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DYNAMIC FEEDBACK BETWEEN MONEY SUPPLY, EXCHANGE RATES AND INFLATION IN SRI LANKA

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Abstract

Macroeconomic theory postulates possible feedback between money growth, exchange rates and inflation. Empirical evidence derived, however, from various countries is mixed. While some finds strong feedback relationships in some countries, others find weak feedback. As there is dearth of empirical studies on this with reference to the case Sri Lanka, this paper examined long run dynamic feedback between money growth, exchange rates and inflation in Sri Lanka by using the Auto Regression Distributed Lag Model approach to cointegration. Possible short run dynamics were examined by using error correction model. The results are mixed. Monetary expansions have not lead to inflation during the period of estimation possibly because monetary expansions have been accommodated by capital inflows for foreign borrowing. Results also show that shocks in exchange rates lead to inflation in both short run and long run. Increase foreign prices lead to increase in inflation rate only in the short run. The results are useful for monetary policy makers for macroeconomic management in a small open economy like Sri Lanka.

Key words

Money Supply, Inflation, Exchange Rates, ARDL

INTRODUCTION

Sri Lanka, situated in the South Asian region, adopted market oriented economic policies in late 1970s. As a result, foreign trade and capital mobility was liberalized. Managed floating exchange rate regime was used in 1980s and 1990s, while the fully flexible exchange rates were adopted in early 2000. Sri Lanka experienced depreciating exchange rates for the past few decades in the long term, while periods of high and low inflations. During the liberalized period, shocks in one sector has seemingly spilled over to the other sectors.

Macroeconomic theory tends to postulate interlinkages between volatility in exchange exchange rates, inflation and money supply. Excess money growth is thought to positively influence inflation. In the fiscal aspect, budget deficits are regarded to cause of inflation in countries with prolonged high inflation. In the balance of payments aspect, emphasis is placed on the exchange rate and the prices of imported products. The collapse of exchange rates brings about inflation either through higher import prices and increase in inflationary expectations, which are often accommodated, or through an accelerated wage indexation mechanism. Among many causes, structural factors are also believed to influence the rate of inflation.

These different approaches to explaining the causes of inflation have led to differing prescriptions about the appropriate policy responses. Those focusing on monetary factors have emphasized reducing government budget deficits and restraining credit to public enterprises, while advocating exchange rate depreciation to offset any over valuation resulting from past inflation and deterioration in the terms of trade. Those emphasizing the role of exchange rate depreciation, in contrast, have argued against further exchange rate adjustments, preferring instead a combination of incomes policies, price controls, and demand reduction measures. In addition, recent literature has begun to emphasize more on the linkages between exchange rate policy and other tools for macroeconomic management, noting that a fixed exchange rate can serve as a "nominal anchor" to an economy and thus limit inflation if supported by appropriate monetary and fiscal policies.

Empirical studies in different countries on interlinkages between money supply, exchange rates and inflation have generated mixed results. Marta et al. (2004) examining monetary policy in Albania during the transition period using a vector Auto Regression Model (VAR) of key macroeconomic variables including money growth, inflation, exchange rate, remittances and the trade balance, demonstrated a weak link between money supply and inflation. Nicolleta and Edward (2001) updating and extending Friedman's (1972) evidence on the lag between monetary policy actions and the response of inflation found that money growth rates, inflation and interest rates are mutually determined in UK and USA. Clemens and Alex (2002) empirically estimated the relationship between exchange rate accommodation and the degree of inflation persistence using a non-linear autoregressive inflation equation for ten European countries and found evidence for the existence of a positive link between exchange rate accommodation and inflation persistence for most of the smaller and more dependent exchange rate mechanism (ERM) countries. Zettelmeyer (2004) and Kearns & Manners (2005) found that increases in interest rates have a significant appreciating effect on exchange rate. As Frankel (1999) observes, fixing the exchange rate has the advantage of providing an observable commitment to monetary policy. Atkenson and Kehoe (2001) believe that fixing the exchange rate has the advantage of providing an observable commitment to monetary policy. However, these interlinkages have not been studied with reference to Sri Lanka. Moreover, these mixed empirical results in different countries and the fact that there is a dearth of studies in Sri Lanka provide the basis for examining the empirical linkages between money supply, exchange rates, and inflation in Sri Lanka.

MATERIALS AND METHODS

Possible interrelationships between money growth, exchange rates and inflation are explained by monetarist approach and structuralist approach. The importance of the link between money supply and inflation is emphazised by the monetarist's approach to the study of inflation.

We use the theoretical procedure following by Akinbobola (2012) to establish empirical equation to estimate interlinkages between growth of money, exchange rate and inflation in Sri Lanka. This procedure allows us to capture both monetary and structural factors that determine interlinkages between these macroeconomic variables. The linkages are based on demand shifts and the level of economic activity or unemployment. The theoretical link can be specified as:

$$P = f(M, S, U) \tag{1}$$

where:

M = Money supply
S = Demand shifts
U = Unemployment.

The structuralist approach states the role played by deficit financing or government expenditure, export earnings variations, import prices, demand shifts, agricultural bottlenecks and availability of foreign reserves. This implies that the export earnings variation could be an explanatory of availability of foreign reserves. The latter is a good proxy for ability to import. Deficit financing is an important explanatory of the growth of money supply. Thus, the structuralists are inadvertently emphasizing money supply when they emphasize deficit financing. Import prices stands on its own as it explains the contribution of imported inflation. Demand shifts in the structuralists school do not differ from that of the monetarist school. The level of economic activity is already subsumed in the structuralists theory since their theory pertains to developing economies where full employment is yet to be attained. One could therefore econometrically specify the structuralist theory of inflation as:

$$P = f(DF, EXR, PM, S, A, R, U) \tag{2}$$

where:

DF= deficit finance,
EXR = exchange rate,
PM = import prices,

S = demand shifts,
A = agricultural bottlenecks,
R = foreign reserves availability
U = level of economic activity respectively.

By removing DF and substituting M (Money supply), we have:

$$P = f(M, EXR, PM, S, A, R, U) \quad (3)$$

A synthesis of the Monetarists and the Structuralist specifications would give us an integrated specification since M, S, and U are common to both, and R, Pm and A are particular to the structuralists. Our model for identifying the factors responsible for price increases in Sri Lanka in the period under review is an adaptation of this latter specification:

$$P = f(M, EXR, PM, S, A, R, U) \quad (4)$$

where:

M = money supply, defined as currency outside banks plus private sector demand deposits in the banking system.
PM = Foreign prices;
A = agricultural bottleneck, which could be measured by food prices.
S = demand shift
R = the ability to import are yet to be acceptably specified. As such, they cannot be used in the model.
U = Unemployment

A better specification of the level of economic activity could be the level of real output. This datum, represented by Y, measures how much all the factors of production in an economy are producing at a given time and therefore a good indicator of the level of economic activity. Also included in the model is expected rate of inflation (P_{t-1}) . Thus, the model becomes:

$$P = f(M, EXR, P^f, Y, P_{t-1}) + \varepsilon \quad (5)$$

$$f(M) > 0; f(EXR) > 0; f\left(P_f\right) > 0; f(Y) < 0; f(P_{t-1})$$

where ε is the error term.

Sequel to the model developed from our theoretical framework, the general price level can be expressed as a weighted average of the price of tradable goods (PT) and non-tradable goods (PN):

$$\text{Log}\, P = \theta(Log\ P^N) + (1-\theta)(Log\ P^T) \quad (6)$$

where 0$< \theta < 1$

The price of tradable goods is determined in the world market and depends on foreign price P^f and on the exchange rate (e). In domestic currency terms, P_T can be depicted by the following expression:

$$Log\ P_T = Log\ e + P_f \quad (7)$$

Equation 7 states that both an increase in the exchange rate and a rise in foreign prices leads to an increase in domestic prices. The price of non-tradable goods is assumed to be determined in the domestic money market, where it is assumed that the demand for non-tradable goods moves in line with the overall demand in the economy. Accordingly, the price of non-tradable goods is determined by the money market equilibrium condition, where real money supply ${Ms}/{P}$ equals real money demand M^d:

$$Log\ P_N = \beta(Log\ M^s - Log\ M^d) \quad (8)$$

where β is a scale factor illustrating the relationship between economy-wide demand and demand for non-tradable goods.

It is assumed that the demand for real balances is a function of real output (y) and inflationary expectations π^e. Due to relatively underdeveloped financial markets in Sri Lanka, it is assumed that the relevant substitution is between goods and money and not among different financial markets. Consequently, the opportunity cost of substitution between goods and money is the expected inflation rate.

$$M^d = f(y, \pi^e) \quad (9)$$

Being a developing economy and highly imperfect markets, the expected rate of inflation is assumed to be determined by inflation in the previous period following adaptive expectations hypothesis:

$$\pi^e = \Delta\ Log\ P_{t-1} \quad (10)$$

The theory predicts that an increase in real income will lead to an increase in money demand, while an increase in expected inflation will lead to a decrease in money demand. Substituting and rearranging, we obtain the following estimable equation:

$$Log\ P_t = \alpha + \beta Log\ M_t + \gamma Log\ y_t + \gamma\ Log\ P_{t-1} + \omega Loge_t + \varphi LogP^f + \epsilon_t \quad (11)$$

where,

$\alpha > 0;\ \beta < 0;\ \gamma > 0;\ \gamma > 0;\ \omega > 0;\ \varphi > 0$

α = constant
P_t = rate of inflation
M_t = growth in money supply
y_t = growth in real output measures in terms of real GDP
P_{t-1} = expected rate of inflation
e_t = US dollar versus SL rupee exchange rate
P^f = foreign prices
ϵ_t = stochastic error term

Theory predicts that an increase in money supply, expected inflation, the exchange rate and foreign prices will drive prices up, while an increase in real output will lead to a decline in the inflation rate. Adding the effect of lagged prices to the equation can capture the effect of sluggish adjustment due to rigidities and inertia in imperfect markets. The inflation equation considers the monetarists variables in addition to exchange rate. Thus, inflation is hypothesized to depend on growth in money supply, real output (measured by real GDP), expected rate of inflation, exchange rate changes and foreign prices.

A series of studies by Pesaran and Shin (1996), Pesaran and Pesaran (1997), Pesaran, Shin and Smith (1998) and Pesaran et al. (2001) have introduced an alternative cointegration technique known as the 'Autoregressive Distributed Lag (ARDL)' bound test. This technique has a number of advantages over Johansen cointegration technique. First, the ARDL model is the more statistically significant approach to determine the cointegration relation in small samples (Ghatak and Siddiki 2001), while the Johansen co-integration technique requires large data samples for validity. Second advantage of the ARDL approach is that while other cointegration techniques require all of the repressors to be integrated of the same order; the ARDL approach can be applied whether the repressors are I(1) and/or I(0). This means that the ARDL approach avoids the pre-testing problems associated with standard cointegration, which requires that the variables be already classified into I(1) or I(0) (Pesaran et al, 2001). Third, if we are not sure about the unit root properties of the data, then applying the ARDL procedure is the most appropriate model for empirical work. As Bahmani- Oskooee and Nasir (2004: 485) explains, the first step in any cointegration technique is to determine the degree of integration of each variable in the model but this depends on which unit root test one uses as different unit root tests could lead to contradictory results. For example, by applying conventional unit root tests such as the Augmented Dickey Fuller and the Phillips-Perron tests, one may incorrectly conclude that a unit root is present in a series that is actually stationary around a one-time structural break (Perron 1989, 1997). The ARDL approach is useful as it avoids these problems. Fourth, yet another difficulty of the Johansen cointegration technique which the ARDL approach avoids concerns the large number of choices which must be made: including decisions such as the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements as well as the order of VAR and the optimal number of lags to be used. The estimation procedures are very sensitive to the method used to make these choices and decisions (Pesaran and Smith 1998). Finally, with the ARDL approach, it is possible that different variables have different optimal number of lags, while in Johansen-type models this is not permitted.

According to Pesaran and Pesaran (1997), the ARDL approach requires the following two steps. In the first step, the existence of any long-term relationship among the variables of interest is determined using a F-test. The second step of the analysis is to estimate the coefficients of the long-run relationship and determine their values, followed by the estimation of the short-run elasticity of the variables with the error correction representation of the ARDL model. By applying the ECM version of ARDL, the speed of adjustment to equilibrium will be determined.

Following Pesaran et al, (2001), we apply the bounds test procedure by modeling the long-run equation (6) as general vector autoregressive (VAR) model of order *p*, in *t z*:

$$z_t = c_0 + \beta_t + \sum_{i=1}^{p} \emptyset_i z_{t-1} + \epsilon_t \qquad (12)$$

$$t = 1,2,3, \dots, T$$

with c_0e following vector equilibrium correction model (VECM) corresponding to (13)

$$\Delta z_t = c_0 + \beta_t + \pi z_{t-1} + \sum_{i=1}^{p} \tau_t \Delta z_{t-1} + \epsilon_t$$

$$t = 1,2, \dots, T \qquad (13)$$

where the (*k*+1)x(*k*+1) matrices $\pi = I_{k+1} + \sum_{i=1}^{p} \varphi_i \, and \, \tau = -\sum_{j=i+1}^{p} \varphi_j$, $i = 1,2, \dots, p-1$ contain the long-run multipliers and short-run dynamic coefficients of the VECM. *t z* is the vector of variables $t \, logIR$ and $t \, x$ respectively. $t \, logIR$ is an I(1) dependent variable defined as $logIR$ and $logX_{t-1} = (logMB, \, logRGDP, \, logFP, \, logER)$ *which* is a vector matrix of 'forcing' I(0) and I(1) regressors as already defined with a multivariate identically and independently distributed zero mean error vector $\varepsilon_t = (\varepsilon_{1t}, \varepsilon'_{2t})'$and a homoskedastic process.

Further, assuming the presence of a unique long-run relationship among the variables, the conditional VECM (2) now becomes:

$$\Delta logIR_t = c_0 + \beta_t + \delta_{yy} logIR_{t-1} + \delta_{xx} logX_{t-1} + \sum_{i=1}^{p} \emptyset_i \Delta logIR_{t-i} + \sum_{j=1}^{q} \omega_j \Delta logX_{t-j} + \varphi D_1 + \epsilon_t$$

$$t = 1,2, \dots, T \qquad (14)$$

On the basis of equation (3), the conditional VECM of the relationship among inflation rate, exchange rate, broad money supply, foreign prices and real GDP can be specified as:

$$\Delta logIR_t = c_0 + \delta_1 logIR_{t-1} + \delta_2 logRGDP_{t-1} + \delta_3 logMB_{t-1} + \delta_4 logFP_{t-1} + \delta_5 logER_{t-1} + \sum_{i=1}^{p} \emptyset_i \Delta logIR_{t-i} + \sum_{j=1}^{q} \omega_j \Delta logRGDP_{t-j} + \sum_{l=1}^{q} \varphi_l \Delta logMB_{t-l} + \sum_{m=1}^{q} \gamma_m \Delta logFP_{t-m} + \sum_{P=1}^{q} \vartheta_p \Delta logER_{t-p} + \varphi D_1 + \epsilon_t \qquad (15)$$

where, δ_t are the long run multipliers, c_0 is the drift and ϵ_t are white noise errors, D_t is a dummy variable. The reason for including this variable is to address possible structural breaks in time series data for inflation rate in Sri Lanka.

$$D_1 \begin{cases} 1 = 1978\text{-}1986 \\ \quad\;\; 1992\text{-}2012 \\ 0 = \text{Otherwise} \end{cases}$$

The first step in the ARDL bounds testing approach is to estimate equation (15) by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e.,

$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$

$H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$.

We denote the test which normalize on $logIR$ by $F_{logIR}(logIR/logRGDP, logMB, logFP, logER)$ Two variables are cointegrated when the independent variables are I(d) (where 0≤d≥1): a lower value assuming the regressors are I(0) and an upper value assuming purely I(1) regressors. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and the upper critical values, the result is inconclusive.The approximate critical values for the F test were obtained from Pesaran and Pesaran (2007).

In the second step, once cointegration is established the conditional ARDL $(p_1, q_1, q_2, q_3, q_4)$ long-run model for $t\ logIRt$ can be estimated as follows:

$$logIR_t = \emptyset + \sum_{i=1}^{p_1} \delta_1 logIR_{t-i} + \sum_{i=0}^{q_1} \delta_1 logRGDP_{t-i} + \sum_{i=0}^{q_2} \delta_3 logMB_{t-i} + \sum_{i=0}^{q_3} \delta_4\, logFP_{t-i} + \sum_{i=0}^{q_4} \delta_5 logER_{t-i} \qquad + \varphi D_1 + \epsilon_t \tag{16}$$

where, $\varphi, \delta_1, \delta_2, \delta_3, \delta_4$ are long run dynamic coefficients.

This involves selecting the orders of the ARDL $(p_1, q_1, q_2, q_3, q_4)$ model in the variables using Akaike information criteria (AIC).

In the third and final step, this paper obtains the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta logIR_t = \mu + \sum_{i=1}^{p} \emptyset_i \Delta logIR_{t-i} + \sum_{j=1}^{q} \omega_j \Delta logRGDP_{t-j} + \sum_{l=1}^{q} \varphi_l \Delta logMB_{t-l} + \sum_{m=1}^{q} \gamma_m\, \Delta logFP_{t-m} + \sum_{P=1}^{q} \beta_p \Delta logER_{t-p} + \vartheta ecm_{t-1} + \epsilon_t \tag{17}$$

where, $\emptyset, \omega, \varphi, \gamma, \beta$, are short run dynamic coefficients of the model's convergence to equilibrium and ϑ is the speed of adjustment.

This study used annual data from 1961 to 2012. These data for all the variables have been taken from annual reports and published statistical appendix of the Central bank of Sri Lanka for different years and World Development Indicators. These variables have been converted into a natural log form (Table 1).

TABLE 1. DESCRIPTION OF VARIABLES FOR EMPIRICAL TESTS

RGDP	Real Gross Domestic Product.
MB	Broad Money Supply: Time deposits plus savings deposits of Commercial Banks
IR	Rate of inflation: growth rate of Colombo Consumer Price Index
ER	USA dollar-Sri Lankan rupee nominal exchange rate
FP	Foreign prices: measured by export price index and import price index

RESULTS AND DISCUSSION

Results of ADF and PP tests for level variables are summarized in Table 2. Unit root test results of all eleven variables are presented. Maximum lag length proceeds down appropriate lag by examining the Schwarz Criterion (SBC) and AIC. ADF and PP tests are conducted with 1 lag. Results show that only the variable LRGDP is stationary in level from, and is known as the I(0) variable in this study. The remaining variables were processed to test the unit root in the 1st difference (Table 3).

Results of the 1st difference show that LMB, LIR, LFP and LER are significant, and I (1) in all three methods. Among the variables selected, both I (0) and I (1) are found. Results show that all the variables are either I (0) or I (1). Therefore, the ARDL approach to cointegration was used to test the relationship between the variables over long term.

TABLE 2. RESULTS OF UNIT ROOT TESTS ON LEVELS

Variables	Test with a constant		Test with a constant and a trend	
	ADF	PP	ADF	PP
LMB	-2.644	-4.933***	-2.914	-5.376
LRGDP	-2.723	-5.604***	-4.283***	-6.147***
LIR	-2.625	-3.113	-3.143	-3.711
LFP	-0.349	-0.011	-1.775	-2.265
LER	-0.655	-0.511	-1.436	-1.708
critical 1% *** value 5% **	-3.574 -2.920	-3.568 -2.919	-4.163 3.500	-4.154 3.498

TABLE 3. RESULTS OF UNIT ROOT TESTS ON 1ST DIFFERENCE

	Test with a constant	Test with a constant and a trend

Variables	ADF	PP	ADF	PP
LMB	-6.959***	-13.371***	-6.837***	13.204***
LIR	-6.156***	-8.386***	-5.983***	-8.164***
LFP	-3.77***	-6.148***	-4.414***	6.961***
LER	-4.704***	-6.917***	-4.706***	6.871***
Critical value 1% **, 5% *	-3.381 -2.927	-3.574 -2.924	-4.173 -3.511	-4.163 -3.50

TABLE 4. RESULTS OF BOUNDS TESTS ON EQUATION 22

Dependent Variable	AIC lags	F- statistics	Probability	Results
f_{LOGIR} *(LOGIR/LOGRGDP,LOGMB, LOGFP,LOGER)*	1	4.033	0.0000	Integrated
$f_{LOGRGDP}$ *(LOGRGDP/LOGIR,LOGMB ,LOGFP,LOGER)*	1	3.78	0.005	Integrated
f_{LOGMB} (LOGMB/*LOGI,LOGRGDP, LOGFP,LOGER)*	1	4.49	0.0000	Integrated
f_{LOGFP} *(LOGFP/LOGIR,LOGRGDP, LOGMB,,LOGER)*	1	1.788	0.07	Not integrated
f_{LOGER} *(LOGER/LOGIR,LOGRGDP, LOGMB,,LOGER)*	1	0.674	0.710	Not integrated

Note: Asymptotic critical value bounds are obtained from Table F in Appendix C, Case III, 'unrestricted intercept and trend', k=6 of Pesaran and Pesaran (1997: 478), lower bound I(0)=2.39 and upper bound I(1)= 3.38 at 1% significance level.

In the first step of the ARDL analysis, this paper tested for the presence of long-run relationships. This paper used the AIC to select a maximum lag order of 3 for the conditional ARDL VECM. Following the procedure in Pesaran and Pesaran (1997), we first estimated an OLS regression for the first differences and then tested for the joint significance of the parameters of the lagged level variables when added to the first regression. Table 4 reports the results of the calculated F-statistics when each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions.

The calculated F-statistics f_{LOGIR}*(LOGIR/ LOGRGDP, LOGER, LOGMB, LOGFP) is* 4.033 which is higher than the upper-bound critical value 3.38 at the 1% level. The calculated F statistics is 4.033 and critical value for 1% level of significance is given by 2.39 to 3.38. Since the F statistics exceed the upper bounds of critical value, a null hypothesis is rejected. This clearly shows that LOGIR has a long term relationship with LOGRGDP, LOGBM, LOGFP and LOGER that they move together. Also, f_{LOGRMB}*(LOGMB/LOGIR,LOGRGDP,LOGER,LOGFP) is* 4.49 which is higher than the upper bound critical value, 3.38. Thus, the null hypothesis of no cointegration is rejected implying that long-run cointegration relationships are present amongst the variables, when the regressions are normalized on LOGIR and LOGMB variables

(Table 4). According to these bound test results, we conclude that there is a joint long-run cointegration relationship among inflation rate, broad money supply, exchange rate, foreign price, and real GDP in Sri Lanka.

TABLE 5. ARDL (4 1 4 2 3) MODEL LONG-RUN RESULTS (DEPENDENT VARIABLE: LOGIR)

Regressor	Coefficient	Standard error	t value	P value
$logIR_{t-1}$	-0.3115	0.20118	-1.5484	0.1822
$logIR_{t-2}$	0.3518	0.2254	1.5607	0.1793
$logIR_{t-3}$	0.2464	0.1593	1.5468	0.1826
$logIR_{t-4}$	0.8529	0.3322	2.5668	0.0502
$logRGDP_t$	1.1877**	0.3326	3.5708	0.0160
$logMB_t$	0.9379***	0.1981	4.7328	0.0052
$logMB_{t-1}$	0.7502**	0.1941	3.8642	0.0118
$logMB_{t-2}$	0.7966*	0.3747	2.1258	0.0118
$logMB_{t-3}$	0.6573**	0.1991	3.3016	0.0869
$logMB_{t-4}$	0.4597*	0.1960	2.3449	0.0214
$logER_t$	12.056**	3.252	3.7068	0.0139
$logER_{t-1}$	-2.726	2.4371	-1.1186	0.3141
$logER_{t-2}$	-8.0035**	2.0028	-3.9961	0.0104
$logFP_t$	0.1909	0.2119	0.9007	0.4090
$logFP_{t-1}$	0.8173**	0.234	3.4931	0.0174
$logFP_{t-2}$	-0.1875	0.2402	-0.7809	0.4702
$logFP_{t-3}$	0.877***	0.1787	-4.9052	0.0045
D_1	-2.9275***	0.6742	-4.3421	0.0074
C	-11.0341**	3.4406	3.2069	0.0238

(critical value ***-1% ,**-5% ,*- 10% $\bar{R}^2$ = 0.8544 SER= 0.223 AIC= -0.168 SBC= 0.806 DW= 2.39 F=8.41 (prob 0.013)

The test statistics in Table 5 show that the coefficient and sign of $LOGMB_t$, $LOGRGDP_t$, $LOGER_t$ are consistent with theoretical predictions, as they are significant at 5% level of significance. This proves the long term impact of $LOGRGDP_t$, $LOGMB_t$ and $LOGER_t$, on $LOGIR_t$. The estimated coefficient of the long run relationship shows that broad money supply has a very high significant impact on inflation rate. A 1% increase in broad money supply at time t leads to approximately 0.93 increase in inflation rate at time t, all things being equal.

The real GDP variable is positive and significant at 5% level indicating that there is a relationship between LOGIR and LRGDP. Table 5 shows that there is a positive relationship between LIR and LRGDP. The relationship between real gross domestic product and inflation rates is negative, showing that a 1% increase in LRGDP leads to approximately 1.18% decrease in LIR, all things beings equal.

Considering the impact of exchange rate to inflation rate, it is significant at 5% level and it has the expected negative impact on inflation rate. A 1% increase in exchange rate at time t leads to a 12.05% decrease in real money demand. There is a positive relationship between exchange rate at time t and interest rate.

This analysis also found that the coefficient of broad money supply at time t has a negative impact on inflation rate and is significant at 5% level. A 1% increase in broad money supply leads to 1.12 decrease in inflation rate. The real gross domestic product is positive and significant at the 1% level. A 1% increase in real gross domestic product at time *t* leads to approximately 1.44% increase in inflation rate, all other being equal. The exchange rate has a positive impact on inflation rate in short run.

TABLE 6. ARDL (4 3 1 2 2) MODEL ECM RESULTS (DEPENDENT VARIABLE: DLOGIR)

Regressor	Coefficient	Standard error	t value	P value
$d(logIR_{t-1})$	-0.3745	0.1911	-1.9601	0.1073
$d(logIR_{t-2})$	-0.5593**	0.1536	-3.6414	0.0149
$d(logIR_{t-3})$	0.1482	0.2129	0.6958	0.5175
$d(logIR_{t-4})$	0.4150	0.2298	1.8058	0.1308
$d(logRGDP_t)$	1.4400***	0.323	4.4579	0.0042
$d(logRGDP_{t-1})$	0.100	0.4454	0.2245	0.1974
$d(logMB_t)$	-1.1275**	0.2267	-4.9731	0.0101
$d(logMB_{t-1})$	-0.4989	0.3357	-1.4859	0.7677
$d(logMB_{t-2})$	-1.2098**	0.3007	-4.0231	0.0067
$d(logMB_{t-3})$	-0.0985	0.3159	-0.3119	0.8312
$d(logER_t)$	13.376**	3.4795	3.8442	0.0892
$d(logER_{t-1})$	3.7429	2.3932	1.5639	0.0019
$d(logER_{t-2})$	-2.3289	2.3885	-0.9750	0.0881
$d(logFP_t)$	0.4914*	0.2334	2.1046	0.0121
$d(logFP_{t-1})$	1.6425***	0.2741	5.9923	0.1786
$d(logFP_{t-2})$	0.8218*	0.3886	2.1146	0.3743
ecm_{t-1}	-0.884**	0.8727	-2.9616	0.0315
C	-1.051***	0.2484	-4.2332	0.0082

(critical value ***-1% ,**-5% ,*- 10% & $\bar{R}^2 = 0.848$ SER= 0.327 AIC= 0.6414 SBC= 1.53 DW= 1.76 F=8.257 (prob 0.014)

The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the ECM equation 12 are given in table 6. Table 6 shows that the ECM (-1) is statistically significant with a correct sign, although the coefficient of -0.88 suggests that about 88% of the disequilibria of the previous year's shock is adjusted back to the estimated equilibrium correction coefficient by -0.88(0.03) which is highly significant and tend to have the correct sign and implies a high speed of adjustment to equilibrium after a shock. Approximately 88% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year.

CONCLUSION

The estimation results show that increase in broad money supply will lead to decrease in inflation in both long run and short run. Furthermore, increase in real GDP and exchange rates will lead to increase in inflation in both short run and long run. Increase foreign prices will lead to increase in inflation rate only in the short run.

These results imply that exchange rate, growth rate of real GDP, foreign prices have remained the main causal factors of the persistent increase in price level in Sri Lanka. The evidence from studying the exchange rate fluctuation shows that it has more influence on inflation dynamism. The fact that exchange rate is appreciating as a result of both imported and domestically produced goods continue to experience rise in prices. This estimation results show that exchange rate fluctuation has more positive and significant influence on inflationary pressure in Sri Lanka. Finally, concluded that there is demand pull and import based inflation situation faced in Sri Lanka. The results indicate that monetary policy formulation and implementation is Sri Lanka needs to take into account both domestic and external factors along with the multi-faceted bi-causal relationships between various macroeconomic variables.

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