Exchange Rate, Competitiveness and Balance of Payment Performance

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Abstract

This paper examines the effectiveness of exchange rate policy of Sri Lanka in achieving external competitiveness since liberalization of the economy in 1977. The conventional two-country trade model that explains the traditional approach to Balance of Payment (BOP) was applied using quarterly data covering the period of 1978:1 to 2000:4. Results reveal that the Real Effective Exchange Rate(REER) does not have significant impact on improving the Trade Balance (TB) particularly in the short run implying a blurred J-Curve phenomenon. Even though the cointegration tests reveal that there is a long run relationship between TB and the REER it shows very marginal impact in improving TB in long run. (JEL F40, O24)

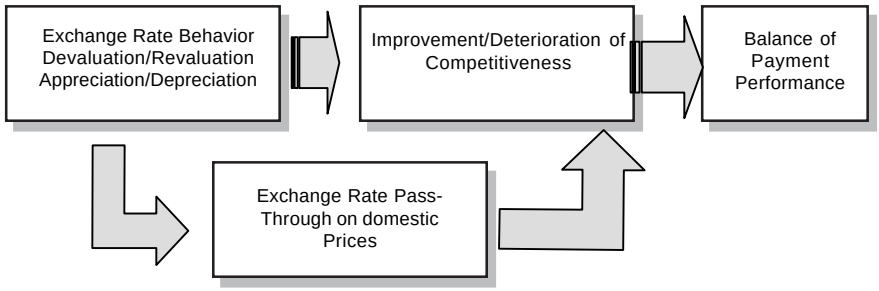
I. Introduction

The exchange rate is the price of national currency in terms of foreign currency. The close linkage of the exchange rate to the general price levels of the economies produce an economy wide importance of policy making since it affects the real income and wealth of those economies.

One of the major objectives of the exchange rate based stabilizations is to improve the Balance of Payment (BOP) performance through international competitiveness. Countries have been using this strategy for a considerable period of time producing varying results. The empirical observations reveal that some countries were successful in following the particular strategy while some countries producing disastrous results. Under these circumstances the obvious question that has to be answered is " What are the reasons for producing such varying results?" The objective of this study is to analyze Sri Lanka's exchange rate behavior, competitiveness and BOP performance.

As per the framework given in Figure 1.1, the main policy objective is to improve the BOP performances through external competitiveness allowing the nominal exchange rate to depreciate. External competitiveness is generally measured using the behavior of the Real Exchange Rate (RER) in terms of bi-lateral trade and Real Effective Exchange Rate (REER) in multi-lateral trade. Although there are number of other criterion used to measure the external competitiveness, the real exchange rate is extensively used in literature. In calculating RER or REER different methodologies are adopted depending on the nature of the study. The oldest and commonly used criteria is Purchasing Power Parity (PPP) based real exchange rate formula, $R = EP^*/P$ where, E is nominal exchange rate, P^* is foreign price level and P is

Figure 1.1 - Conceptual Framework For Relationship Between Exchange Rate, Price level and BOP Performance



domestic price level. The price ratio of tradable to non-tradable is another method, which generally measures the internal competitiveness (Hinkle and Montiel, 1999). In both methods domestic price level has substantial influence on RER. Increasing of domestic price level at a higher rate relative to foreign price levels directly affects the RER in terms of appreciation of domestic currency in real terms eroding the external competitiveness. Nominal devaluation in turn leads to increase in the domestic price level.

As stated earlier, the main objective of the devaluation or depreciation is to gain external competitiveness and BOP improvement in an economy. Under this scenario the policy makers should face certain dilemma in terms of increasing price level and eroding competitiveness under a single policy variable if the pass-through of exchange rate is substantial. It is also apparent that the policy makers have to face certain trade-off between external competitiveness and increasing price level in formulating their policies. This scenario is more or less applicable to both developed and developing economies in policy making.

II. Literature Review

Mercantilism and balance of trade doctrine, which was in existence during the period between 1500-1800**,** is considered to be the oldest approach to the BOP. In a broader sense, Mercantilists believed that the wealth of merchants and power of nations could be increased by accumulation of species (precious metals such as gold and silver that one used as money in international transactions). As a result, they strictly advocated maintaining the surplus on Balance of Trade and commodity imports were considered to be undesirable due to resulting outflow of accumulated species. Hence, foreign trade was regulated by way of subsidizing exports and taxing imports. In this approach, financial flows between countries were not given a great prominence and trade flows were the main determinant of the analysis. (Pitchford, 1995)

Through the price specie- flow and gold standard mechanism David Hume (1752) established an opposing view of mercantilists, elaborating the fact that any attempt to sustain the trade surplus would not be persistent in the absence of capital flows due to changes of money supply as a result of accumulation of species. In Hume's exposition, general price levels in domestic economy and abroad is determined by quantity theory of money under the classical assumptions. (Ibid) If a country which is initially in equilibrium, experience an

increase in supply of species (Gold) due to continuous trade surpluses, then the price level of that country tend to be driven up encouraging imports and discouraging exports worsening trade balance. As a result, corresponding outflow of species would continue until the price level return to its original level and thereby returning of trade balance back to zero. (Caves et al, 1999) In this sense, Hume's explanation of BOP is a self-adjusting process, which demonstrate how the price mechanism can equilibrate the trade balance, current account and balance of payment under the classical assumptions. A fundamental pre-requisite for the self-adjustment mechanism is the flexibility of prices and it is in turn a close function of the flexibility of cost of production, notably of labor costs. The flexibility of production costs particularly labor costs had been rather high until the middle of the 19th century and as a result BOP adjustment process was automatic and occurred without major frictions when Hume postulated his mechanism. (Riechel, 1978)

The Elasticity Approach is one of the traditional approaches that acquired substantial attention of the economic theorists and researchers who focused on the balance of payment literature during the past few decades. Even though a number of new BOP approaches has come to light subsequently, traditional elasticity approach still possesses the substantial popularity in the current empirical research especially in analyzing the trade performances in developing countries. The elasticity approach is considered to be a sub theory of the Keynesian approach to the balance of payment and focuses mainly on trade balance while capital movements are being considered as exogenous and play a minimum role in the BOP analysis. (Arize et al, 2000) The development of elasticity approach was accredited to Charles Bickerdike, John Robinson and Lloyd Metzler and subsequently the model has come to be known as Bickerdike, Robinson and metzler model even though this theory somewhat explains the absorption approach which would be dealt in a subsequent section. The particular model developed in terms of independent markets for exports and imports is considered to be a partial equilibrium in nature. (Dornbusch, 1988)

The exchange rate is an important policy variable in the elasticity approach and deficits in a BOP require a devaluation of domestic currency against foreign currencies to eliminate the deficit. This approach stresses the relative price induced substitution of domestic demand away from foreign imported goods to the domestic goods and foreign demand towards the domestic exports through devaluation. Hence, the elasticity notion was typically set in a fixed exchange rate environment and also subsequently applied to the managed floating regimes by policy makers.

The key question of the elasticity approach was whether exchange rate devaluation or depreciation would raise net exports and current account balance and thereby restore the BOP equilibrium? The answer generally rests on the elasticities of demand for both exports and imports. If both export and import elasticities are together greater than unity ($E_x+E_M>1$), it was considered to be the sufficient and necessary condition for devaluation or depreciation to improve the trade balance. This notion is called Marshall-Lerner condition, (M/L Condition) which was named after Alfred Marshall and Abba Lerner who presented this view. (Krugman and Obstfeld, 1997) If the demand elasticities of both export and imports do not satisfy M/L condition, devaluation would increase current account deficit or reduce surplus. (Pitchford, 1995)

However, the empirical results had shown mixed results with regards to holding of M/L condition and in 1940s a view known as Elasticity Pessimism arose suggesting that in most of the cases the actual trade elasticities were insufficient to hold M/L condition. It is generally observed that when the elasticities were measured in the short run, the M/L condition is unlikely to hold. However, there is abundant evidence that elasticities are higher in long- run and M/L condition is more likely to hold. (Caves, Frankel and Jones, 1999) See Krugman (1991:10) with respect to US Current account and Krugman and Obsfield(1997:485) with respect to the OECD countries. In recent studies, Bahmani-oskooee and Brooks (1999) found that M/L condition holds for a long run with respect to US bilateral trade elasticities with some of the major trading partners. In another study by Bahmani-oskoee (1998) with respect to less Developed Countries (LDCs) reveals that in most LDCs considered in his paper, the M/L condition was satisfied indicating that devaluation could improve their trade balances. Arize (1994) studied whether there is a long run relationship between REER and Trade Balance (TB) using data of nine Asian countries including Sri Lanka. The study revealed that except Sri Lanka and India there is a long run positive relationship between REER and TB confirming the ML condition of other seven countries. The data covered the period of 1973:1 to 1991:1. However, after 1977 there is a structural break in economic policies and therefore the results are not reliable in the Sri Lankan context.[1/]

The particular long run relationship between exchange rate devaluation/depreciation and trade/current account balance postulated in the Marshall-lerner condition was further analyzed in the popular J-Curve Hypothesis. The tendency of the elasticities to rise over time and its impact on the trade balance as a result of devaluations or depreciations of domestic currencies is observed by this phenomenon. The theoretical discussion of J-Curve hypothesis can be better discussed by the following equation.

$$BOT = P_X \cdot Q_X - P_M \cdot Q_M \qquad (2.1)$$

Where, *BOT* is the trade balance in the local currency, P_X is the unit price of exports, Q_X is the volume of exports, P_M is unit price of imports and Q_M is volume of imports. (Zhang, 1996) The J-Curve analysis considers two effects of changing in exchange rate on trade balance-"price effect" and "volume effect". The price effect implies that devaluation or depreciation would cause imports to be more expensive and domestic exports to be cheaper for foreigners at least in short-run. Here the assumption is that the economy's export and import contracts are mainly written in local currency and foreign currencies respectively. Since the volume of goods imported and exported might not be changed in short-run due to various reasons[2/] and as a result, the trade balance may initially deteriorate. However, in a long –run, import and export volume would respond to the changes in the exchange rate dominating the volume effect eliminating the perverse effect generated through the price effect. In other words, the price effect is generally believed to dominate volume effect in the

1/ It is generally considered that the cointegration property is equivalent to stability of long run behavior and therefore, if there is a structural break there cannot be cointegration.

2/ Import and supply contracts, strng consumer habits, Lags in prductin and delivering of import orders and payments, inability of switching immediately from the intermediate imported goods in domestic manufacturing and supply rigidities of domestic export in short run are sum of the reasons for short run pervasive effect on trade balance after devaluation.

short-run deteriorating the trade balance (Declining part of the J-Curve) while the volume effect takes over and reverses the perverse effect generated in the short run and trade balance improves (Rising Part of the J-Curve) if the M/L condition holds. This can be observed when the total effect is plotted on two-dimensional space with trade balance in Y-axis and time variable in the X-axis which together yield the J-curve.

However, the empirical studies reveal mixed results with regards to validity of the J-curve hypothesis. Gupta-Kapoor and Ramakrishnan (1999) conducted a study using a Vector Error Correction (VEC) model for the period of 1975:1 to 1996:4 with respect to Japanese data and concluded that the J-curve phenomenon holds for Japan and there is a long run equilibrium relationship between exchange rate and trade balance. Rosensweig and Koch (1988), Mahdavi and Sohrabian (1993) and Mead (1988) find evidence of delayed J-curve pattern in relation with US data. In contrast, Rose and Yellen (1989) with respect to G-7 countries and Rose (1990) for the sample of developing countries observed that J-curve phenomena do not hold for both the situations.

When the elasticity approach and its extensions had reached a stalemate in the economic discussions, Sidney S. Alexander (1952) introduced a new approach to devaluation analysis. The particular approach to BOP analysis is called as Absorption Approach, the name introduced by Alexander himself when he presented this proposition. Here the term, absorption refers to the total domestic expenditure and BOP is considered to be the difference between the flow of aggregate income and expenditure of an economy. In his original article Alexander concentrates on trade balance as same as the elasticity approach neglecting the adjustments in the capital flows. (Reichel, 1978) The identity of absorption approach could be depicted using the equations below. Following Keynesian national income identity,

$$Y = C + I + G + (X - M) \qquad (2.2)$$

$$A = C + I + G \qquad (2.3)$$

Substituting (2.3) in 2.2 and re-arranging them yields,

$$Y - A = X - M \qquad (2.4)$$

Where, A= total absorption, X= Exports, M= Imports, Y= total income, I= Private domestic investments and G=Govt. expenditure.

The equation 2.2 can be calculated in both nominal and real terms since the identity holds both ways. (Arize et al, 2000) This set of equations says that if absorption is greater than income, the economy will experience trade deficit. This is obvious since the income is derived from production, so if absorption is greater than production the difference must be made up by net imports which in turn leads to trade deficit. To reduce the deficit, the expenditure–output gap must be reduced or eliminated through reduction of absorption, increase in output (income) or combination of both. Therefore, devaluation to be a success, adjustments are required in either or both of these two variables, increase in income (Output) and reduction in expenditure. One of the main criticisms is that the absorption approach does not contain the automaticity in the adjustment process and domestic policy measures would generally be required along with the exchange rate policy in order to achieve the desired changes of BOP. Hence, the devaluation should be accompanied with contractionary fiscal and monetary policies to improve the trade balance.

One of the main criticisms against the conventional approaches was that most of those approaches were partial equilibrium in nature. In order to overcome this problem and other inherent weaknesses ie. as ignorance of the role of the capital account etc., a modern approach called Monetary Approach to the Balance of Payment (MABP) was presented, alternative to the traditional theories of BOP in 1960s and early 1970s. The traditional approaches exclusively concentrated on real variables and ignored the influence of the monetary variables on BOP adjustment mechanism. In order to address the above problems MABP possesses following fundamental principals. (Riechel, 1978)

1. The BOP has been considered essentially as monetary phenomenon and imbalances of BOP are rooted in the relationship between the demand and supply of money.
2. It considered the importance of both stable money supply process and money demand function.
3. It concentrates on long-run consequences of policy and parametric changes for behavior of the BOP.

As stated in the first principal, if the system is disturbed by the excess supply of money creating disequilibria in the money market, then actual cash balances exceed the desired balances. This would cause BOP deficit as individuals adjust their excess money balances for foreign goods, services and capital assets. (Humphrey and Keleher, 1982) In a BOP surplus, process works the other way around. However, MABP does not differentiate among the partial balances such as trade balance, long term and short capital account etc., in the BOP account as in the traditional approaches. Hence, MABP relies on a comprehensive definition of BOP namely, as the sum of the items "below the line" which relates to balance of official settlement or official reserve transaction account. (ORT Account) (Riechel, 1978) Therefore, MABP is considered as a general equilibrium analysis. Any imbalance or change in the official settlement account is identical to change in the country's international reserves. As a result, in most empirical analysis, monetary approach considers the changes in the reserve flow as a target variable. In this sense, BOP is considered as essentially a monetary phenomenon.

Another premise of BOP to be considered as monetary phenomena is that MABP treats demand function for money as a stock and not as a flow as treated in conventional approach. This is the same reason that under monetary approach BOP is considered as self-adjusting. When the desired level of stock of money is reached, the inflow or outflow of funds ceased and as a result deficit and surplus of BOP is also eliminated. Hence, monetary approach postulates a direct relationship between BOP and money supply. (Humphrey and Keleher, 1982)

Due to the self-adjustment mechanism, some writers suggested that MABP is the intellectual grandchild of the specie flow mechanism of David Hume. Self-correcting external balance and monetary flows are cornerstones to both the theories. However, there is a major difference in self-correcting process and in Humes' specie flow mechanism adjustments in the BOP occurred through relative changes in the commodity prices and where as in the monetary approach it is done through the stable demand and supply of money as a stock. Hence, surplus or deficit in the BOP reflects stock disequilibria between the demand and supply of money. (Arize et al, 2000)

The monetary approach, unlike traditional approach clearly delineates between monetary and real variables while asserting the fundamentality and superiority of monetary variables. The term superiority is defined in terms of ability of variables to act as initiators of disturbances and transmission channels in the system and real variables are generally considered as neither initiators nor transmission channels. (Ibid)

Even though the MABP was initially designed in the regime of fixed exchange rate, the analysis was subsequently extended to other exchange rate regimes as well. The Monetary Approach to the exchange rate determination was the floating exchange rate version of the monetary approach. According to monetary approach, freely floating exchange rates maintain continuous equilibrium in the BOP. Since reserve changes are held at zero, monetary authority has direct control over money supply and as a result it becomes a policy variable. In the fixed exchange rate regime money supply becomes an endogenous variable since any change in the domestic component in the monetary base is a change in the international component (external reserves) if the reserves flows are not-sterilized.

The monetary approach also takes an account of the intermediate regime of managed floating. "It has to be borne in mind, however, that a policy which fixes the exchange rate above its equilibrium value or one which through a "dirty float" keeps the exchange rate of the domestic currency undervalued will induce an adjustment process in the private sector very similar to those brought about by a devaluation. Therefore, if adopted correctly and interpreted carefully, the result of the analyses presented in this study will be relevant for wide range of exchange arrangements and policies." (Riechel, 1978)

Under the fixed exchange rate regime, the govt. (monetary authority) is obliged to buy and sell foreign exchange with its own currency to maintain the exchange rate at a fixed parity and as a result the adjustment occurs through the Official Reserve Transactions (ORT) account accumulating or de-cumulating the foreign exchange reserves. The result is the BOP deficit or surplus. In the case of floating exchange rate regime, an adjustment occurs through changes in exchange rate and not through the reserve flow or BOP. Finally, under the regime of managed floating, crawling peg or crawling band, adjustment occurs both through the foreign reserves (BOP) and exchange rate changes. (Humphrey and Keleher, 1982) Under this situation, the authorities intervene time to time in the foreign exchange market to control the fluctuations in the exchange rates and to keep the rate in the equilibrium level. Also they have to decide the proportionate amount of exchange rate pressure, originated through disequilibria in the money market, should be relieved through the exchange rate movement and through the reserve flows. In this case, both the variables will change and contribute to the restoration of monetary equilibrium.

Although devaluation as a policy tool plays a prominent role in the traditional approaches of BOP. MABP consider that exchange rate does not provide an effective contribution towards correcting external imbalances. According to the MABP, under fixed exchange rate regime, external imbalances are viewed as self-correcting and therefore such policies are considered unnecessary and ineffective except in short run transitory effects. (Kreinin and Officer, 1978) Even in short run, the mechanism that has certain impact on BOP though devaluation depends neither on variations in relative prices nor on elasticities as predicted in the traditional approaches. "For the monetarists, devaluation operates through a totally

different mechanism- stock demand for and supply of money. The only condition postulated by the monetary approach is that a reduction in real balances (caused by an increase in domestic-currency prices following devaluation) would produce a reduction in real expenditures, or absorption, out of a real income." (Ibid) In this sense the Monetary approach could be reconciled with the absorption approach, up to a certain extent, than the elasticity approach in terms of assumption of full employment, more longer run view and general equilibrium in nature. It is generally considered that the elasticity approach represents the short run, absorption approach to the medium run and monetary approach deals with long run, on the ground that the asset portfolios take a longer time to adjust following a major dislocation.

III. Model Specifications

A. Traditional Trade Balance Equation

The particular study takes standard trade model as a point of departure and many researchers (Rose and Yellen (1989), Rose (1991) Bahmani-Oskooee (1991), Shirvani and Wilbratte (1997)) have employed this model with certain variations in their respective studies.

Standard two country trade model which is also extensively used in the traditional elasticity approach assumes that the demand for imports (D_m) depend upon the domestic income (Y) and the relative price of imported goods to the domestically produced goods (P_m) and both measured in home currency terms. Hence, the basic equation following Rose and Yellen (1989) would be,

$$D_m = D_m (Y, P_m) \text{ and } D_m^* = D_m^*(Y^*, P_m^*) \qquad (3.1)$$

Where, *Dm* and *Dm** are the quantity of imports by home and foreign country respectively and * sign represents the foreign component of the analogous relative price of imports *(Pm*)* and foreign income *(Y*).* The model assumes the perfect substitutability between imports and domestic goods. Also, the above equations represent the Marshallian demand function which predict income and relative price elasticities to be positive and negative in signs with respect to demand for imports.

Supply of exportable in each country depends positively on relative price of exports and this proposition postulates a perfect competitive situation.

$$S_x = S_x (P_x) \text{ and } \quad S_x^* = S_x^*(P_x^*) \qquad (3.2)$$

Where, S_x and S_x^* are the home country and foreign country supply of exports respectively. P_x is the home country relative price of exportable, defined as ratio of the domestic currency price of exportable to the domestic price level *(P)*. P_{x^*} is analogously defined as the foreign component in which P_x^* is the foreign currency price of exportable divided by Foreign price level, *P**.

The domestic relative price of imports depicted in the equation (1) could be further expressed as,

$$P_m = E \cdot P_x^* / P = (E \cdot P^* / P) \cdot (P_x^* / P^*) \; a \quad q \cdot P_x^* \tag{3.3}$$

Where, *E* is the nominal exchange rate, defined as the domestic currency value of foreign exchange following direct method and q is the real exchange rate defined as $q = E \cdot P^* / P$ following the PPP based real exchange rate. Thus, increase in value of E and q indicates a devaluation or depreciation of the domestic currency. Foreign country relative price of imports could be defined analogously as,

$$P_{m^*} = (P_x / q) \tag{3.4}$$

The quantities of transactions and relative prices of exports in equilibrium condition could be expressed as,

– $Dm = S_x^* \quad and \quad D_m^* = S_x$ (3.5)

The value of domestic country Balance of Trade (BOT) or Trade Balance (TB) in general, could be expressed as,

$$TB = P_x \cdot D_m^* - q \cdot P_x^* \cdot D_m \tag{3.6}$$

BOT in the above equation in real terms is generally depicted as value of net exports in domestic currency divided by domestic price level (P). The equations (1)-(4) along with the equilibrium condition in (5) could be solved for the levels of domestic imports and exports (D_m and D_m^*) and the relative prices (P_x and P_x^*) as a function of real exchange rate (q), domestic income (Y) and foreign income (Y*). Substituting these in to equation (6) and re-writing it, yields the following reduced form equation.

$$TB = TB\,(q, Y, Y^*) \tag{3.7}$$

The above model expresses the trade balances as a function of real exchange rate and the levels of domestic and foreign income. Taking logs of both sides and using log linear approximation, the following econometric model of testable form is derived.

$$ln(B_t) = \beta_0 + \beta_1 ln(q_t) + \beta_2 ln(Y_t) + \beta_3 ln(Y_t^*) + u_t) \tag{3.8}$$

here, *ln* represents natural logarithm, β_0 is the constant term and *u* is the white noise process to represent the unimportant omitted factors in the model. The expected signs of each variable are, $\beta_1 > 1, \; \beta_2 < 1, \beta_3 > 1$.

The real exchange rate in the model is taken as Multilateral Real exchange Rate (MREER) or Real Effective Exchange Rate (REER) in which the methodology of calculations are discussed subsequently in this paper. The foreign country in the two-country trade model is considered as the Rest of the World (ROW), in which two of the variables in this study are defined as the trade weighted aggregate of price levels and GDPs of major trading partners.

However, the above model does not take the monetary variables in to consideration. Therefore, in accommodating the monetary approach to the balance of payments and some of its variables, an auxiliary regression would be tested including domestic and foreign money supplies as adopted by Bahmani-Oskooee(1985) and Shirvani and Wilbratte (1997).

B. Exchange Rate Pass-Through Equation

As depicted in the conceptual model in the introduction, the impact of the real exchange rate on trade balance could be influenced negatively or positively with changes in the exchange rate and thereby passing-through those changes to domestic price level. This phenomenon is also directly related with the changes of exchange rate and its impact on the real exchange rate through the increasing of domestic price level based on the degree of pass through. The expected depreciation of real exchange rate and thereby external competitiveness is generally considered to be eroded by the pass-through of exchange rate to domestic price level. Therefore, it is worthwhile to estimate the degree of pass-through of exchange rate to domestic prices.

The conventional and simpler model specification of testing Exchange Rate Pass-through (ERPT) has been derived through the basic Purchasing Power Parity (PPP) relationship as depicted in the following equations.

$$P = E \cdot P^* \tag{3.9}$$

This PPP relationship could be converted to the following testable form using log linear transformation.

$$ln\ P_t = a_0 + a_1\, ln(e_t) + a_2\, ln(p_t^*) \tag{3.10}$$

Under flexible exchange rate regimes (Both in managed and fully floating) either exchange rate or foreign price level can adjust the domestic price level in order to maintain the PPP. Following Goldberg and Knetter (1996) the equation (10) could be further extended as follows to include other variables that can possibly affect the domestic price level.

$$lnP_t = \alpha_0 + \delta lnx_t + \gamma lne_t + \psi lnz_t + \varepsilon_t \tag{3.11}$$

Where, all the variables are in natural logarithm and p is the local currency domestic price and it may be import, producer, and wholesale or consumer price depending on the study. The particular study uses both general price level (consumer price) and the wholesale price level in order to study the impact of inflation on the real exchange rate changes. *X* is the primary control variable for cost of price of exporter and it may be general (consumer) foreign price level, producer price level (foreign) or wholesale price level (foreign) depending on the study. The variable Z may include the demand shifters such as level of income, competing prices of imports and money supply etc., that also depends on the study. Finally, the pass-through coefficient is depicted by the γ sign and in isolating the particular coefficient, the degree of pass through could be estimated.

C. Reserve-Flow Equation

This study intends to employ the reserve flow equation in order to fully accommodate the monetary approach to the balance of payment as an exercise of model comparison depend-

ing on the performance of the traditional trade model depicted in the equation (3.8). If the monetary variables included in the auxiliary regression have considerably significant impact on trade balance, it may pave the path to compare the monetary approach with the traditional elasticity approach. Under these circumstances the derivation of the standard reserve flow equation that would be employed in this exercise is as follows. (Kreinin and Officer (1978), Arize et al (2000), Das (2000))

The nominal demand for money is generally considered to a function of income (Y), nominal interest rate (i) and general price level (P).

$$M^d = f(Y,i,P) \tag{3.12}$$

Real demand for money could be depicted as,

$$M^d/P = f(y,r) \tag{3.13}$$

Differentiation of equation 3.13 with respect to time and rearranging it yields the following equation for real money demand function.

$$\Delta m^d/m^d = \varepsilon_y \Delta y/y + \varepsilon_r \Delta r/r \tag{3.14}$$

Where, $m^d = M^d/p$ which represent the demand real money balances. $å_y$ and $å_r$ are the elasticities of money demand in respect to real income and real interest rates respectively. Equation 3.14 in nominal terms could be written as,

$$\Delta M^d/M^d = \Delta P/P + \varepsilon_y \Delta y/y + \varepsilon_r \Delta r/r \tag{3.15}$$

When the monetary authority in an open economy handle the international reserves R, by way of buying or selling at pre-determined rate from the household and firm sector it affects the money supply through changes of the reserves and the domestic credit extended by the monetary authority. Therefore, the money supply could be described by the following equation.

$$M^s = a(R + DC) \tag{3.16}$$

Or,
$$M^s = aH \tag{3.17}$$

Where, M^s is the money supply, a, is the money multiplier, R is international reserves (international component), DC is the domestic credit by monetary authority.(domestic component of Monetary Base) and M=R+D. Eq. 3.16 and 3.17 in growth form could be written as,

$$\Delta M^s/M^s = \Delta a/a + \Delta R/(R+DC) + \Delta DC/(R+DC) \tag{3.18}$$

$$\Delta M^s/M^s = \Delta a/a + \Delta R/H + \Delta DC/H \tag{3.19}$$

Equivalently, Eq.3.19 could be written as,

$$\Delta M^s/M^s = \Delta a/a + R/H(\Delta R/R) + DC/H(\Delta DC/DC) \tag{3.20}$$

and rearranging it would yields,

$$R/H(\Delta R/R) = \Delta M^s/M^s - \Delta a/a - DC/H(\Delta DC/DC) \tag{3.21}$$

and $$(\Delta R/R)R/H = \Delta M^s/M^s - \Delta a/a - DC/H(\Delta DC/DC) \tag{3.22}$$

The eq. 3.22 could be re-written as,

$$ÄR/R = H/R(ÄM^s/M^s - \Delta a/a) - DC/H(\Delta DC/DC) \quad (3.23)$$

Under the assumption of money market equilibrium $M^d = M^s$ and substituting 3.15 in 3 .23 yields the following equation.

$$\Delta R/R = H/R(\Delta P/P + \varepsilon_y \Delta y/y + \varepsilon_r \Delta r/r - \Delta a/a) - DC/H(\Delta DC/DC) \quad (3.24)$$

Rearranging Eq. 3.24 results the following equation.

$$\Delta R/R(R/H) = \Delta P/P + \varepsilon_y \Delta y/y + \varepsilon_r \Delta r/r - \Delta a/a - DC/H(\Delta DC/DC) \quad (3.25)$$

Eq. 3.25 is re-formulated with inclusion of a constant term and an error term for the purpose of econometric estimation in the reduced form equation with log linear transformation. The growth formed eq. 3.24 is analogous to the following equation.

$$\Delta R_t/H_t = \beta_0 + \beta_1 \Delta(lnP_t) + \beta_2 \Delta(lnY_t) + \beta_3 \Delta(lnr_t) + \hat{a}_4 \Delta(lna_t) + \beta_5 \Delta DC_t/H_t + U_t \quad (3.26)$$

where, R is the country's international reserves, H is the monetary base (R+DC), P is the price level, y is the real income, r is the real interest rate, a is the money multiplier, DC is the domestic component of the monetary base i.e. domestic credit. The coefficient of the DC is generally known as "offset coefficient" and it shows the degree of changes in international reserves of a country against the changes in the domestic component of the monetary base (ÄDC). The expected signs and magnitudes of the coefficients are as follows.

$$\beta_1 = 1 \quad \beta_2 > 0 \quad \beta_3 < 0 \quad \beta_4 = -1 \qquad \beta_5 = -1$$

$\beta_1 = 1$ indicates that there is no money illusion, which implies one percent increase in price level increase demand for money by same proportion and thereby increases international reserves in similar proportion, ceteris paribus, accommodating the excess demand as a result of changes of price level.

The coefficient $\beta_2 > 0$ indicates that keeping all other thing equal, an increase in real income leads to increase in international reserves as a result of increase demand for money.

$\beta_3 < 0$ implies that increase in real interest rate leads to decrease the demand for real balances and liquidity creating an excess supply of money. This would lead to outflow of reserves.

$\beta_4 = -1$ indicates that increase in money multiplier, ceteris paribus, leads to proportionate increase in supply of money resulting in out flow of reserves.

Finally, the sign and magnitude of coefficient $\beta_5 = -1$ implies that when the monetary authority expands the domestic credit greater than required, the economic agents tend to increase the expenditure or absorption over income creating a high demand for foreign goods which results in BOP deficit and reserve outflow.

All the reverent Data was obtained through the International Financial Statistics (IFS) CD ROM and Quarterly book and Direction of Trade Statistics of IMF. In addition, Central Bank of Sri Lanka, Annual Reports, Various Issues were used to get data.

IV. Empirical Analysis, Results and Interpretations

A. Traditional approach to the Balance of Payments

The particular study uses the quarterly data covering the period 1978:1 to 2000:4 of Sri Lanka as well as its 24 major trading partners. As mentioned earlier, in estimating the traditional trade equation (Eq.4.8) the variables of exports to imports ratio (X/M) as dependent variable, Real Effective Exchange Rate (REER), real domestic income (Y_d) and world income or income of rest of the world (Y_{row}) approximated by trade weighted real income of 24 major trading partners are used as explanatory variables. Expressing the trade balance as X/M allow the equation to use as log linear transformation and obviates the requirement of expressing the trade balance as real index (Shirvani and Wilbratte, 1997). Also, the ratio is insensitive to the unit of measurement (foreign currency vs.domestic currency) of imports or exports. (Bahmani-Oskooee, 1991) The domestic money supply (M2) and world money supply (Trade weighted M2 of 24 trading partners) is also introduced in the model as an auxiliary regression.

As a prior step in the data analysis, it is vital to check the causality and its direction in each variable in order to observe the dynamic relationships between data. Therefore, Granger Causality test was carried out based on the following equation formulated by Granger (1969)

$$Y_t = \Sigma \acute{a}_i Y_{t-I} + \Sigma \beta_j X_{t-j} + u_t \qquad (4.1)$$

Accordingly, the results of the Granger causality test for the variables both in the basic model as well as the auxiliary regression are shown in table 4.1.

Table 4.1 shows that the causality running from REER to ratio of export to import is very blurred showing very week causality only at 17% level of significance. Also the two way causality is indicated in the world money supply ($M_{(row)}$) and the X/M ratio. However, there is strong one way causality indicated in all other variables with high 1% level of significance. The strongest causality is running from domestic money supply to the ratio of X/M. After testing the causality between variables in Granger sense, the basic behavior of those variables should be examined over time in order to correctly specify the dynamic relationships. Since the time series data are generally considered to be non-stationary it is advisable to check whether the data used in the particular model is stationary. If the non-stationary (Unit Root) data is used to model the basic economic relationship through the conventional OLS procedure, there is a possibility of getting spurious or dubious relationships between variables, which ultimately can lead to erroneous inferences. Therefore, the well-known "Augmented Dickey-Fuller test"(ADF test) is used to check whether the variables are stationary or non-stationary and the particular test is based on the following equation.

$$\Delta Y = \acute{a} + \beta_1 t + \beta_2 Y_{t-1} + \quad \beta_3 \Delta Y_{t-i} + u_t \qquad (4.2)$$

Where, t is the time trend, $\ddot{A}$ is the first difference operator and the u_t is the error term. The following table provides the ADF test results for unit root.

All variables are integrated in order 1, accepting a null hypothesis (H_o) of unit root in levels and rejecting H_o indicating no-unit root in the first difference, that is I (1), since all the Variables are stationary in its first difference. This behavior indicates the possibility of long run cointegrated behavior of all the variables. Therefore, the cointegration test is carried out to check whether the variables are cointegrated as the next step in this process.

Table 4.1 - Results of Granger Causality test

Direction of causality			F-STAT.	P.VALUE	Level of Significance
lnREER	→	lnX/M	1.82681	0.1679	1%
lnX/M	→	lnREER	0.53739	0.5862	
lnY_d	→	lnX/M	4.73496	0.0112	1%
lnX/M	→	$LnY_{(row)}$	0.89648	0.4118	
$LnY_{(row)}$	→	lnX/M	4.62273	0.0124	1%
lnX/M	→	$LnY_{(row)}$	0.76279	0.4695	
lnM_a	→	lnX/M	8.34694	0.0004	1%
lnX/M	→	lnM_d	1.15221	0.3208	
$LnM_{(row)}$	→	lnX/M	4.71384	0.0114	1%
lnX/M	←	LnM(row)	3.64892	0.0301	5%

Testing for Cointegration

The cointegration test is carried out by employing both the Engle-Granger approach and Johansen procedure. The Engle-Granger approach suggests that the variables of the model are cointegrated, then the linear combination of these will be stationary and therefore residual (u_t) of the cointegrated equation is also stationary. The stationarity of u_t can be checked based on the following equation employed in the general ADF test with error term as dependent variable.

$$\Delta u_t = \acute{a} + \beta_1 t + \beta_2 u_{t-1} + \Sigma \beta_3 \Delta u_{t-i} \qquad (4.3)$$

Where, u_t is the residual of the cointegrated equation. The test is carried out for both the variables of the basic model and for the auxiliary regression separately. The money supply of the rest of the world ($M_{(row)}$) was dropped from the auxiliary regression since Granger causality test indicates that there is two way causality between lnM(row) and ln X/M. Two-way causality could mislead the results leading to erroneous conclusions due to simultaneity and identification problem. The following table shows the cointegration results based on the Engel-Granger procedure for the basic model and auxiliary regression.

Table 4.2 - ADF (Unit Root) Test Results

Variable	Level		First difference	
	With out trend	With Trend	With out trend	With Trend
LnX/M	-2.842646	-4.617647*	-5.737968*	-5.737575*
Lnreer	-1.452738	-1.764195	-3.834405*	-3.828395*
lnY_d	-.0877725	-2.277664	-6.605611*	-6.594246*
$LnY_{(row)}$	-0.433062	-2.432051	-5.232190*	-5.120557*
LnM_d	-1.589732	-2.664770	-5.743650*	-6.742542*
$LnM_{(row)}$	1.445136	-2.241932	-5.905833*	-6.506557*

**Indicates critical values of t-statistics at 1% significant level*

The above results show that the error term in the cointegrating equations are stationary or free of unit root and therefore it could be concluded that both the regressions are cointegrated. It further suggests that there is a long run relationship between those variables. The cointegration test based on the Johansen procedure was also carried out and it indicates that there is "one cointegrating equation at 5% significant level" for the basic model and "two cointegrating equations at 5% significant level" for auxiliary regression. This also confirms the results obtained in Engel and Granger procedure. (The test results are not presented here)

Following equations indicate the OLS estimation of the cointegrated basic trade model and auxiliary regression. As suggested by the cointegration theory this regression results reveal the long run relationship between variables.

Basic Trade model

$$\text{Ln X/M} = -2.31265 + 0.0193\text{lnREER} - 0.114634\text{lnY}_{d} + 0.526175\text{lnY}_{(row)} \qquad (4.4)$$

(-2.8217) (0.1907) (-0.6694) (2.0434)

$R^2 = 0.1617$ DW = 1.2876

Auxiliary Regression

$$\text{Ln X/M} = -5.6627 + 0.0368\text{lnREER} + 0.956162\text{Yd} + 1.2644\text{lnY}_{(row)} - 0.4164\text{lnM}_{d} \qquad (4.5)$$

(-4.2443) (0.3789) (2.50188) (3.6946) (-3.0995)

$R^2 = 0.2450$ DW = 1.4088

In both the equations Durbin-Watson (DW) statistics of 1.2876 and 1.4088 is large enough to reject any spurious problems associated with the regression results. The results indicate that variable ln REER has very marginal impact on Trade balance (X/M) with correct sign. However, t-stat shows that the coefficient is insignificant and therefore finding of this test is not clear. Also the domestic income (Y_d) has expected sign[3/] but the variable is not significant.

Table 4.3 - Engle –Granger test (ADF Test) for Cointegration

Model	t-statistics With out Trend	t-statics With Trend
Basic Model	-3.986437*	-4.098139*
($\ln X/M, \ln REER, Y_d, Y_{(row)}$)		
Auxiliary Regression	-4.675584*	-4.700926*
($\ln X/M, \ln REER, Y_d, Y_{(row)}, \ln M_d$)		

* Indicates critical values of t-statics at 1% significant level

3/ Some (i.e. Maagee(1973) argues that "the expected sign of domestic income is either negative or positive since imports are the difference between domestic production and consumption and hence, as real income rises the domestic production of importable (import substitutions) could rice faster than consumption so as to reduce the volume of imports "(Bahmani-Oskooee(1989))

The coefficient of the income of the rest of the world ($Y_{(row)}$) is significant at 5% level and has correct expected sign. This variable suggests that income level of the rest of the world (More specifically, income of the major 24 trading partners) in the typical two-country model has positive effect on the domestic trade balance. In quantitative terms, keeping all other variables constant, a 1% increase of the world income leads to 0.5% increase in domestic trade balance in long run. This also suggests that income elasticity of trade balance is positive and equivalent to 0.526% indicating substantial trade dependence on the rest of the world.

Accommodating the Monetary Approach to the Balance of Payment (MABP) the domestic money supply (M_2) was added to the basic trade model in the equation 5.5 as an auxiliary regression and the results indicate that the explanatory power of the previous regression was increased up to a considerable level. In this estimation all the variables are significant at 1% level except the REER. However, the sign of the domestic income has changed towards opposite direction of the basic regression with inclusion of the domestic money. The impact of the world income has increased further with more than unity, indicating strong influence on domestic trade balance. As predicted by the MABP, the domestic money supply indicates negative impact on the domestic trade balance with 1% level of significance in the long run. Also the positive sign of the domestic income coefficient is compatible with the MABP, which leads to increase of the demand for money and thereby increase the Balance of payment (BOP) or Trade Balance. This provides strong sign of applicability of MABP in the Sri Lankan context and paves the way to test the MABP as a part of this study.

Short Run Dynamics

In analyzing the short run dynamics, the Granger representation theorem suggested by Granger (1983) and Engle and Granger (1987) is an important part of cointegration analysis. Accordingly, if the long run relationship exists between the variables, the short run dynamics of the long- run relationship could be explained by the Error Correction Model (ECM) as depicted in the following equation.

$$\Delta \ln(X/M)_t = \alpha_0 + \Sigma(\beta_{1i}\Delta \ln REER_{t-i} + \beta_{2i}\Delta \ln Y_{dt-i} + \beta_{3i}\Delta \ln Y_{(row)t-i}) + \Sigma\beta_{4i}\Delta \ln(X/M)_{t-i} + \beta 5EC_{t-1} + v_t \quad (4.6)$$

The ECM for the auxiliary regression can also be depicted adding the domestic money supply as follows.

$$\Delta \ln(X/M)_t = \alpha_0 + \Sigma(\beta_{1i}\Delta \ln REER_{t-i} + \beta_{2i}\Delta \ln Y_{dt-i} + \beta_{3i}\Delta \ln Y_{(row)t-i} + \beta_{4i}\Delta \ln M_{dt-i}) + \Sigma\beta_{5i}\Delta \ln(X/M)_{t-i} + \beta_6 EC_{t-1} + v_t \quad (4.7)$$

Where, Δ represents the first difference operator and EC is the error correction term. EC is the one period lagged values of the residuals of regressions 5.4 and 5.5, which represent the empirical error terms. V_t is the error term with the usual properties. While explanatory

variables with Δ term capturing the short-term disturbances of explained variable ($\Delta X/M_t$) EC term captures the short run adjustments towards long run equilibrium. The empirical results of the equations 4.6 and 4.7 is presented in table 4.4

The lag length is decided on the basis of the Akaike and Schwartz criterion and the lag length of eight quarters was introduced for the variable REER since it is generally considered in the literature that there should be at least 24 months for observable impact of REER to occur on trade balance. (Shirvani& wilbratte(1999),Bahmani-Oskooee(1985))

The short run behavior of equation 4.6 reveals that the variable is significant only at 10% level in the 2nd and 8th quarters. In the 2nd quarter, it shows a behavior in an opposite direction (1% change in REER resulted –0.39% lowering in the exports to imports ratio) and in the 8th quarter it possess the correct sign as expected. (1% change in REER resulted in positive 0.57% change in X/M ratio) All other variables, including its quarterly lags are not statistically significant and therefore, it is difficult to reach any conclusion. However, the error correction term is negative and shows significant results (at 1% level). This indicates that the error is corrected quarterly by 0.59% showing a relatively high speed of adjustment between short term and long-term equilibrium.

The short-term behavior suggests that there is a long-run relationship between the REER and trade balance and confirms the results of the cointegration test. However, the statistically significant behavior shows only in lag lengths of 2nd and 8th quarters. Therefore, all other quarters shows no-impact effect indicating a blurred J-curve phenomena and Marshall-Learner condition. The model as a whole shows a poor performance in the short-run with insignificant coefficients and opposite signs of all other variables in terms of the Sri Lankan situation.

However, after introducing the money supply and its lags in to the model in the auxiliary regression, the model performed quite differently showing statistically significant coefficients in REER, Y(row) and in the 1st lag value of money supply and 2nd lag value in REER.(at 10% level) The power of the regression has also been increased.

This behavior further extends the long run phenomena that the money supply has significant effect on the trade balance even in the short -run. Also there is a strong negative (-0.80) correlation between TB and money supply as predicted by MABP. (See appendix 2) This particular phenomenon suggests testing the MABP in terms of the Sri Lankan context.

It should be noted that the serial correlation of the above equations was tested using LM test and it rejected the presence of the serial correlation up to 8th order. Meanwhile, the heteroscedasticity was also rejected by both the White test and ARCH test up to 8th order.

B. Exchange Rate Pass-Through and its impact on Domestic price level and thereby adjustment of REER

The next obvious question that arises after the results obtained with regard to the above models is why the trade balance is not so responsive especially in the short-run even after substantial devaluations or depreciations. In the long run, it even indicates a positive effect it shows a very marginal impact on TB. Data indicates that, even though the SL Rs./US$ nominal exchange rate depreciated 424% between 1978:1 to 2000:4, the REER has appreciated during the same period by 21.25%. However, it further shows that the REER continued to depreciate until 4th quarter of 1990 and subsequently began to appreciate until 1st quarter of

Table 4.4 - Regression Results of Equations 4.6 and 4.7 (Error Correction Model)

Variable	Basic Regression			Auxiliary Regression		
	Coefficient	St. Error	T-Statistics	Coefficient	St. Error	T-Statistics
Δ lnREER	-0.397497	0.312503	-1.271979	-0.701999	0.322265	**-2.178328**
Δ lnREER$_{t-1}$	0.529752	0.322761	1.641312	0.361821	0.340505	1.062600
Δ lnREER$_{t-2}$	-0.629597	0.334498	**-1.882214**	-0.582231	0.339452	-1.715211
Δ lnREER$_{t-3}$	0.1337727	0.324936	0.411547	0.001171	0.339093	0.003453
Δ lnREER$_{t-4}$	0.249125	0.319624	0.779430	-0.016018	0.331030	-0.048389
Δ lnREER$_{t-5}$	0.361131	0.309018	1.168640	0.062277	0.33384	0.186547
Δ lnREER$_{t-6}$	-0.245363	0.30726	-0.798551	-0.182098	0.315847	-0.576539
Δ lnREER$_{t-7}$	-0.360816	0.309542	-1.165642	-0.275881	0.324157	-0.851072
Δ lnREER$_{t-8}$	0.573789	0.308868	**1.857712**	0.442723	0.311295	1.422196
Δ lnY$_{dt}$	0.589104	0.920611	0.639906	0.946534	0.915963	1.033376
Δ lnY$_{d\,t-1}$	-0.462642	0.942355	-0.490942	-0.567719	0.940046	-0.603926
Δ lnY$_{dt-2}$	0.294443	0.73102	0.402784	0.274719	0.923851	0.297363
Δ lnY$_{(row)t}$	0.895097	0.768692	1.164443	1.774249	0.830626	**2.136038**
Δ lnY$_{(row)t-1}$	-0.045317	0.748237	-0.060565	0.263459	0.773762	0.340491
Δ lnY$_{(row)t-2}$	0.294443	0.731020	0.402784	0.50569	0.752098	0.672373
Δ lnM$_{dt}$				-0.208777	0.582377	-0.358491
Δ lnM$_{dt-1}$				-1.154608	0.580098	**-1.990367**
Δ lnM$_{dt-2}$				-0.768643	0.594312	-1.293333
Δ ln(X/M)$_{t-1}$	-0.083576	0.146180	-0.57173	-0.022771	0.157060	-0.14498
Δ ln(X/M)$_{t-2}$	-0.030876	0.122769	-0.251497	0.032658	0.128687	0.253776
EC$_{t-1}$	-0.585997	0.162238	**-3.611955**	-0.688276	0.178291	**-3.860410**
	R^2 = 0.5197	DW = 2.0902	F.St.= 3.8482	R^2 =0.5505	DW = 2.0850	F.St. = 3.5584

1998. (See Appendix 2). Also figures in Appendix 3 show the behavior of "Effectiveness Index" (EI) of REER and Bi-lateral RER along with CPI. EI generally provides the effectiveness of nominal devaluations/depreciations of intervening currency on the REER. The Effectiveness index (EI) is formulated as,

$$EI = \%\Delta REER/\%\Delta \text{ Nominal Exchange Rate (NER)} \qquad (4.8)$$

When the *EI* is 1 then it indicates that the devaluation/depreciation of NER has fully pass-through on the depreciation of REER on one-to–one basis. On the other hand negative value of EI indicates that the devaluation or depreciation is completely eroded by certain factors. The figures in Appendix 3 reveal that the EI tend to behave negatively most of the time both with respect to multilateral and bi-lateral RER eroding the effectiveness as well as external competitiveness. In both the situations, behavior of inflation is opposite direction indicating a negative correlation of -0.41 and –0.46. It is a generally accepted fact that the

nominal devaluation or depreciation is not a sufficient condition for achieving the depreciation of REER as the effect of many devaluations are being eroded by the inflationary conditions prevailing in the economy. (Ghei and Hinkle, 1999) This particular situation could be clearly seen in the tables 4.2 and 4.3. For a successful depreciation of REER through nominal devaluation or depreciation, the increase in aggregate domestic price level must be less than the foreign price level in domestic currency terms. This particular scenario implies that the REER is not a direct policy variable or instrument and the level of which is determined by other fundamental macro economic variables such as money supply growth along with the nominal exchange rate and the other nominal variables that affect domestic price level.

In this context the exchange rate pass-through (ERPT) is a very vital concept in assessing more formally, the impact of the nominal devaluation or depreciation in achieving real depreciation.

The textbook definition of EPRT is the percentage change in local currency domestic prices (Consumer, producer or import prices) resulting from a one-percentage change in exchange rate. (Goldberg and Knetter, 1996)

The following equations are employed derived from the equation 4.11 in the previous chapter of model specifications.

$$LnP_t = \alpha + \beta_1 lnE_t + \beta_2 ln P_t^* + \beta_3 ln Yd + \beta_4 ln M_t + U_t \qquad (4.9)$$

where, P_t is the domestic consumer price level represented by Colombo Consumer Price Index (CCPI) which is the official price index of Sri Lanka, E_t is the nominal Sri Lankan Rupees/ US$ exchange rate, P_t^* is the US wholesale price index (US WPI is selected due to it providing better representation of Tradable goods)[4/] and Mt is the domestic money supply represented by M_2.

The EPRT is also estimated using the production or wholesale level of distribution chain, employing the following equation in order to examine the degree of pass-through at wholesale level. Due to non-availability of import price index on quarterly basis for the selected period WPI is also taken as a proxy for import price level.

$$LnWPI_t = \alpha + \beta_1 lnE_t + \beta_2 ln P_t^* + \beta_3 lnYd + \beta_4 ln M_t + U_t \qquad (4.10)$$

The regression results are shown in table 4.5

Both the equations work very well in the Sri Lankan context and the above results reveals that 1% change in exchange rate resulted in 0.72% of pass-trough on domestic consumer prices with 1% level of significance with expected sign. All other variables are also significant at 1% level in both the models with expected sign. The sign of domestic income variable is generally negative since with increase of domestic output the price level tends to go down as a result of increased aggregate domestic supply. One of the appealing facts is that the exchange rate pass-through in to consumer prices is greater than the wholesale price level (0.72 vs. 0.47). This indicates the apparent fact prevailing in the Sri Lankan market in which the traders or domestic producers tend to capitalize the exchange rate changes at the expense of ultimate consumers passing more cost towards them than the wholesalers (trad-

4/ US WPI and US$ nominal exchange rate is used since US$ is the intervening currency in determination of all cross rate of other currencies. Also the *USA is the largest trading partner representing about 40%-45% of total international trade in the recent years.

ers). This clearly shows the relatively less bargaining power of consumers against the trading or manufacturing class indicating a seller's market with imperfect market conditions. At a glance, the rivalry among existing competitors in the domestic market is very minimal compared to other emerging markets and pricing behavior is mostly governed by the premium strategy due to lesser rivalry among domestic competitors. This particular situation in turn negatively affects the external competitiveness due to absence of well-behaved competitive domestic market in order to gain productivity based competitive edge against foreign competitors at micro economic level.

On the other hand, as stated earlier, competitiveness at macro level, also gets eroded due to inability of affecting the desired changes of REER as a result of exchange rate pass-through and inflationary pressure. There is a possibility that this behavior works as a vicious circle aggravating the situation if the authorities continuously rely on exchange rate devaluation/depreciation rather than broad based macro economic policies that could influence entire system wide transformations.

Another apparent feature of not responding to the trade balance to the REER is that the export component responds in opposite direction against expected in elasticity approach. As a rough indicator of relationship between exports and REER the correlation coefficient is negative 0.52 while the same correlation coefficient with imports is also negative 0.52. This indicates that the strong correlation between exports and imports with a positive coefficient of 0.98. (See appendix 2) A possible reason for this strong correlation is high import component in the inputs of exports. This particular scenario suggests that the hypothesis of "import pessimism" is highly applicable to the Sri Lankan context. In fact Central Bank reports indicates that the imports of intermediate and investment goods as a percentage to total imports ranged from 70% to 80% for so many years. (Central Bank of Sri Lanka, Annual reports 1998,1999) One of the main features that emerge from this scenario is lack of backward integration or feeder industries to support the growing exports. Also export component is negatively responsive to REER individually (considering correlation coefficient) and growing exports may be positively responsive to other policy measures targeted to improve exports rather than manipulating of REER through devaluation or depreciation.

Table 4.5 - Exchange Rate Pass- Through Equation.

Dependent variables- CPI and WPI Sri Lanka

Variable	Consumer Price Level		Wholesale Price Level	
	Coefficient	t-Statistics	Coefficient	t-Statistics
Exchange Rate (E_t)	0.7265	6.9601*	0.4756	3.4455*
Foreign Price Level (P_t*)	0.6900	2.8076*	0.7911	2.9075*
Domestic Income (Y_d)	-0.5546	-4.5295*	-0.7914	-5.1972*
Domestic Money supply (M_t)	0.4214	7.0102*	0.5035	6.5146*
	R^2 =0.99	DW = 2.02	R^2 = 0.99	DW = 1.99

*Indicates the critical values of t-statistics at 1% levels of significance. The regression results were obtained after correcting serial correlation using Cochrun-Orcutt method up to 3rd and 4th order for 1st and 2nd models respectively. ARCH test and White's test confirmed the free of Heteroscadaticity up to 4th order for both the models.

C. The Monetary Approach to the Balance of Payments: An Empirical Application in the Sri Lankan Context

The regression results of traditional approach revealed that the model has not performed well in the Sri Lankan context especially in short-run even though the variables are cointegrated in long run. In short-run, the coefficients are continued to be negative in the statistically significant quarters until the 8th quarter where a positive expected sign is available. However, adding the money supply variable in the same model has shown considerable improvement in the individual coefficients and in the power of the regression suggesting the validity of monetary variables and paving clear path to testing the monetary approach to the BOP. In this instance also the coefficients show unexpected negative sign as claimed by MABP.[6/] Under these circumstances this study carried out testing of MABP Using Sri Lankan data from 1978:1 to 2000:4 using standard reserve flow equation derived in the chapter 4. Accordingly, testable reduced form equation is as follows.

$$\Delta R_t/H_t = \beta_0 + \beta_1 \Delta(lnP_t) + \beta_2 \Delta(lnY_t) + \beta_3 \Delta(lnr_t) + \beta_4 \Delta(lna_t) + \beta_5 \Delta DC_t/H_t + U_t \qquad (4.11)$$

where, r is the real interest rate calculated using the Fisher equation (r=I-P), a is the money multiplier calculated using the formula M = a(DC+R) and a=M/(DC+R).Colombo Consumer Price Index is taken as price level. R is the international reserves and DC is the domestic credit by Central Bank. The regression results based on the equation 5.11 are given in table 4.6.

ARCH LM test and White Heteroscedasticity test confirms that the regression is free of serial correlation and Heteroscedasticity up to 4th order. Correlation Matrix shows that there is no multicollinearity in the regression.

The signs of all the variables in the regression are as expected. Both domestic credits by monetary authority and money multiplier are statistically significant at 1% level and close to theoretical magnitude of –1. This indicates that money multiplier leads to proportionate increase in money supply and excess money supply tend to increase outflow of reserves creating a deficit in BOP ceteris paribus. On the other hand, every thing else were equal, expansion of domestic credit by monetary authority is faster than required, the general public tends to increase their expenditure proportionately creating a BOP deficit. However, the price elasticity is not statistically significant even though it has expected sign. One of the possible reasons for this behavior is that the Colombo Consumer Price Index (CCPI) is substantially outdated with the base year of 1952 and does not represent a true basket of goods consumed by average consumer in Sri Lanka. It is constructed with the consumer basket consumed by the consumers in the Colombo city.

In order to check the performance of the particular equation with possible alternative price index, Wholesale price index (WPI) was replaced and regression was performed. The base year of WPI is 1974 and this represent substantially both tradable and non-tradable. The regression results are shown in the following table.

The results reveal that regression performs better with WPI and the power of the regres-

6/ MABP claims that the exchange rate changes are incapable of achieving lasting change in BOP position and short-term temporary disequilibria if any can create surplus or deficit that last only until money market equilibrium is restored. (See for further explanations, Kreinin and Officer, 1978)

sion has increased with R^2 of 0.86. Almost all the variables are statistically significant at 1% level except the interest rate variable also with expected signs of all variables. The variables

Table 4.6 - Reserve Flow equation

Dependent Variable = $\Delta R_t/H_t$

Variable	Coefficient	t-statistics
Price Level Change - $\Delta(\ln P_t)$	0.466205	1.230162
Real Income Growth - $\Delta(\ln Y_t)$	0.740676	1.775203***
Real Interest Rate Change - $\Delta(\ln r_t)$	-0.035276	-1.861305***
Change in Money Multiplier - $\Delta(\ln a_t)$	-0.842733	-19.96051*
Change in Domestic(CB) Credit- $\Delta DC_t/H_t$	-1.171967	-8.413343*

** and *** Indicates the level of significance of t-statistics at 1% and 10% respectively.*

$R^2 = 0.84$ DW = 2.35

of domestic credit and money multiplier became closer to the theoretically expected magnitudes of –1. The insignificant coefficient of interest rate provides possible explanation that the domestic interest rate is more sensitive to the CPI than WPI as the official inflation rate is calculated based on the CCPI. The real interest is the nominal interest rate minus expected inflation as per the Fisher Equation of real interest rate.

Finally, test results suggest that the monetary approach to the BOP works reasonably well compared to the traditional elasticity approach in the Sri Lankan context in explaining the behavior of the balance of payment. Therefore, under this scenario monetary authority must concentrate more on restoration of domestic money market equilibrium rather than excessive concentration on manipulation of exchange rate at the expense of other macro economic fundamentals.

V. Conclusion

With the liberalization of economy in 1977, the BOP policies were substantially compatible with the traditional approach of BOP pursuing deliberate attempts to manipulate the exchange rate as a policy tool in order to maintain external competitiveness. The nominal exchange rate with respect to the intervening currency (US$) has been devalued/depreciated by 424% during the period of 1978 to 2000. This is in average, 19.7% depreciation annually. In testing empirically and analyzing the success of the particular policy stance, conventional

Table 4.7 - Reserve Flow Equation with WPI

Dependent Variable = $\Delta R_t/H_t$

Variable	Coefficient	t-statistics
Price Level Growth(WPI) - $\Delta(\ln Pwpi_t)$	0.472157	4.228780*
Real Income Growth - $\Delta(\ln Y_t)$	0.661874	2.544967*
Real Interest Rate Change – $\Delta(\ln r_t)$	-0.023061	-1.307652
Change in Money Multiplier - $\Delta(\ln a_t)$	-0.850225	-22.39655*
Change in Domestic(CB) Credit- $\Delta DC_t/H_t$	-1.143925	-8.998459*

** Indicates the critical values of t-statistics at 1% significance level .*

two-country trade model that explain the traditional approach to BOP was applied in Sri Lankan context using quarterly data covering the period of 1978:1 to 2000:4. The test results reveals that the REER does not have significant impact on improving the Trade balance (TB) especially in the short run implying a blurred J-Curve phenomena.

Although the cointegration test reveals a long run relationship between TB and the REER it shows very marginal impact in improving TB in long run shedding the doubt of even holding the Marshall-Learner condition in the Sri Lankan context. This particular scenario indicates that the behavior of BOP account in Sri Lanka does not explain sufficiently the traditional elasticity approach.

The obvious questions that arise under this scenario are why the trade balance does not respond sufficiently to the changes of nominal exchange rate and REER? Is the expected external competitiveness being achieved in the light of substantial devaluations/depreciations? If not, what are the possible explanations of such behavior? In order to find the possible answers to the particular questions the exchange rate pass-through equation was empirically tested. Theory suggests that one of the main reasons for eroding the competitiveness is that the inflationary pressures stemmed from devaluations or depreciations and other possible means. Also the devaluations/depreciations episodes works as a vicious circle passing through the exchange rate in to domestic prices damaging the competitive edge maintained through the cost advantages in micro economic firm level and leading to the appreciation of real exchange rates and thereby eroding the external competitiveness at macro economic level.

Empirical results show that the pass-through coefficient of the exchange rate changes on consumer price level is 0.72 while on wholesale price level it is 0.47 indicating a relatively lower pass through coefficient towards wholesale price level. This is an indication of the relatively lower bargaining power of consumers and capitalizing the exchange rate changes by the organized trading class at the expense of ultimate consumers indicating an imperfect market structure. However, the test does not indicate the complete-pass through as claimed by the monetary theory. Certain portions of the exchange rate changes may be absorbed by the traders or firms passing through the major portion of the cost to the consumers. This particular scenario paves the path to analyze the particular case in more detailed study. This study therefore proposes to do a detailed study on the exchange rate-pass through in an industrial-organization frame work in order to check the firm level exact reactions of exchange rate changes on pricing strategy and impact on competitive structure of the firms in the Sri Lankan context.

However, test results reveals that the devaluations/ depreciations along with the other inflationary pressures substantially leads to erosion of the competitiveness through the pass-through of exchange rate back to domestic prices.

Another possible reason for the failure of the exchange rate changes to improve trade balance is that while exports have negative reactions to changes in REER (with negative correlation) the imports have strong positive correlation (0.98) with exports supporting the "import pessimism" in the Sri Lankan context.

The auxiliary regression with domestic money supply (in the same model) has shown statistically significant results with expected sign under MABP of both the money supply and domestic income indicating a validity of the MABP. Therefore, the reserve flow equation

in the standard MABP model was employed in the Sri Lankan Context. Test results shows that the model works reasonably well with Sri Lankan data. All the variables are significant at 1% and 10% significance level with expected signs and approximate magnitudes except domestic price level (price elasticity), which represented by CCPI. However, price elasticity coefficient has expected positive sign even though it is statistically insignificant. Real interest rate has very marginal impact on the changes in reserves with expected direction of sign. This indicates that the reserves changes are not so responsive to real interest rate. A change in money multiplier and domestic credit has very significant impact of reserve changes and this indicates that increase in both of these variables has negative impact on reserve through excess money supply as predicted by MABP.

As an alternative to the CCPI, WPI has been included in the second regression and test results indicate that the WPI has performed well in terms of the power of regression and level of significance. WPI has statistically significant (at one percentage) with expected sign. The pass-through coefficient was lower on wholesale price level than the coefficient obtained with CCPI and this indicates that the relatively strong bargaining power of wholesale or trading class and burden on exchange rate changes passing on to consumers with less bargaining power. Under the imperfect market conditions of this nature consumers have to bear more burden on devaluations/depreciation episodes eroding their purchasing power further.

The coefficients of the domestic credit and money multiplier became more close to expected magnitude of negative unity with improvement of the level of significance. However, impact of the real interest rate and its significance level further deteriorated indicating the less relative importance of interest rate on changes of reserve flow confirming the results of previous regression. This may also be due to less-responsiveness to wholesale prices than the CCPI since official inflation rate is generally calculated using CCPI. Real interest rate was calculated in this study using the Fisher Equation.

With consideration of the core finding of the study, it can be concluded that the traditional elasticity approach does not very well explain the Sri Lankan situation and the pursued exchange rate policy more than two decades of economic history is less influential in terms of restoring the external balance. The export growth during the particular period is substantially attributed to the other export promotional tools such as establishment of export development board, substantial export incentives and extension of manufacturing base under the structural changes of the liberalization package.

Based on the performance of the model adopted using MABP it could be further concluded that the policy stance should be more concentrated on the restoration of the money market equilibrium in which case the external balance is also automatically restored to a considerable extent. This particular scenario confirm the appropriateness of recent move to free float exchange rate regime and policy declaration of concentrating more on restoration of money market equilibrium.

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Appendix 1

Methodology of Calculating Real Effective Exchange Rate

Real Effective exchange Rate (REER) was calculated using twenty-four major trading partners of Sri Lanka for the period of 1978:1 to 2000:4 and selection of this was based on the relative share of total international trade (Exports and Imports) of Sri Lanka. The calculation of REER possesses few stages.

After selection of major trading partners bilateral real exchange rate was calculated for each trading partner. Following formula based on the PPP (P=EP* and RER=EP*/P) was utilized in this exercise.

$$RER = (CPI_j.Eij /CPI_i)$$

Where, CPI_j *is the consumer price index, proxy for the price level of j country and* E_{ij} is the bilateral exchange rate between *j* and *I* countries. CPI_i *is the domestic consumer price index proxy for domestic price level.*

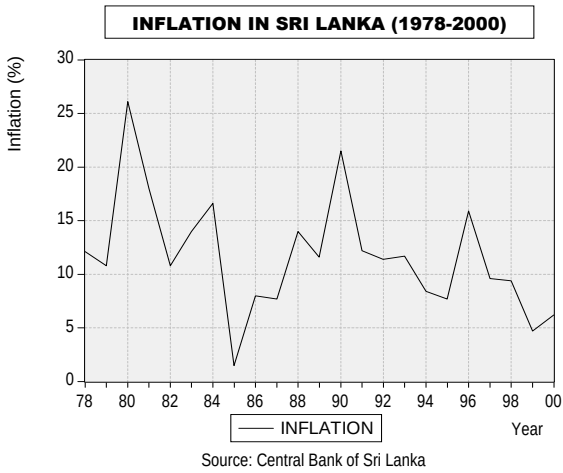
All bi-lateral nominal exchange rates were converted to an index in order to make those homogeneous across the countries. The base was selected as 1995 since base years of all the price indexes, obtained from IFS were also based on 1995 values. In this exercise the bilateral real exchange rate is also automatically transformed to an index based on the 1995 values.

The next step was to assign relative weights to bilateral RER based on the annual international trade (Total Export and Imports) with each trading partner. The annual weights were allowed to vary in every year and as a result the trading partners were also changed replacing with new trading partners. Also annual weights were distributed constantly in each quarter in a particular year assuming constant weight during the year. Finally, the equation based on the above methodology was as follows.

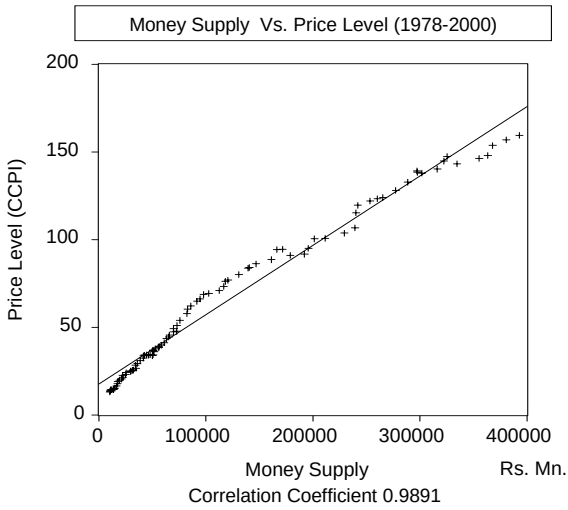
$$REER = \Sigma\beta_{ij}\ddot{y}\, RER_{ij}$$

Where, β_{ij} is the weights of each trading partner and RER is the bilateral real exchange rate. Here, $\Sigma\beta_{ij}=1$. In this calculation when the value of REER is increased then it is considered a depreciation of REER and if its value is decreasing it is considered an appreciation.

Appendix 2

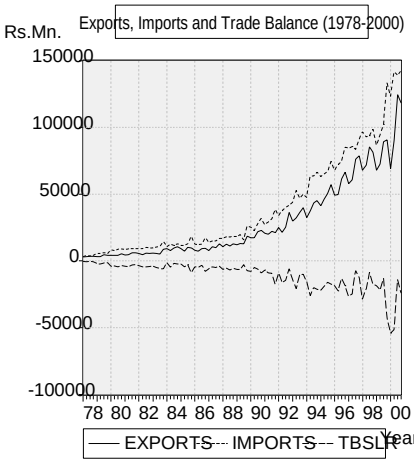


Source: Central Bank of Sri Lanka



Correlation Coefficient 0.9891

Appendix 3



Source: Central Bank of Sri Lanka and IFS