positive effect on inflation in the both next and following months. However, the immediate effect is not statistically significant showing the potential of having long run effect. Apart from that, all other variables are weakly exogenous during the short run adjustment process. Moreover, the speed of the adjustment of a shock is low because the coefficient is -0.0593. That means, approximately 6 percent of the previous month disequilibrium in CCPIN from its equilibrium path has been corrected during the current month.

Stability of the VECM was tested using inverse roots of AR characteristic polynomial and the annexure 05 depicts the graph of the unit circle. Since, no root has plotted outside the circle, it can be concluded that the VECM model does satisfy the stability conditions. The variance of the model is decomposed to decide, what portion of the variance is caused by its own shocks and by shocks of other variables. The variance decomposition with Cholesky with Monti Carlo for 100 times were used for the decomposition. The annexure 07 shows the variance decomposition of CCPIN and accordingly, at first horizon, 100% of the variance of CCPIN is determined by its own shock. In the time horizon 2, 3 and 4, the own shocks are 98.23, 94.98 and 94.04 percent, respectively. The only other variable, which effect on the variance of CCPIN is IPIS, and it determines nearly 6.5 of the CCPIN variance in the 10^{th} time horizon.

TABLE 5: Results of the VECM Estimation

Error Corrections	**Coefficients**	**t-Statistics**
Coint. Equation1	-0.0593	-1.2244
Coint. Equation2	0.0547	1.0584
D(CCPIN(-1))	0.5993	4.8661
D(CCPIN(-2))	-0.0576	-0.4796
D(TB(-1))	0.0790	0.9819
D(TB(-2))	0.0756	0.9866
D(RP(-1))	-0.0747	-1.1820
D(RP(-2))	0.0589	0.8481
D(ER(-1))	0.0444	0.3445
D(ER(-2))	0.1239	1.0040
D(IPI(-1))	0.0383	1.0272
D(IPI(-2))	0.1171	2.8723
D(M2B(-1))	-2.49E-05	-1.2962
D(M2B(-2))	2.89E-05	1.4027
C	0.4472	1.0003

Source: Calculated by the authors based on the data from Central Bank of Sri Lanka

The dynamic property of the model was analyzed using the generalized impulse response function where ordering of the variables does not matter. The annexure 06 exhibits the response of CCPIN to a shock to the CCPIN, TB, RP, ER, IPIS and M2b. A positive shock to IPI will have a contractionary effect on CCPIN until the second period. From the period 2, it has a persistent expansionary effect on the CCPIN until 10^{th} period. This finding is consistent with the economic theory where increase in output will reduce the inflation in the short run. A shock to the TB will have an impact on CCPIN until 4^{th} period; contractionary effect in the first period and expansionary effect from 2^{nd} period to the 4^{th} period, and then it disappeared. However, it is clear from the impulse response functions that both rice price (RP) and broad money supply (M2B) have a bigger impact on inflation in Sri Lanka, and that impact will continue for long term. A recent study by Deyshappriya (2014) has confirmed impact of rice price and monetary expansion on inflation in Sri Lanka.

4. CONCLUSION AND RECOMMENDATION

The volatility of inflation could negatively affect the decision makers in the economy. Therefore, continuous alert on the behavior of inflation is quite important. The study is an attempt to analyze the determinant of inflation using monthly data from 2003-January to 2010-December, which represent the current socio economic conditions of Sri Lanka. The analysis was conducted using ARIMA and VECM models. ARIMA (1,1,1) model was best fit to the data set and VECM model indicate two co-integration relationships. According to the long run analysis based on the cointegration equation, Rice Price (RP), Broad Money Supply (M2B), Industrial Production Index (IPI) and Exchange Rate (ER) are positively related with the long run inflation while Treasury Bill (TB) rate is negatively related. In contrast, the short run inflation mainly depends on the inflation expectation of the public. According to the error correction model, inflation expectation has a positive and statistically significant link with the subsequent month's inflation while all other determinants are weakly exogenous during the short run. Moreover, as the error correction term indicates, there is a short-run adjustment process of inflation towards its long run equilibrium.

The results of the current study have come up with crucial policy implications to deal with the existing inflation in Sri Lanka. Especially, it is important to have a strategic plan to revise inflation expectation of the public. Though, it is really difficult task to control the peoples' thinking process; it may be possible if the authorities can create a good confidence in their mind about the future of the economy. In addition, it is important to control the unnecessary fluctuations and hike of the rice price by imposing appropriate price controlling systems to maintain the stability of the general price level in both short run and long run. Similarly, controlling the unnecessary monetary expansion is highly recommended to avoid the long run inflation which creates many adverse effects in the economy.

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ANNEXURES

ANNEXURE 1: ARIMA Models

ARIMA(2,1,2)

Dependent Variable: D(LCCPIN)
Method: Least Squares
Date: 07/28/11 Time: 18:16
Sample (adjusted): 2003M04 2010M12
Included observations: 93 after adjustments
Convergence achieved after 65 iterations
MA Backcast: 2003M02 2003M03

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009012	0.002007	4.490766	0.0000
AR(1)	0.546773	0.651113	0.839751	0.4033
AR(2)	0.207529	0.477264	0.434832	0.6647
MA(1)	-0.177042	0.639661	-0.276775	0.7826
MA(2)	-0.278784	0.287124	-0.970951	0.3342

R-squared	0.193458	Mean dependent var	0.008435
Adjusted R-squared	0.156797	S.D. dependent var	0.009118
S.E. of regression	0.008373	Akaike info criterion	-6.675343
Sum squared resid	0.006169	Schwarz criterion	-6.539182
Log likelihood	315.4034	Hannan-Quinn criter.	-6.620365
F-statistic	5.276958	Durbin-Watson stat	1.998307
Prob(F-statistic)	0.000741		

Inverted AR Roots	.80	-.26
Inverted MA Roots	.62	-.45

ARIMA(2,1,1)

Dependent Variable: D(LCCPIN)
Method: Least Squares
Date: 07/28/11 Time: 18:19
Sample (adjusted): 2003M04 2010M12
Included observations: 93 after adjustments
Convergence achieved after 19 iterations
MA Backcast: 2003M03

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.008968	0.002055	4.363906	0.0000
AR(1)	1.023950	0.349605	2.928880	0.0043
AR(2)	-0.165491	0.202669	-0.816554	0.4164
MA(1)	-0.681731	0.319465	-2.133980	0.0356

R-squared	0.184345	Mean dependent var	0.008435
Adjusted R-squared	0.156851	S.D. dependent var	0.009118
S.E. of regression	0.008373	Akaike info criterion	-6.685612
Sum squared resid	0.006239	Schwarz criterion	-6.576683
Log likelihood	314.8810	Hannan-Quinn criter.	-6.641629
F-statistic	6.704912	Durbin-Watson stat	1.936534
Prob(F-statistic)	0.000393		

Inverted AR Roots	.82	.20
Inverted MA Roots	.68	

ARIMA(1,1,1)

Dependent Variable: D(LCCPIN)
Method: Least Squares
Date: 07/28/11 Time: 18:44
Sample (adjusted): 2003M03 2010M12
Included observations: 94 after adjustments
Convergence achieved after 7 iterations
MA Backcast: 2003M02

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008892	0.001955	4.548949	0.0000
AR(1)	0.768183	0.124847	6.152994	0.0000
MA(1)	-0.488325	0.177554	-2.750300	0.0072

R-squared	0.204236	Mean dependent var	0.008238
Adjusted R-squared	0.186747	S.D. dependent var	0.009267
S.E. of regression	0.008357	Akaike info criterion	-6.699960
Sum squared resid	0.006356	Schwarz criterion	-6.618791
Log likelihood	317.8981	Hannan-Quinn criter.	-6.667173
F-statistic	11.67779	Durbin-Watson stat	1.855122
Prob(F-statistic)	0.000031		

Inverted AR Roots	.77
Inverted MA Roots	.49

ARIMA(1,1,1)
Dependent Variable: D(LCCPIN)
Method: Least Squares

Date: 07/28/11 Time: 18:43
Sample (adjusted): 2003M03 2010M12
Included observations: 94 after adjustments
Convergence achieved after 9 iterations
MA Backcast: 2003M02

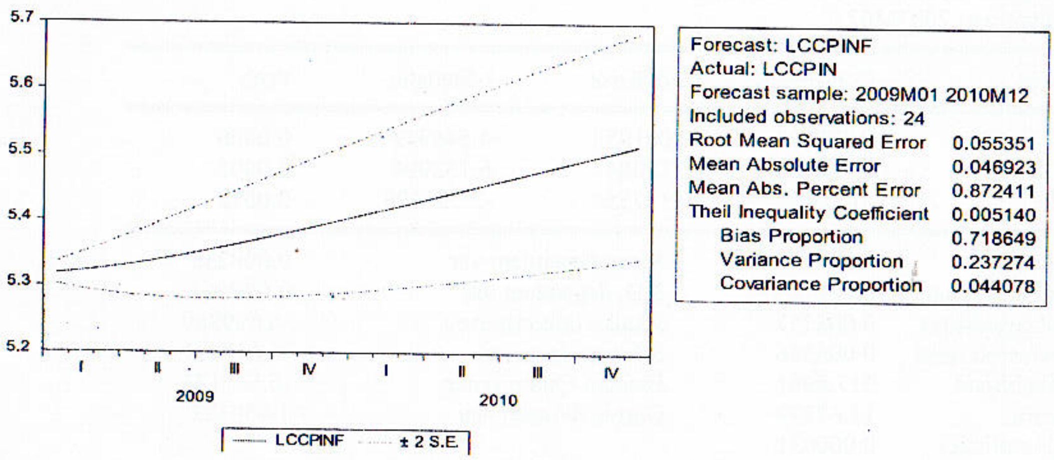
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002061	0.001123	1.834843	0.0698
D(LCCPIN(-1))	0.768182	0.124847	6.152971	0.0000
MA(1)	-0.488325	0.177554	-2.750289	0.0072

R-squared	0.204236	Mean dependent var	0.008238
Adjusted R-squared	0.186747	S.D. dependent var	0.009267
S.E. of regression	0.008357	Akaike info criterion	-6.699960
Sum squared resid	0.006356	Schwarz criterion	-6.618791
Log likelihood	317.8981	Hannan-Quinn criter.	-6.667173
F-statistic	11.67779	Durbin-Watson stat	1.855123
Prob(F-statistic)	0.000031		

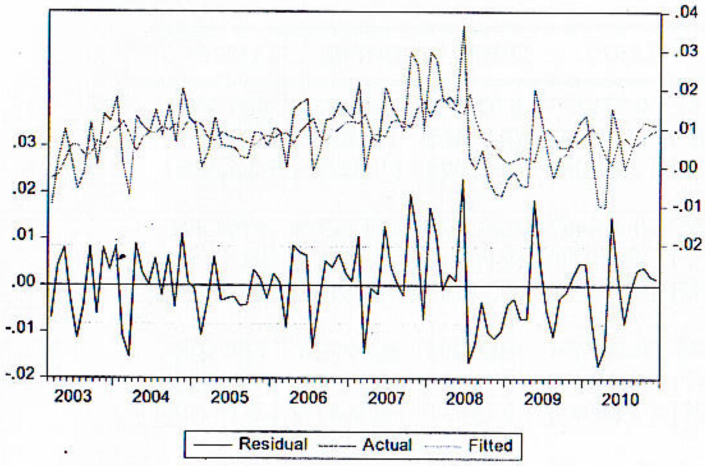
Inverted MA Roots	.49

ANNEXURE 2: ARIMA Forecasting Graph

ARIMA (1,1,1)



ANNEXURE 3: Residual, Actual and Fitted Graph



ANNEXURE 4: VECM Estimation

Vector Error Correction Estimates
Date: 07/29/11 Time: 09:56
Sample (adjusted): 2003M04 2010M12
Included observations: 93 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(2,3)=0, B(1,1)=1, B(2,2)=1
Convergence achieved after 1 iterations.
Not all cointegrating vectors are identified
Restrictions are not binding (LR test not available)

CointegratingEq:	CointEq1	CointEq2
CCPIN(-1)	1.000000	0.248782
TB(-1)	0.066426	1.000000
RP(-1)	-0.770728	0.000000
ER(-1)	-0.138470	-0.449951
IPIS(-1)	-0.161048	-0.194799

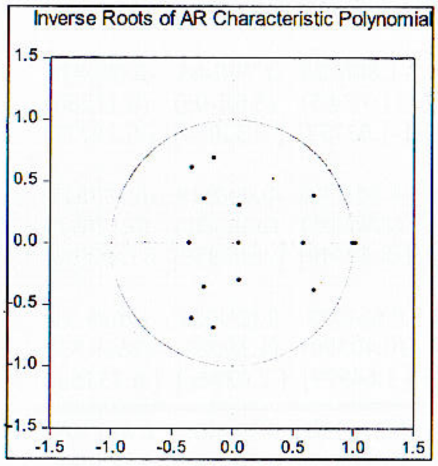
M2B(-1)	-0.000105	-3.97E-05
C	22.60312	68.05266

Error Correction:	D(CCPIN)	D(TB)	D(RP)	D(ER)	D(IPIS)	D(M2B)
CointEq1	-0.059340	0.151181	0.271277	0.024940	0.003170	689.6909
	(0.04846)	(0.05763)	(0.09469)	(0.04368)	(0.14093)	(283.934)
	[-1.22447]	[2.62319]	[2.86496]	[0.57095]	[0.02249]	[2.42905]
CointEq2	0.054768	-0.137277	-0.219487	-0.022545	-0.120278	-1397.471
	(0.05174)	(0.06153)	(0.10110)	(0.04664)	(0.15047)	(303.155)
	[1.05847]	[-2.23091]	[-2.17104]	[-0.48341]	[-0.79933]	[-4.60976]
D(CCPIN(-1))	0.599337	-0.116342	0.449878	0.017301	-0.346761	-113.5107
	(0.12316)	(0.14647)	(0.24065)	(0.11102)	(0.35818)	(721.613)
	[4.86617]	[-0.79429]	[1.86945]	[0.15584]	[-0.96812]	[-0.15730]
D(CCPIN(-2))	-0.057699	0.190933	-0.161160	-0.179016	0.597284	77.60411
	(0.12029)	(0.14305)	(0.23503)	(0.10842)	(0.34981)	(704.760)
	[-0.47967]	[1.33472]	[-0.68571]	[-1.65109]	[1.70743]	[0.11011]
D(TB(-1))	0.079086	-0.560377	0.484833	0.050264	-0.102222	-211.1970
	(0.08054)	(0.09578)	(0.15736)	(0.07259)	(0.23422)	(471.867)
	[0.98198]	[-5.85073]	[3.08104]	[0.69240]	[-0.43644]	[-0.44758]
D(TB(-2))	0.075645	-0.583194	0.340478	0.033684	0.436474	-270.5455
	(0.07667)	(0.09118)	(0.14980)	(0.06911)	(0.22296)	(449.199)
	[0.98665]	[-6.39623]	[2.27287]	[0.48742]	[1.95760]	[-0.60228]
D(RP(-1))	-0.074722	0.277248	0.190076	0.039468	-0.272288	238.2158
	(0.06321)	(0.07518)	(0.12351)	(0.05698)	(0.18383)	(370.363)
	[-1.18206]	[3.68800]	[1.53895]	[0.69268]	[-1.48117]	[0.64320]
D(RP(-2))	0.058971	-0.097063	0.354735	0.031993	0.044437	1043.348
	(0.06953)	(0.08269)	(0.13585)	(0.06267)	(0.20220)	(407.362)
	[0.84816]	[-1.17387]	[2.61124]	[0.51050]	[0.21977]	[2.56123]
D(ER(-1))	0.044408	0.053309	-0.125819	0.125607	-0.045372	-141.9698
	(0.12887)	(0.15326)	(0.25180)	(0.11616)	(0.37479)	(755.069)
	[0.34458]	[0.34783]	[-0.49967]	[1.08130]	[-0.12106]	[-0.18802]
D(ER(-2))	0.123987	-0.310389	0.325217	-0.115541	-0.134954	-446.0640
	(0.12348)	(0.14685)	(0.24127)	(0.11130)	(0.35911)	(723.481)
	[1.00408]	[-2.11363]	[1.34794]	[-1.03807]	[-0.37580]	[-0.61655]
D(IPIS(-1))	0.038355	-0.003201	0.153720	0.101651	-0.561561	-383.1716
	(0.03734)	(0.04441)	(0.07296)	(0.03366)	(0.10859)	(218.767)

	[1.02721]	[-0.07210]	[2.10704]	[3.02028]	[-5.17152]	[-1.75150]
D(IPIS(-2))	0.117102	-0.077807	0.291793	-0.051667	-0.352614	-81.26986
	(0.04077)	(0.04848)	(0.07966)	(0.03675)	(0.11856)	(238.865)
	[2.87232]	[-1.60478]	[3.66308]	[-1.40599]	[-2.97406]	[-0.34023]
D(M2B(-1))	-2.49E-05	8.54E-06	8.17E-05	-1.80E-05	1.79E-05	-0.089829
	(1.9E-05)	(2.3E-05)	(3.8E-05)	(1.7E-05)	(5.6E-05)	(0.11260)
	[-1.29627]	[0.37362]	[2.17683]	[-1.03737]	[0.32074]	[-0.79777]
D(M2B(-2))	2.89E-05	2.37E-06	3.02E-05	-9.25E-06	-0.000119	-0.177612
	(2.1E-05)	(2.5E-05)	(4.0E-05)	(1.9E-05)	(6.0E-05)	(0.12091)
	[1.40270]	[0.09658]	[0.74811]	[-0.49746]	[-1.97859]	[-1.46897]
C	0.447274	-0.235210	-2.047461	0.664545	2.639029	17649.51
	(0.44710)	(0.53171)	(0.87357)	(0.40300)	(1.30023)	(2619.53)
	[1.00039]	[-0.44237]	[-2.34378]	[1.64899]	[2.02966]	[6.73766]
R-squared	0.399373	0.589613	0.377777	0.216790	0.374405	0.481798
Adj. R-squared	0.291568	0.515954	0.266096	0.076213	0.262119	0.388788
Sum sq. resids	147.1444	208.1068	561.7426	119.5499	1244.454	5.05E+09
S.E. equation	1.373487	1.633412	2.683622	1.238019	3.994313	8047.210
F-statistic	3.704597	8.004623	3.382636	1.542150	3.334379	5.180039
Log likelihood	-153.2962	-169.4148	-215.5889	-143.6390	-252.5754	-960.1389
Akaike AIC	3.619273	3.965909	4.958902	3.411592	5.754310	20.97073
Schwarz SC	4.027756	4.374393	5.367386	3.820076	6.162794	21.37921
Mean dependent	1.334477	-0.023247	0.288602	0.150616	0.816548	13852.96
S.D. dependent	1.631833	2.347754	3.132576	1.288076	4.649956	10293.17

Determinant resid covariance (dof adj.)	3.19E+10
Determinant resid covariance	1.11E+10
Log likelihood	-1867.395
Akaike information criterion	42.35259
Schwarz criterion	45.13028

ANNEXURE 5: AR Root Graph



ANNEXURE 6: Variance Decomposition Table

Period	S.E.	CCPIN	TB	RP	ER	IPIS	M2B
1	1.373487	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.476363	98.23406	0.955352	0.168144	0.003052	0.206112	0.433279
3	3.468169	94.98176	1.682361	0.087864	0.041968	2.984513	0.221538
4	4.330232	94.04419	1.582001	0.119766	0.105986	3.844945	0.303113
5	5.167105	93.64705	1.553936	0.425368	0.104555	4.020052	0.249035
6	5.981770	92.76676	1.514046	0.763911	0.099048	4.604966	0.251269
7	6.743215	91.92941	1.399964	0.942332	0.114712	5.296733	0.316851
8	7.450572	91.45232	1.286418	1.051245	0.143239	5.738748	0.328029
9	8.111714	91.09645	1.199102	1.105389	0.175415	6.110517	0.313127
10	8.720603	90.75989	1.119121	1.101417	0.216591	6.497760	0.305221

ANNEXURE 7: Impulse Response Functions