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EXCHANGE RATE CHANGES AND THEIR IMPACT ON INFLATION; ASSESSING THE EVIDENCE FROM SRI LANKA

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ABSTRACT

This paper evaluates by simulating a small macro-economic model, the possibility of maintaining inflation at a lower rate by restraining the exchange rate changes, and the consequences of such restraints on the major macro-economic variables. The paper points out that it is possible to maintain inflation at a lower rate by restraining exchange rate depreciations, but that it has adverse repercussions on the balance of payments and real output. Further, the results suggest that exchange rate depreciations would not cause continuing inflationary pressure in Sri Lanka and the impact of an exchange rate depreciation on domestic prices would be at a substantially lower rate than the rate at which exchange rates are depreciated. Hence, exchange rate adjustments could be used effectively in Sri Lanka as an element of an adjustment programme.

Keywords: Exchange rate, Inflation, Balance of payments

INTRODUCTION

The effectiveness of exchange rate changes in easing the balance of payments difficulties and improving the real output depends largely upon the effect of exchange rate change on the domestic prices. For example, if the domestic prices (in particular, the price of non-tradable) were to increase at the same percentage at which exchange rates are depreciated, the price of tradable relative to non-tradable will not be changed and hence, there will not be any adjustment to the balance of payments disequilibrium. Furthermore, in developing countries, particularly among politicians, there seems to be a resentment against the depreciation of exchange rates mainly due to the fear of its probable adverse impact on domestic inflation. However, in the case of Sri Lanka, the extent of the impact of exchange rate change on inflation has not been well quantified.

The present paper attempts to assess quantitatively the effect of exchange rate changes on inflation. In particular, the paper examines whether Sri Lanka could have maintained inflation at

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a lower rate by restraining the exchange rate changes and, if so, the possible cost of maintaining the inflation at such a lower rate or maintaining an overvalued exchange rate, in terms of the balance of payments and real output. This objective is accomplished by simulating a simple macro-economic model estimated for Sri Lanka. Specifically, the model is simulated to examine the implications of fixing the Sri Lanka exchange rate against the US dollar at the level which prevailed in 2012:4, for the entire period from 2013:1 to 2017:4, on the prices, balance of payments and real output. Furthermore, to isolate the immediate as well as longer term implications of exchange rate changes, the effects of a depreciation of the Sri Lanka rupee by a certain percentage, on inflation as well as the main macro-economic variables are examined.

Section 2 introduces the model descriptively, while the mathematical specification of the model is presented in the Appendix. Section 3 outlines the main features of the estimated model, emphasizing their policy implications. Simulation experiments and their results are discussed in Section 4. Finally, Section 5 concludes the paper highlighting the major observation.

THE MODEL

The model estimated and employed in the paper belongs basically to the type of models presented in Aghevli and Khan (2000) and Aghevli and Rodriguez (2002). As the model specification is fully described in Dissanayaka (2007), it is not reproduced here, though an outline is given in the Appendix.

The model employed in this paper is centered on the monetary approach to the balance of payments and hence, the excess money (excess supply of money over the demand) plays a central role in it. The model highlights the impact of excess money on real expenditure, inflation and balance of payments and in turn, the impact of balance of payments on money.

The model contains four behavioural equations to explain the behaviour of real expenditure, inflation, volume of imports and exports. Given these equations, set of identities defines real output, balance of payments and money supply.

Usually real expenditure is expressed as a function of real income and perhaps of interest rates. The present model augments this by introducing a concept of excess money. The underlying hypothesis is that the supply of money in excess of demand[1] for it would spill over into the goods market, thus increasing nominal spending. Hence, it may have a positive impact on both the real expenditure and inflation. Therefore, though the concept of excess money, one period lagged real money and real income become arguments of the real expenditure and inflation equations. Hence, the co-efficient of income elasticity of expenditure.

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For the inflation equation, in addition to one period lagged real income and real money supply, a variable 'GAP' was created and introduced to represent the excess demand for goods and services caused by the excess of real income over the trend or capacity level of real income. The effects of foreign prices on domestic inflation is also brought in by introducing the rate of change in import prices as an argument of the function.

Import and export function retain the usual forms. The volume of imports is specified as a function of real expenditure and price of imports relative to the domestic prices. The volume of exports is expressed as a function of real income of major industrial countries, price of exports (in foreign currency) relative to the level of price in industrial countries, and the price of exports (in local currency) relative to the level of domestic prices.

As specified in the model, an exchange rate depreciation may have direct impact on imports, exports and inflation by increasing the domestic currency price of imports and exports. The increase in domestic currency price of imports would induce a reduction in the volume of imports provided that the level of domestic prices is not increased at the same rate at which exchange rates are depreciated. Similarly, an increase in the volume of exports would be induced if the exchange rate depreciation results in an increase in the price of exports relative to the level of domestic prices. The immediate effect of the depreciation on inflation is determined by the coefficient of the import price variable in the inflation equation. However, depreciation may have an impact on inflation in the subsequent period as well, due to its impact on the balance of payments and, thus on money supply. An initial improvement in the balance of payments would increase money supply, which may raise the inflation and real expenditure. The magnitude of the changes and their net outcome need to be assessed simulating the complete model.

MAIN FEATURES OF THE ESTIMATED MODEL

The main features of the estimated model are briefly discussed in this section. The estimated model is presented in Table 01 and for easy reference a list of variables is given in Table 02.

The basic hypothesis of the model, I.e. that the excess money would spill over into the goods market raising both the real expenditure and inflation is confirmed by the estimated results. However, it is noted that in Sri Lanka, while real money is strongly related to inflation, its relationship with the real expenditure is rather weak as indicated by the relatively low 't' statistics of the coefficient of real money in the real expenditure equation. Hence, this implies that monetary policy is effective in Sri Lanka mainly through its impact on the inflation.

The dummy variable incorporated to take into account the package of liberalization policies implemented since late 2007 became significant in the real expenditure and import equations, which indicates that the liberalization policies have been quite effective in raising the real

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expenditure and increasing the availability of goods and services. Increased availability has pushed the inflation down as indicated by the negative coefficient of the dummy variable in the inflation equation, though the coefficient is statistically significant only at level of 10 percent.

The importance of the changes in the prices of imports in the determination of inflation is also highlighted in the estimated equation for inflation. The coefficient of the import price variable in the inflation equation is statistically significant with the correct sign. The coefficient of the variable employed to pick-up the excess demand created by the excess of real income over the potential income, GAP, indicates the correct direction of the impact, but it is not statistically significant.

The estimated expenditure elasticity of imports at 1.07 is quite high and in fact, is significantly different from one statistically. This highlights the importance of expenditure reducing policies in regulating the volume of imports and hence, the balance of payments. The relative price elasticity (though the absolute size is not very large) is also statistically significant. Hence, exchange rate depreciations would be effective in Sri Lanka in reducing the foreign exchange expenditure on imports to some extent, though the rupee expenditure would be increased.

As indicated by the statistically significant coefficient of the liberalization dummy, trade liberalization has resulted in substantially increasing the volume of imports in 1986 and thereafter. This increase was mainly to meet the pent-up demand arising from the controls which prevailed earlier and to sustain the increased level of economic activities since 1986. However, after the first few years the pent-up demand had already been met and since the latter part of 1992 there had been a slowing-down in the expansion of the volume of imports. This slowing-down continued, particularly since the latter half of 1993, due to the civil disturbances (LTTE terrorist treble) and the associated decline in the level of economic activities. This movement of the volume of imports was captured by introducing another dummy variable, DUM, into the equation for the volume of imports and this dummy variable also was found to be statistically significant.

Table 01: Estimated Model for Sri Lanka

Behavioural Equations

Ln ABR = 1.713378 + 0.342476 Ln YQ(-1) + 0.204038 Ln (M/P) (-1) + 0.272341 Ln AB R(-1)
(2.955862) (2.800057) (1.656546) (1.914109)

+ 0.153825 DL + 0.019171 DS1 + 0.043992 DS2 - 0.021179 DS3
(3.448079) (0.882494) (2.046317) (-0.961243)

$R^2 = 0.9715$
$R^2 = 0.9714$
Durbin 'h' = indeterminate *

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n = 55

Δ Ln P = 0.946037 - 0.265441 Ln YQ(-1) + 0.174525 Ln (M/P) (-1) + 0.749305 GAP(-1)
(1.826410) (-2.641627) (2.282411) (1.632806)

+ 0.433327 Δ Ln PM - 0.069042 DL + 0.000488 DS1- 0.007565 DS2 + 0.028420 DS3
(3.519742) (-1.738661) (0.026721) (-0.402671) (1.583063)

R^2 = 0.4228
R^2 = 0.3202
DW = 1.9840
n = 54

Ln MQ = -3.446813 + 1.069587 Ln ABR -0.565026 Ln (PM/P) + 0.401557 DL -0.205864DUM
(-3.147186) (7.401541) (-3.451546) (3.784074) (-4.822319)

+ 0.164980 Ln MQ(-1) +0.024596 DS1 -0.016774 DS2 -0.015226 DS3 (2.292398)
(0.838569) (-0.581001) (-0.536812)

R^2 = 0.9781
R^2 = 0.9743
Durbin 'h' = 2.23
n = 55

Ln XQ = 5.576824 + 1.157529 Ln IWI - 0.562196 Ln (PXF/WF) + 0.290980 Ln (PX/P)(-1)
(5.881345) (4.397460) (-5.566083) (3.972143)

+ 0.353155 Ln XQ(-1) + 0.040552 DS1 - 0.071290 DS2 + 0.050207 DS3 (3.182110)
(1.241861) (-2.170476) (1.476612)

R^2 = 0.8968
R^2 = 0.8811
Durbin 'h' = 1.69
n = 54

Identities

Real Income:	YQ = ABR + XQ – MQ + DR
Balance of Payments:	B = XQ . PX – MQ . PM + TR
Export and Import Prices:	PX = PXF . Rx
	PM = PMF . Rm
Money Supply:	M = M(-1) + B + DCE
Excess Demand:	GAP = Ln YQ – Ln YQ*
	YQ* = YQ (0) e^{gt}

Table 02: List of variables

ABR	Real Expenditure
B	Balance of Payments
DCE	Domestic Credit Expansion
DL	Liberalization Dummy

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DR	Dummy variable employed to account for the valuation differences of exports and imports in national accounts and balance of payments data. These differences were due to the national account practice of valuing all the pre 1978 external flows at the FFEC (Foreign Exchange Entitlement Certificates) exchange rate.
DS1, DS2, DS3	Seasonal Dummies
DUM	Dummy variable employed to capture the slowdown in the volume imported since 1992.
GAP	Excess demand for goods and services, defined as Ln YQ - LnYQ*
IWI	Index of real income in selected industrial countries
M	Broad Money Supply
MQ	Volume of imports of goods and non-factor services
PM	Price of imports in local currency
PMF	Price of imports in foreign currency
PXF	Price of exports in foreign currency
Rm	Import weighted index of exchange rates
Rx	Export weighted index of exchange rates
TR	All the net inflows in the balance of payments other than the net exports of goods and non-factor services
WF	Index of wholesale prices in selected industrial countries
XQ	Volume of exports of goods and non-factor services
YQ	Real Income
YQ*	Trend or capacity income

In the case of exports, two demand side variables as well as the supply side variable were found to be statistically significant. The significant coefficient of the real income of the developed countries and the relative foreign currency price of export variables, which are externally given, signifies the vulnerability of the export sector of Sri Lanka to the external shocks. However, it appears that even under such a vulnerable situation, Sri Lanka is not totally helpless as she could improve her exports by improving competitiveness and providing price incentives to the exporters through policy measures aimed at either reducing the rate of inflation (monetary policy) or increasing the domestic currency price of export (exchange rate policy). This possibility is high-lighted in the significant coefficient of the relative price (domestic currency) variable, though the size of the coefficient is not very impressive.

SIMULATION RESULTS: EXCHANGE RATE CHANGES AND INFLATION

Fixing US Dollar at Rs. 103.72

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The effect of exchange rate changes would be transmitted into domestic prices through their impact on domestic currency prices of exports and imports, and balance of payments. Domestic inflation is directly related to the price of tradable goods and this is captured in the present model by including the rate of change in the import prices as an argument of the inflation equation. Hence through this channel a depreciation of the Sri Lanka rupee against the currencies of Sri Lanka's major trade partners would cause a once and for all increase in the rate of inflation. However, exchange rate changes would most probably cause changes in the balance of payments and thus in the money supply. Therefore, during the subsequent period, the exchange rate changes would have an indirect impact on inflation through their impact on the money supply. Our aim in the present simulation exercise is to quantify both of these direct and indirect impacts of exchange rate changes on inflation.

In the present model the average exchange rate for each period (quarter) is incorporated through export weighted and import weighted indices of effective exchange rates which convert the foreign currency prices of exports and imports into domestic currency prices. It is not intended to analyse the movements of these indices in the present paper, but to analyse the impact if Sri Lanka rupee exchange rate against the US dollar were fixed at the average rate that prevailed in the fourth quarter of 2000, i.e. Rs. 103.72, for the entire period from 2000:4 to 2006:4. With the US dollar fixed at this rate, the Sri Lanka rupee exchange rates against other major currencies were computed using cross rates between the US dollar and other currencies. Using these new exchange rates both the export weighted and import weighted indices of effective exchange rates were recomputed. These hypothesized indices, together with the actual indices observed during the period, are reported in Table 03.

The hypothesized indices indicate depreciations over the actual indices only in the first and second quarters of 2001. Throughout the remaining period, the hypothesized indices indicate appreciations over the actual indices and, hence, as there is an accumulated effect, the rate of appreciation increases over time. By the fourth quarter of 2006, the hypothesized export weighted index indicates only a 15.50 percent depreciation over the average level that prevailed in 2000:4, as against the rate of depreciation of 69.51 percent recorded in the actual index. Similarly, the hypothesized import weighted index indicates only an 11.30 percent depreciation over the same period as against the 63.35 percent depreciation recorded in the actual index. Hence in 2006:4 the hypothesized indices record an appreciation of 31.86 percent over the actual indices. The impacts of this exchange rate adjustment are analysed by simulating the model with the hypothesized indices of exchange rates instead of the actual indices and comparing the simulation results with the control solution, i.e., the solution obtained by using the actual indices. Table04 presents the percentage changes in the hypothesized indices of exchange rates (export weighted as well as import weighted) together with the changes in the level of domestic prices

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and other major macro-economic variables caused by them. In the present Table positive figures in the exchange rate changes indicate depreciations while negative figures reflect appreciations over the actual exchange rate indices.

As observed in the simulation results reported in Table 04, hypothesized exchange rate changes in fact have import on inflation. In the first two quarters of 2012, in which hypothesized exchange rate indices indicate depreciations over the actual indices, the level of domestic prices have in fact increased, confirming the usual belief that exchange rate depreciations are inflationary. However, the point to be emphasized is that the rate of increase in the prices in each of these two quarters is substantially lower than the corresponding rate of depreciation in the average exchange rates. During the rest of the period, when the hypothesized exchange rate adjustment results in an appreciation over the actual average exchange rates, the level of domestic prices have in fact declined at progressively higher rates. In fact, the exchange rate adjustment has resulted in reducing the quarterly average increase in the level of domestic prices from 1.9 percent to 0.9 percent. Furthermore, even in the case of exchange rate appreciations, the corresponding declines in the level of domestic prices were at a lower rate than the rate at which exchange rates appreciated.

Table 03: Actual and Hypothesised Exchange Rate Indices

(2010 Average = 100)

	EREX	EREX*	% Change	ERIM	ERIM*	% Change
2011.4	1.1181	1.1181	0.00	1.1102	1.1102	0.00
2012.1	1.0875	1.0943	0.63	1.0769	1.0836	0.62
2012.2	1.0632	1.0670	0.36	1.0510	1.0548	0.36
2012.3	1.0386	1.0332	-0.52	1.0223	1.0170	-0.52
2012.4	1.0297	1.0172	-1.22	1.0149	1.0025	-1.22
2013.1	1.0980	1.0234	-6.79	1.0872	1.0133	-6.79
2013.2	1.1257	1.0169	-9.66	1.1088	1.0017	-9.66
2013.3	1.1596	0.9926	-14.40	1.1402	0.9760	-14.40
2013.4	1.1730	0.9916	-15.46	1.1526	0.9744	-15.46
2014.1	1.1940	0.9844	-17.56	1.1698	0.9644	-17.56
2014.2	1.1841	0.9781	-17.40	1.1603	0.9584	-17.40
2014.3	1.1404	0.9341	-18.09	1.1120	0.9109	-18.09
2014.4	1.1396	0.9087	-20.26	1.1078	0.8833	-20.26
2015.1	1.1148	0.8717	-21.80	1.0819	0.8460	-21.80
2015.2	1.1962	0.9100	-23.93	1.1552	0.8787	-23.93
2015.3	1.2577	0.9546	-24.10	1.2149	0.9221	-24.10
2015.4	1.3398	1.0152	-24.23	1.2958	0.9819	-24.23
2016.1	1.4077	1.0608	-24.65	1.3623	1.0266	-24.65
2016.2	1.4882	1.1088	-25.49	1.4362	1.0701	-25.49
2016.3	1.5567	1.1476	-26.26	1.5052	1.1100	-26.26

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2016.4	1.5547	1.1349	-27.01	1.5000	1.0949	-27.01
2017.1	1.6410	1.1894	-27.52	1.5775	1.1434	-27.52
2017.2	1.7289	1.2382	-28.38	1.6627	1.1907	-28.38
2017.3	1.7382	1.2185	-29.90	1.6678	1.1692	-29.90
2017.4	1.8953	1.2914	-31.86	1.8136	1.2357	-31.86

EREX = Export Weighted,ERIM = Import Weighted

*Hypothesised indices were computed by fixing the US dollar rate at Rs. 103.72 for the entire period from 2011.4 to 2017.4.

In brief, it is quite evident in the simulation results that if the Sri Lankan authorities had fixed the rupee exchange rate against US dollar at the level that prevailed in the last quarter of 2011, for the rest of the period, Sri Lanka could have maintained its domestic prices at a substantially lower level. However, the reductions in the level of domestic prices were at substantially lower rates than rates at which average exchange rates appreciated. The apparent success in maintaining the level of domestic prices at lower levels by restraining the exchange rate change should be evaluated against the effects of such restraint on other major macroeconomic variables i.e. exports, imports, balance of payments and real output.

During the first two quarters of 2012, as the hypothetical exchange rate adjustment resulted in a depreciation of the average exchange rate, both the import prices and domestic prices recorded increases. However, as the rate of increase in domestic prices was lower than that in the local currency price of imports, it resulted in increasing the relative price of imports. Hence, during these two quarters, the volume of imports declined marginally. However, throughout the rest of the period, the volume of imports recorded increases as the hypothetical exchange rate adjustment resulted in an appreciation of the exchange rates.

Table 04: Effects of Fixing US $ Exchange Rate Rs. 103.72

	ER%	P%	MQ%	XQ%	ABR%	YQ%	M%B	Rs.Mn.
2012.1	0.62	0.27	-0.20	0.00	0.00	0.11	-0.03-	-7.41
2012.2	0.36	0.16	-0.17	0.10	-0.02	0.10	0.03	5.66
2012.3	-0.52	-0.21	0.14	0.10	-0.01	-0.05	0.04	14.41
2012.4	-1.22	-0.49	0.47	-0.06	0.03	-0.17	0.00	-13.43
2013.1	-6.76	-2.96	2.43	-0.23	0.05	-1.01	-0.06	-19.58
2013.2	-9.66	-4.25	4.06	-1.25	0.27	-1.77	-0.19	-42.86
2013.3	-14.40	-6.59	6.10	-2.11	0.31	-2.98	-0.87	-266.25
2013.4	-15.46	-7.49	6.55	-3.24	0.26	-3.64	-1.75	-384.32
2014.1	-17.56	-9.17	6.78	-3.72	0.03	-4.26	-2.59	-386.18
2014.2	-17.40	-9.89	6.11	-4.07	-0.06	-4.01	-3.20	-226.88
2014.3	-18.09	-10.87	5.97	-3.92	0.05	-3.89	-4.28	-437.67
2014.4	-20.26	-12.50	6.53	-3.80	0.11	-4.01	-5.09	-413.34

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2015.1	-21.80	-13.72	7.15	-3.99	0.29	-4.19	-5.96	-544.64
2015.2	-23.93	-15.23	7.96	-4.21	0.37	-4.17	-5.94	-193.46
2015.3	-24.10	-15.52	8.47	-4.56	0.77	-4.16	-6.46	-376.83
2015.4	-24.23	-15.81	8.53	-4.65	0.84	-4.28	-6.36	10.92
2016.1	-24.65	-16.23	8.65	-4.64	0.90	-4.50	-6.08	128.22
2016.2	-25.49	-16.83	9.03	-4.65	1.01	-4.36	-5.41	471.05
2016.3	-26.26	-17.13	9.95	-4.76	1.38	-4.40	-5.71	-10.41
2016.4	-27.01	-17.44	10.62	-4.99	1.48	-4.56	-6.11	-263.10
2017.1	-27.52	-17.70	10.93	-5.25	1.44	-4.70	-6.76	-510.89
2017.2	-28.38	-18.26	11.13	-5.45	1.29	-4.56	-7.29	-201.98
2017.3	-29.90	-19.06	11.94	-5.66	1.33	-4.94	-8.73	-999.64
2017.4	-31.86	-20.33	12.57	-6.05	1.08	-5.46	-10.18	-1121.49

ER% = Percentage change in the indices of exchange rates due to fixing US $ at Rs. 103.72

Though the exchange rate appreciation resulted in reducing the level of domestic prices, it reduced the local currency price of imports at higher rates, thus reducing the relative price of imports. Consequently, the volume of imports demanded increased. As the average exchange rate appreciated at progressively higher rates, the volume of imports also increased at progressively higher rates. However, the increased volume of imports would not have increased the expenditure on imports in local currency as the rates of appreciation of exchange rates (thus the rates of decline in the local currency price of imports) were at higher rates than the rates at which the volume of imports were increased. Nevertheless, as the foreign currency price of imports is given exogenously and hence not affected by the rupee exchange rate adjustments, every increase in the volume of imports would definitely increase the foreign exchange expenditure on imports, which in fact is the most important consideration for balance of payments purposes.

The relative price of exports in local currency is a factor which influences the suppliers' behaviour with a time lag of one quarter in the present model. Hence, as the average exchange rate depreciated during the first two quarters of 2012, the volume of exports was increased marginally in the second and third quarters of 2012. However, during the remaining period, the hypothetical exchange rate adjustment resulted in reducing the local currency price of exports at higher rates than the rates at which the level of domestic prices declined. Hence, the resulting decline in the relative price of exports (in domestic currency) caused the volume of exports to decline at progressively higher rates. Similarly to imports, as the foreign currency price of exports is given exogenously, every decline in the volume of exports would result in reducing the foreign exchange earnings of the exports.

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Hence, except for the two quarters in 2012, the hypothetical exchange rate adjustment would invariable increase the volume of imports and reduce the volume of exports, thus worsening the balance of payments, in foreign currency. The reduction in export earning in local currency would be higher than that in the foreign currency as the exchange rate adjustment resulted in reducing the local currency price of exports as well. However, the (local currency) expenditure on imports would decline despite the increase in the volume of imports as the local currency price of imports has decline at substantially higher rates than the rates at which the volume of imports increased. Nevertheless, the overall balance of payments position would deteriorate even in local currency terms except for a few quarters in which reductions in the expenditure on imports exceeded the reduction in export earnings. As a result, money supply would record declines at progressively higher rates.

Finally, real expenditure recorded marginal increases throughout the period except for the second and third quarters of 2012, which followed the two quarters of exchange rate depreciations. These marginal increases should be attributed to the substantial reductions in the level of domestic prices resulting from the hypothesized exchange rate adjustment. However, the most important point to be noted is that despite the increases in the real expenditure, real gross domestic product recorded decreases throughout the period from 2012.3 to 2017.4 at progressively increasing rates. By 2017.4, the reduction in the real GDP would be as high as 5.46 percent. This is due to the substantial decline in the relative price of imports which caused the volume of imports demanded to increase at substantially higher rates than the rates at which real expenditure increased. Hence, as far as the level of domestic economic activities and the balance of payments are concerned, any policy measures to reduce the level of domestic prices would not be effective if they would not lead to an increase in the relative price of imports.

DEPRECIATION OF SRI LANKA RUPEE

In the previous simulation, the rupee exchange rate against US dollar was fixed at the level that prevailed during 2011.4 for the entire period 2012.1-2017.4 and thus, the hypothesized exchange rate indices reflected different rates of changes over the actual indices. Hence, it was not possible to assess precisely the short-term and long-term impacts of a given rate of change in the exchange rates. In the present simulation experiment, indices of impact weighted and export weighted exchange rates were raised by 10 percent only for the first quarter of 2012, while the values for the rest of the period were kept unchanged. This resulted in raising the local currency price of exports and imports exactly by 10 percent. Their import on the endogenous variables were assessed by simulating the model with these changes and comparing the results with the control solution. The deviations of the simulated values from the control solution i.e., the effects of the exchange rate depreciation, are reported in the summary in the form of total accumulated

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effects over the sample period (i.e., long run effect) and within the first four quarters (i.e., short run effects) are given in Table 5.

The impact multiplies (effects within the same quarter in which the adjustment was introduced) of the exchange rate adjustment indicated that a 10 percent depreciation would result in a 4.2 percent increase in the level of prices. Hence, though the level of prices would increase, the rate of increase in prices would be substantially lower than the rate of depreciation. Therefore, an exchange rate depreciation would result in an increase in the relative price of imports, thus reducing the volume of imports by 3 percent.

Table 05: Exchange Rate Depreciation by 10 percent Accumulated Effects

	Over the Sample Period	Within the First Four Quarters
Aggregate Expenditure (%)	-0.51	-0.09
Price Level (%)	5.90	4.94
Volume of Imports (%)	-3.12	-3.31
Volume of Exports (%)	1.69	2.25
Real Gross Domestic Product (%)	1.72	2.24
Money Supply (%)	1.12	0.45
Balance of Payments:		
At current Exchange Rates in each period, Rs. Mn.	22.27	670.00
At 2010 Average Exchange Rates Rs.Mn.	4210.76	4780.96
At 2010 Average SDR Rates, SDR Mn.	190.60	220.26

As aggregate expenditure and export volume were not affected immediately, the reduction in the import volume indicated a substitution of domestic goods for imports, thus increasing real GDP by 1.6 percent. As exchange rate adjustment affects only the domestic currency prices but not the foreign price, the reduction in the import volume invariably results in an improvement in the balance of payments in foreign currency. In fact, the simulation results indicated an improvement in the balance of payments by Rs. 314 million at 2010 average exchange rates which provides an indication on the extent of the change in foreign currency terms. In fact, this represents an improvement in the balance of payments approximately by SDR 75 million at 2010 average exchange rate. However, as the rate of increase in the domestic currency price of imports was substantially higher than the rate at which the import volume declined, the balance of payments would deteriorate in local currency by Rs. 228.7 million. Hence, the initial impact of the depreciation on money supply would be contractionary, though the rate of decline in the money

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supply would be rather small at 0.4 percent. As a result, in the next quarter, the level of prices and real expenditure decline marginally, reducing the volume of imports further. As exchange rate depreciation induces the supply of export with a time lag of one quarter, the volume of exports would increase by 1.58 percent. The increase in exports and reduction in imports result in improving the balance of payments both in local and foreign currency, which exerts an expansionary impact on money supply. This expansionary impact is seen during the level of domestic prices, the volume of imports would further increase while the volume of exports would decline. This would result in reducing the real GDP and real expenditure, imposing a contractionary impact on the volume of imports during the subsequent quarters. In fact, after the seventh quarter, the volume of imports recorded decreases. The overall impacts of the exchange rate depreciation are summarized in Table 05.

Accordingly, long run impacts of exchange rate depreciation appear to be favourable. The main adverse impact of the depreciation is the increase in the level of prices. However, the depreciation induced increase in the level of prices was only 5.9 percent, which is substantially lower than the rate of depreciation. Moreover, more than 80 percent of this increase occurs during the first four quarters. Hence, depreciation does not appear to create continuing pressure on inflation. On the positive side, the volume of imports would decline by 3.12 percent and exports would increase by 1.69 percent. Apparently, the expansion in exports is small though it recorded a relatively high rate of increase, 2.25 percent, in the short run. The reduction in the expansion in the long run is due to the increase in domestic prices, which reduced the profitability of exports. The reduced imports, as well as the increased exports, result in improving both real output and balance of payments. In the short run, the exchange rate depreciation induced growth in real output is 2.44 percent, though the long run impact is reduced to 1.72 percent. The balance of payment improves both in terms of local and foreign currency and the impact is quite substantial in foreign currency. Hence, at a time when the balance of payments has been recording continuous deteriorations, exchange rate depreciation could be employed as a correct adjustment policy.

CONCLUSION

The paper quantitatively assessed the possibility of maintaining inflation at a lower rate by restraining the exchange rate change, and its consequences on the other major macroeconomic variables. This assessment was based on a simple macroeconomic model which served as a frame for simulation experiments. The simulation results pointed out that it is indeed possible to maintain inflation at a lower rate by restraining depreciations, but that it has adverse repercussions on imports, exports, real output and balance of payments. Continuing balance of

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payments difficulties would make it imperative that either exchange rates are depreciated or exchange restrictions are imposed.

Simulation results suggested that exchange rate depreciation would not cause continuing inflationary pressure in Sri Lanka. Its impact on domestic prices would be completed within a short period and the rate of change in the level of prices would be substantially lower than the rate at which exchange rates are depreciated. Hence, the results suggested that exchange rate adjustments could effectively be used in Sri Lanka as an element of an adjustment programme. While correcting the balance of payments, it would also improve the domestic economy by increasing the real output.

However, in the interpretation of the results, the limitations of a small model should be noted. In particular, the model has been derived basically from the demand side and hence, has not paid sufficient attention to the supply side. Nevertheless, it is believed that results derived from the model shed sufficient light on the implications of exchange rate adjustments on inflation and other major macroeconomic variables.

Appendix Table

Simulation Results: Depreciation of Sri Lanka Rupee by 10%

Time	ABR%	P%	MQ%	XQ%	YQ%	M%	BRs.Mn	B*	B**
2012.1	0.00	4.22	-3.01	0.00	1.63	-0.42	-108.67	314.06	14.60
2012.2	-0.37	-0.01	-0.90	1.58	0.52	0.31	190.56	180.33	8.38
2012.3	0.14	0.30	0.17	0.56	0.27	0.34	16.51	15.62	0.73
2012.4	0.14	0.44	0.43	0.11	0.02	0.22	-31.40	-31.05	-1.44
2013.1	0.00	0.41	0.30	-0.09	-0.15	0.09	-37.26	-34.22	-1.59
2013.2	-0.12	0.28	0.08	-0.15	-0.21	0.03	-19.61	-17.55	-0.82
2013.3	-0.15	0.13	-0.08	-0.13	-0.18	0.02	-1.89	-1.49	-0.07
2013.4	-0.13	0.02	-0.13	-0.09	-0.11	0.04	9.06	7.97	0.37
2014.1	-0.07	-0.03	-0.11	-0.04	-0.04	0.07	11.12	9.57	0.44
2014.2	-0.10	-0.03	-0.05	-0.01	0.01	0.08	6.10	5.27	0.24
2014.3	0.02	-0.01	0.01	0.01	0.02	0.08	-0.72	-0.67	-0.03
2014.4	0.03	0.02	0.05	0.00	0.02	0.07	-5.36	-4.85	-0.23
2015.1	0.02	0.04	0.05	0.00	0.00	0.05	-7.32	-6.76	-0.31
2015.2	0.01	0.04	0.04	-0.01	-0.01	0.03	-6.68	-5.75	-0.27
2015.3	0.00	0.03	0.02	-0.02	-0.02	0.02	-4.72	-3.84	-0.18
2015.4	-0.01	0.02	0.01	-0.01	-0.02	0.01	-2.38	-1.81	0.08
2016.1	-0.01	0.01	0.00	-0.01	-0.01	0.01	-0.54	-0.36	-0.02
2016.2	-0.01	0.00	-0.01	-0.01	-0.01	0.01	0.26	-0.20	0.01
2016.3	0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-0.01	0.00
2016.4	0.00	0.00	0.00	0.00	0.00	0.01	-0.60	-0.39	-0.02
2017.1	0.00	0.01	0.00	0.00	0.00	0.01	-1.09	-0.69	-0.03

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2017.2	0.00	0.01	0.01	0.00	0.00	0.01	-1.23	-0.73	-0.03
2017.3	0.00	0.00	0.00	0.00	0.00	0.01	-1.07	-0.63	-0.03
2017.4	0.00	0.00	0.00	0.00	0.00	0.00	-0.83	-0.45	-0.02

***** At 2010 Average Rupee Exchange Rates, Rs. Mn.

** At 2010 Average SDR Exchange Rate, SDR Mn.

Appendix

Model Estimation

In the estimation of the model, certain modifications were introduced. For all the equation, dummy variables (DS1, DS2, DS3) were included to reflect the seasonal effects on the variables. For all equation, except the volume of exports, another dummy, DL, was added to reflect the effects of the liberalization policies introduced late in 1997. This variable was not included in the export function as a substantial portion of exports (i.e., traditional exports) was not sufficiently induced by the liberalization policies. Another dummy variable, DUM, was introduced in the equation for volume of imports to capture the slowdown in volume imported since 2002, following a period of substantial increases. Assuming a partial adjustment process, lagged dependent variables were included in all the equations except rate of inflation. All the equations were estimated by the Ordinary Least Squares (OLS) method. Even though the model is a system of simultaneous equations, it is recursive and hence OLS is quite appropriate.

The track ability of the estimated model in reproducing the historical values of the endogenous variables was tested by simulating the model for the historical period from 1995:1 through 2007:4 and computing the Root Mean Squared Percentage Errors (RMSPE) of the simulated values of each endogenous variable. As reported in the Table below, RMAPEs were found to be relatively quite small for all the variables except for the balance of payments. A relatively high value of percentage errors for the balance of payments variable was expected considering the absolute size of the variable, which is relatively very small when compared with its two components i.e. volume of exports and imports.

Dynamic Simulation: Summary Statistics

	RMSPE	Correlation
Real Expenditure	6.44	0.97
Price Level	5.86	0.99
Volume of Imports	10.35	0.96
Volume of Exports	9.12	0.92
Real Gross Domestic Product	5.72	0.97
Money Supply	6.73	0.99

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Balance of Payments	455.42	0.54

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