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Exchange Rate, Output and Macroeconomic Policy: A Structuralist Approach

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Current account imbalance and concomitant macroeconomic instability in emerging market economies have been major issues of recent macroeconomic modelling. This paper addresses these issues by asking how international interdependence has impinged on key macroeconomic variables and policy options. There are three assets: domestic bonds, foreign bonds and money. Domestic bonds and foreign bonds are imperfect substitutes due to presence of risk premium. The striking features of the model include endogenous risk premium and balance sheet effect on investment demand due to exchange rate depreciation. We use a simple open economy structuralist macro model that explains the interaction between current account adjustment and exchange rate dynamics. The balance sheet effect and the risk premium together explain how fiscal expansion or monetary expansion may have both short run and long run contractionary effect on the output level with worsening current account balance in the short run.

JEL Classifications: F41, F32, E52, E62
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1. INTRODUCTION

The role of current account imbalance in determining macroeconomic crisis of emerging market economies has been a major concern in recent literature. The weaker macroeconomic fundamentals make an emerging market economy more vulnerable to a variety of internal and external shocks, which in turn, cause exchange rate depreciation with immediate worsening trade balance. The deterioration of current account balance in response to exchange rate depreciation can be attributed to the lagged response of exports and imports, that is, the J-curve phenomenon. This J-curve phenomenon has been observed for the developing countries like Egypt, Nigeria, Bangladesh, Malaysia, and Pakistan.[1] The present paper develops a structuralist framework to explore the dynamics of current account balance and exchange rate in conjunction with endogenous risk premium. This type of framework can be applied to a large class of emerging market economies which are subject to macroeconomic imbalance and the associated increase in

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[1]See Qurat-ul-Ain and Tufail (2013).

risk premium acting as trigger of macroeconomic crisis. Aronovich (1999) investigated the behaviour of the country risk premium for Argentina, Brazil and Mexico from June 1997 to September 1998. He found that the level of country risk premium is determined by several factors namely the US dollar bond market structure; restrictions on the acquisition of emerging market bonds imposed by the developed nations regulators; the credit risk measured by the notion of implied risk-neutral probability default; the different ways agents react to country risk due to asymmetric and imperfect information. The empirical evidence shows that the decrease in the country credit rating causes higher international borrowing cost.[2] In this context, we should mention that most of the developing countries are net debtors in the world market and are subject to underdeveloped financial market as compared to the developed countries, measured by credit worthiness indicators or by the quality of prudential regulation and supervision of financial institution.[3] These lead to a risk premium in credit contracts of developing countries. Krugman (1999, 2003) emphasised the role of firm's balance sheets in explaining financial crisis in South-East Asian Countries. Sikdar (2014) explained why Indian asset market is volatile and identified factors which lead to dampen the optimism of the foreign investors about India that resulted in massive capital flight in accordance with high risk premium.

This paper is an attempt to address the issue of simultaneous response of current account, exchange rate and the output level to macroeconomic policies namely monetary policy and fiscal policy. In particular, we use the J-curve phenomenon for the analysis of dynamics of current account balance. The modelling of current account balance in this paper is significantly different from what is done in the existing literature.

This paper offers a structuralist treatment of different complications of adjustment in exchange rate.[4] Current account responds to exchange rate with a time lag and evolves continuously. However, the exchange rate adjusts instantaneously in the asset markets. The adjustment in exchange rate produces a balance sheet effect on investment, current account, and risk premium as well. The balance sheet effect of exchange rate depreciation (Krugman, 2003) arises due to currency mismatch if the firms borrow in foreign currency but earn revenue in domestic currency. If there is a significant portion of foreign currency denominated debts, which is a true feature for the emerging market economies, then depreciation in the exchange rate leads to a rise in real debt burdens. Furthermore, such a rise in real debt occurs with a disproportionate increase in ability to pay and hence, produces adverse balance sheet effect on investment demand. Moreover, the paper includes an important structuralist feature of a developing country, namely wage price rigidity which in turn leads to Keynesian unemployment. Here, we address the issue of effective demand problem to explore dynamic interaction between current account balance and exchange rate.

The rest of the paper has been organised as follows. A brief review of literature is provided in Section 2. The theoretical model is explained and thoroughly discussed in Section 3. The comparative static exercises are examined in the following section. Section 5 offers summation of results along with concluding remarks.

[2]This was the case of lower rated Latin American countries' bonds. See Aronovich (1999).

[3]See Priewe (2008).

[4]The exchange rate is an asset price and its determination can be explained in a stock-flow consistent effective demand model.

2. RELATED LITERATURE

Scholars have explored and debated the interaction between exchange rate depreciation and current account imbalance since 1940. At that time, the elasticity pessimism view suggested that actual trade elasticities were too low to satisfy the Marshall-Lerner condition for trade balance improvement due to exchange rate depreciation. The trade balance immediately worsens following exchange rate depreciation as export and import quantities remain unchanged in the short run. However, overtime export demand begins to increase and import demand tends to fall. Hence, trade balance gradually improves in the long run as the elasticities rise. The tendency of the elasticities to rise overtime leads to phenomenon of the J-curve. There is voluminous empirical evidence regarding the phenomenon of the J-curve effect in developing countries. For instance, Lal and Lowinger (2002) confirmed existence of J-curve effect in their study of East Asian countries. Petrović and Gligorić (2010) have shown that exchange rate depreciation in Serbia improves trade balance in the long run, while giving rise to a J-curve effect in the short run. Qurat-ul-Ain and Tufail (2013) have explored the existence of Marshal-Lerner condition and J-Curve phenomenon for each D-8 countries. Gebeyehu (2014) also empirically verified existence of J-curve effect in Ethiopia. Using Vector Error Correction Model, Prakash and Maiti (2014) have found the evidence of J-curve phenomenon on goods trade, but not on services over the period 1975 to 2012.

Inclusion of implications of macroeconomic policies for the interaction between current account and exchange rate has been central to the recent macroeconomic studies. For instance, Bjornlan (2008) has analysed the transmission mechanisms of monetary policy in a small open economy like Norway through structural VARs, with special emphasis on the interdependence between monetary policy and exchange rate movements. Ferrero, Gertler, and Svensson (2009), and Makanza and Dunne (2015) examined implications of monetary policy and fiscal policy for current account dynamics. Abbas, et al. (2010) has investigated the relationship between fiscal policy and the current account, drawing on a large sample of advanced, emerging and low-income economies and using a variety of statistical methods including panel regressions (an analysis of large fiscal policy and current account changes) and panel vector auto-regressions. Danmola, et al. (2013) have empirically examined the impact of monetary policy on the components of current account for the period 1970–2010 in Nigeria and their study confirmed a long-run relationship between monetary policy and components of current account under consideration. Buyangerel and Kim (2013) have analysed the effects of various macroeconomic shocks namely monetary policy shocks, price level shocks, output shocks and exchange rate shocks on trade balance and exchange rate in South Korea by using a structural vector error correction (SVEC) model. Prasad (2015) has assessed the role of capital controls, sterilised interventions and an exchange rate peg in explaining China's current account surplus.

This brief literature review shows that there is a dearth of theoretical research on current account imbalance and exchange rate dynamics in presence of endogenous risk premium and output adjustment.[5] Blanchard (2005) and Dornbusch (1980) emphasised the role of net debt accumulation in explaining interaction between current account

[5]A notable exception is work by Blanchard, et al. (2005). This study, they explained how the US current deficits since the mid-1990s through the working out of the J- curve.

dynamics and the exchange rate. Our theoretical study, however, emphasises the role of endogenous risk premium in explaining interaction between current account imbalance and exchange rate dynamics in response to selective macroeconomic policies alongside output adjustment.

3. THE MODEL

The major building blocks of this model have been explained as follows:

Output is demand determined. The economy has an investment demand which is inversely related to both real interest rate and real exchange rate. The inclusion of real exchange rate as a determinant of investment demand is based on the balance sheet effect of exchange rate depreciation. There are three assets: domestic bonds, foreign bonds and money. Foreign bonds and domestic bonds are imperfect substitutes due to presence of risk premium**.** The disposable income is considered to be a determinant of consumption expenditure. The consumer price index depends only on exchange rate at fixed price. In this paper, the current account adjustment is expressed as the outcome of J-curve phenomenon, that is, lagged response of the trade balance to the exchange rate depreciation. On the other hand, the interest rate differential and risk premium together play an important role in determining the exchange rate dynamics under rational expectation.

3.1. The Commodity Market

In the commodity market, aggregate demand (*AD*) consists of expenditure on consumption (*C*) and investment (*I*), government expenditure (*G*) and trade balance (*B*).[6]

$$AD = C(Y - tY) + I\left(r, \frac{eP^*}{P}\right) + G + B \qquad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Consumption expenditure can be expressed as a positive function of disposable income $(Y - tY)$. Investment demand is an inverse function of both real exchange rate $\left(\frac{eP^*}{P}\right)$[7] and interest rate (r). Government expenditure (G) is considered to be exogenous. The aggregate output (*Y*) is demand determined and hence, the commodity market equilibrium is:

$$Y = AD$$
$$\Rightarrow Y = C(Y - tY) + I\left(r, \frac{eP^*}{P}\right) + G + B \qquad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

From Equation (2) we can determine the equilibrium output as:

$$Y^* = Y\left(r, \frac{eP^*}{P}, t, G, B\right) \qquad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

Let us explain partial effect of each variable on the output level. An increase in interest rate reduces investment demand leading to decrease in output level, that is, $Y_1 = \frac{\partial Y}{\partial r} < 0$. An increase in real exchange rate raises real value of external debt burden which in turn generates a negative balance sheet effect on investment demand and hence, output

[6] In this model we consider trade balance as equivalent to the current account balance.

[7] Here, P and P^* are domestic and foreign prices respectively. Both prices are assumed to be fixed.

falls to restore the commodity market equilibrium, that is, $Y_2 = \frac{\partial Y}{\partial\left(\frac{eP^*}{P}\right)} < 0$. An increase in tax rate reduces disposable income and hence, consumption expenditure. This leads to decrease in output level and hence, we get $Y_3 = \frac{\partial Y}{\partial t} < 0$. An increase in government expenditure raises output level such that $Y_4 = \frac{\partial Y}{\partial G} > 0$. A trade balance improvement causes an increase in output level, that is, $Y_5 = \frac{\partial Y}{\partial B} > 0$.

3.2. The Money Market

The money market equilibrium is:

$$\frac{M}{Q(eP^*,P)} = L(r,Y)\ [where, L_1 = \frac{\partial L}{\partial r} < 0\ and\ L_2 = \frac{\partial L}{\partial Y} > 0] \quad \ldots \quad \ldots \quad (4)$$

The left-hand side of Equation (4) represents supply of real money balances. It can be expressed as the money supply deflated by consumer price index (Q) which in turn positively depends on domestic price (eP^*) of importables and price (P) of domestic goods. The right-hand side of Equation (4) shows the demand for money which is inversely related to the interest rate and positively related to output level.

From money market equilibrium we determine the equilibrium interest rate as:

$$r = r(e, Y, M,) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Let us explain partial effect of each variable on interest rate. An increase in exchange rate raises consumer price index which in turn reduces real money balance leading to excess demand in the money market. Hence, interest rate increases to restore money market equilibrium such that $r_1 = \frac{\partial r}{\partial e} > 0$. An increase in output level leads to higher demand for money and hence, higher interest rate, that is, $r_2 = \frac{\partial r}{\partial Y} > 0$. An increase in money supply leads to excess supply in the money market which in turn entails an increase in interest rate and hence, $r_3 = \frac{\partial r}{\partial M} > 0$.

3.3. Current Account Adjustment

The current account adjustment is given by

$$\dot{B} = \varphi(\alpha e - B)[\text{where}, \varphi\ and\ \alpha > 0] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$\dot{B}$ denotes overtime adjustment in trade balance, φ being the speed of adjustment and α is the parameter and

α = *Elasticity of export demand + absolute value of elasticity of import demand* –1.

We assume that Marshall-Lerner condition is satisfied and hence, $\alpha > 0$. Empirical evidences suggest that both exports and imports are subject to lagged response to exchange rate depreciation.[8] The evidences have found that only about 50 percent of the full quantity adjustment takes place in the first years; 90 percent occurs in the first

[8]Here, we consider that both domestic price and world price are given for this small open economy. Hence, any change in nominal exchange rate is equivalent to change in real exchange rate.

five years. There are several reasons[9] why the response of export and import quantities to exchange rate depreciation is greater in the long run than in the short run. In Equation (6) the adjustment in current account arises due to lagged response of trade balance (*B*) to the exchange rate (e) depreciation.

3.4. Interest Rate Parity Condition with Endogenous Risk Premium

One of the major departures of our model from Mundell-Fleming framework is the assumption of imperfect substitutability of domestic bonds and foreign bonds. The return on domestic bonds is domestic interest rate (r) while the return on foreign bonds is the sum of foreign interest rate (r^*), expected change in exchange rate[10] $\left(\frac{\dot{e}}{e}\right)$ and endogenous risk premium (ρ). Now, arbitrage between domestic bonds and foreign bonds therefore implies:

$$r = r^* + \frac{\dot{e}}{e} + \rho(D, B) \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (7)$$

Equation (7) shows the interest rate parity condition. The endogenous risk premium[11] (ρ) is positively related to the government budget deficit (*D*) and inversely related to the trade balance (*B*) and it is given by:

$$\rho = \rho(D, B)\ [where, D = G - tY] \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (8)$$

An increase in government expenditure raises government budget deficit (*D*) leading to increase in risk premium and hence, $\rho_1 = \frac{\partial \rho}{\partial D} > 0$. On the other hand, the budget deficit gets reduced with an increase in the output level or tax rate which in turn raises the tax revenue of government. This leads to decrease in risk premium. An increase in trade balance reduces risk premium, that is, $\rho_2 = \frac{\partial \rho}{\partial B} < 0$.

Based on the interest rate parity condition we can express overtime exchange rate adjustment as the gap between interest differential and risk premium, represented by the Equation (7')

$$\frac{\dot{e}}{e} = r - r^* - \rho(D, B) \qquad (7')$$

Equation (7') illustrates that an increase in domestic interest rate raises return on domestic bonds and hence, to restore the interest rate parity condition exchange rate will increase overtime, that is, $\dot{e} > 0$. On the other hand, an increase in risk premium makes foreign bonds more attractive. Consequently, restoration of interest rate parity condition leads to overtime fall in exchange rate such that $\dot{e} < 0$.

[9]First, there is a lag due to imperfect dissemination of information, during which importers recognise that relative prices have changed. Secondly, there exists a lag in deciding to place a new import order. Thirdly, after a new import order has been placed, there may be production and delivery lags before it is filled. Fourthly, producers sometimes relocate their factories to the country where costs are lower because of exchange rate advantage, regardless of whether it is the home country of the producer or the country where the goods are sold. This leads to the longest delivery process.

[10]Given perfect foresight, expected depreciation is equal to actual depreciation.

[11]We acknowledge the idea of endogenous risk premium to Sikdar (2014), who used it in an extended Mundell-Fleming model.

3.5. Dynamic Adjustment and Stability

On the basis of Equation (6), the current account adjustment can be expressed as a function of trade balance and exchange rate as shown in the Equation (9)

$$\dot{B} = f(B, e) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Let us interpret partial effect of each variable on $\dot{B}$. It follows from Equation (6) that $f_1 = \frac{\partial \dot{B}}{\partial B} = -\varphi < 0$. On the other hand, an increase in exchange rate entails overtime improvement in current account balance[12] such that $f_2 = \frac{\partial \dot{B}}{\partial e} = \varphi\alpha > 0$.

From above interpretation it is clear that the exchange rate depreciation causes a gradual improvement in trade balance so as to keep the current account balance at its steady state level, that is $\dot{B} = 0$, in the long run. This relationship is depicted by the positively sloped $\dot{B} = 0$ schedule in Figure (1). Any point to the left (right) of the $\dot{B} = 0$ locus represents trade deficit (surplus) with $\dot{B} > 0$ ($\dot{B} < 0$).

Based on Equation (7'), the exchange rate dynamics can also be written as a function of both trade balance and exchange rate as represented by Equation (10).

$$\dot{e} = g(B, e) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

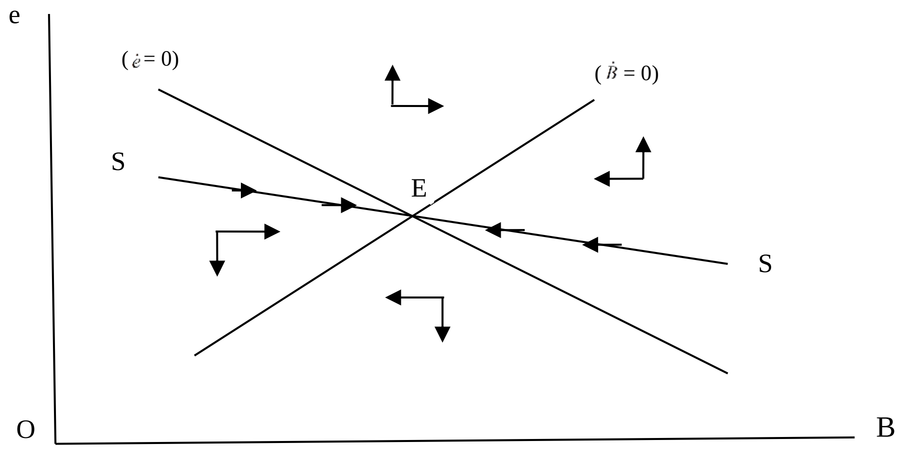
Let us again explain the partial effect of each variable on exchange rate dynamics. From the Equation (8) it is clear that a trade balance improvement leads to decrease in risk premium. Moreover, the increase in trade balance raises output level as obtained from the commodity market equilibrium in Equation (3). This higher output causes higher equilibrium interest rate as explained by Equation (5), that is, $r_2 > 0$. The increase in interest rate and fall in risk premium together explain the overtime increase in exchange rate and hence, $g_1 = \frac{\partial \dot{e}}{\partial B} = r_2 Y_5 - \rho_2 > 0$. An increase in exchange rate raises consumer price index leading to decrease in real money balance and hence, there generates excess demand in the money market. As a result, the domestic interest rate will increase, that is, $r_1 > 0$. The higher interest rate has positive influence on exchange rate dynamics. On the other hand, the balance sheet effect of exchange rate depreciation causes lower investment demand which in turn reduces output level as obtained from Equation (3), that is, $Y_2 < 0$. The lower output leads to higher budget deficit and hence, higher risk premium ($\rho_1 > 0$) which negatively influences exchange rate dynamics. Therefore, it is clear that exchange rate depreciation has ambiguous effect on the dynamic adjustment in exchange rate. However, saddle path stability of the stationary state requires that exchange rate must increase overtime in response to exchange rate depreciation such that $g_2 = \frac{\partial \dot{e}}{\partial e} = r_1 + t\rho_1 Y_2 > 0$, that is, the increase in interest rate must dominate the increase in risk premium.[13]

On the basis of above explanation, we can deduce that an increase in trade balance necessitates exchange rate appreciation so as to maintain the exchange rate at its steady state level, that is, $\dot{e} = 0$. It is represented by the downward sloping $\dot{e} = 0$ schedule in Figure (1).

[12]This is the essence of J-curve phenomenon.
[13]It implies that $r_1 > |t\rho_1 Y_2|$.

Any point that lies above (below) the $\dot{e} = 0$ locus, exchange rate would depreciate (appreciate) and $\dot{e} > 0$ ($\dot{e} < 0$)[14] respectively.

Fig. 1. Phase Diagram Showing Saddle Path Stability



In Figure (1), the steady state equilibrium is represented by the point E at which $\dot{B} = 0$ and $\dot{e} = 0$.

Now, we concentrate on illustration of stable saddle path because it gives economically meaningful result. Assuming perfect foresight, unique convergent saddle path requires characteristic roots of one positive and one negative sign so that the determinant $|J| = \begin{vmatrix} f_1 & f_2 \\ g_1 & g_2 \end{vmatrix}$ is negative.

The saddle path SS is downward sloping and it is flatter than the $\dot{e} = 0$ schedule. For a specific trade balance level, the trajectory of the economy is from a particular value of exchange rate on the saddle path towards the stationary equilibrium, E. Here, exchange rate is a jump variable while trade balance is a slow moving variable.

4. COMPARATIVE STATICS

This section analyses implications of fiscal policy and monetary policy for trade balance, exchange rate, and output.

4.1. Expansionary Fiscal Policy

Let us first consider an expansionary fiscal policy. The adjustment mechanism is as follows: the fiscal expansion leads to higher output level, higher demand for money and hence, higher interest rate which in turn has a positive effect on $\dot{e}$. On the other hand, the increase in government expenditure raises budget deficit which in turn causes an increase in risk premium. Clearly, it has negative influence on $\dot{e}$. Therefore, the expansionary fiscal policy has ambiguous effect on the exchange rate dynamics. If $\dot{e} > 0$, the $\dot{e} = 0$ schedule shifts downward as shown in Figure (2a). The opposite case will appear in Figure (2b).

[14]See appendix for derivations of the loci and saddle path stability.

Fig. 2a. Effect of an Expansionary Fiscal Policy with Exchange Rate Appreciation

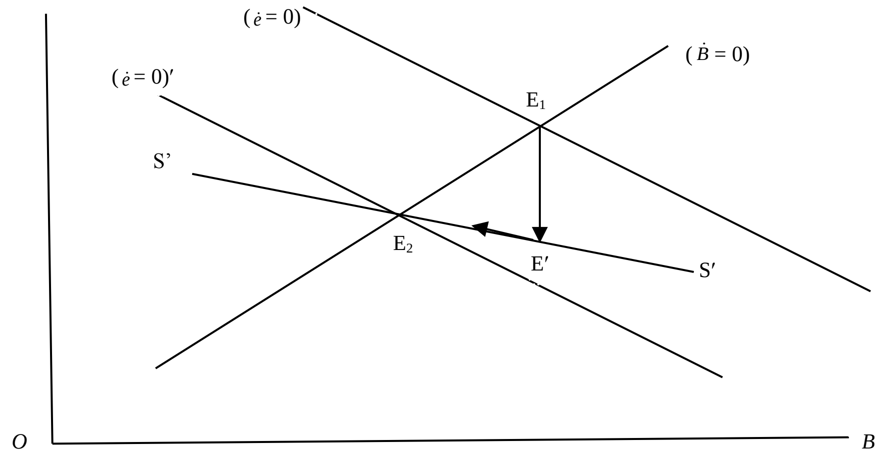
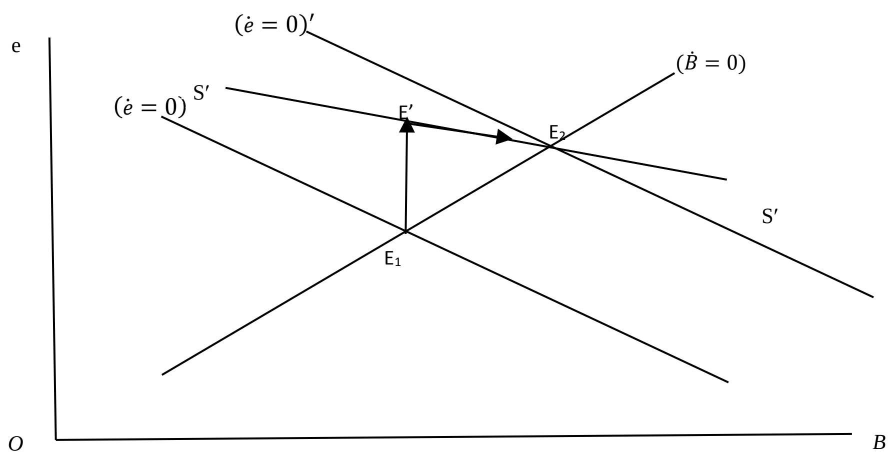


Fig. 2b. Effect of an Expansionary Fiscal Policy with Exchange Rate Depreciation



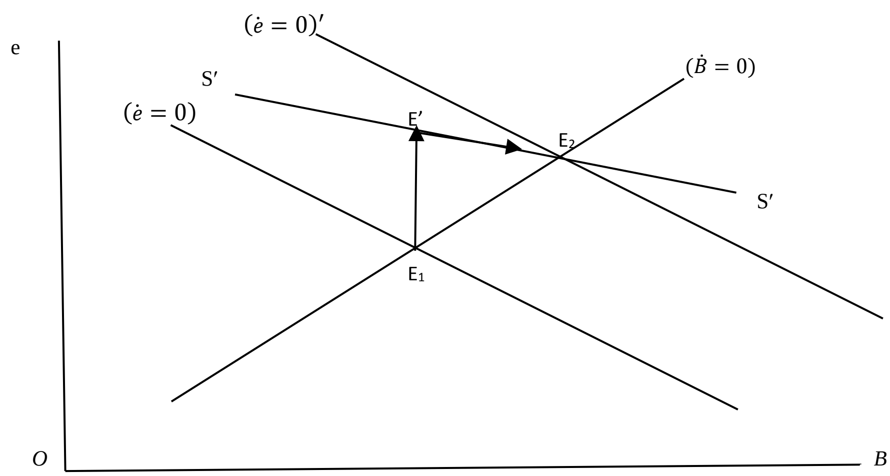
According to Figure (2a), in the short run, the movement from the point E_1 to the point E' on the new saddle path S'S' is due to exchange rate appreciation. As exchange rate appreciates, we immediately get improvement in current account balance, that is, $\dot{B} < 0$ at the point E′ since exports and import quantities would not change instantaneously. This is due to the presence of the pre-existing contracts whereby both the exporters and importers have to honour their prior trade commitments even though the exchange rate has appreciated. Thereafter, the subsequent trading activity reflects the new competitive situation with concomitant worsening trade balance in the long run as the economy gradually moves from the point E' to the point E_2. The deterioration of trade balance moderates the initial decrease in exchange rate and hence in the short run, exchange rate overshoots. Corresponding to the new equilibrium point E_2, the current account is balanced $(\dot{B} = 0)$ and interest rate parity condition is maintained with steady state level of exchange rate $(\dot{e} = 0)$. The expansionary fiscal policy along with exchange rate appreciation[15] dominates the crowding out effect of higher interest rate leading to a short run increase in the output level and level of employment. However, in the long run, output as well as level of employment may fall if the effect of trade balance deterioration outweighs the balance sheet effect of exchange rate appreciation on investment demand.

In contrast, Figure (2b) shows that the exchange rate depreciates in the short run and the economy immediately jumps from the point E_1 to the point E' on the new saddle path S'S' which shifts upward. The exchange rate depreciation immediately leads to trade balance deterioration, that is, $\dot{B} > 0$ at the point E'. In response to this exchange rate depreciation, overtime exports tend to increase and imports tend to fall leading to gradual improvement in trade balance so that in the long run the economy moves from the point E' to the point E_2. The improvement in trade balance partially offsets the initial increase in exchange rate and hence in the short run, the exchange rate overshoots. The new steady state point E_2 represents balanced trade situation $(\dot{B} = 0)$ and higher exchange rate compared to the old equilibrium point E_1. In the short run, expansionary fiscal policy entails an increase in output level and level of employment since initial effect of fiscal expansion dominates the secondary crowding out effect of exchange rate depreciation along with higher interest rate. In the long run, the trade balance improvement reinforces the initial effect of fiscal expansion leading to increase in output level and level of employment.

4.2. Expansionary Monetary Policy

As money supply goes up, there is a fall in the domestic rate of interest, that is, the return on domestic bonds falls. This induces investors to switch their portfolio to foreign bonds leading to capital outflow. The decrease in domestic interest rate causes $\dot{e} < 0$. Consequently, the exchange rate depreciates leading to upward shift of the $\dot{e} = 0$ schedule as represented in Figure (3). However, the trade balance does not improve instantaneously following this depreciation. Nevertheless, the trade balance improves after a time lag along with an improvement in the current account.

Fig. 3. Effect of an Expansionary Monetary Policy



[15]The exchange rate appreciation generates a favourable balance sheet effect on investment demand.

Next, we turn to the dynamic adjustment process. An expansionary monetary policy leads to immediate jump of the exchange rate to point E' on the new stable path S'S'. Corresponding to the point E' the current account balance deteriorates in the short run, that is, $\dot{B} > 0$. The increase in exchange rate improves the trade balance overtime and the economy reaches the new stationary equilibrium point E_2. The rise in trade balance offsets the initial increase in exchange rate and this explains why the exchange rate overshoots in the short run, as shown by point E' in Figure (3). The effect on output as well as on level of employment is ambiguous. If the balance sheet effect of exchange rate depreciation dominates other favourable effects of monetary expansion on output level, output contraction is inevitable in both the short and long run. Hence, level of employment falls. However, the long run contractionary effect is mitigated by the trade balance improvement. It is also to be noted that in the long run intensity of balance sheet effect diminishes since the steady state increase in exchange rate is less than the immediate effect.

5. CONCLUSION

The paper is an attempt to offer an explanation of dynamics of current account imbalance and that of the exchange rate in terms of a structuralist model in which output is demand determined and risk premium in the foreign exchange market is endogenous. While current account evolves continuously overtime, the exchange rate adjusts instantaneously in response to any shock which may be policy induced or otherwise. Though the empirical literature on the issue is copious, the analytical works do not always offer a very clear account of certain essential features of a developing country. In this context, one may refer to the paper by Blanchard, et al. (2005) that discusses the dynamics of current account in the context of US economy with a clear focus on the role of international investors. However, the paper abstracts from the problem of unemployment which may also arise due to effective demand constraint as well as the endogenous adjustment in risk premium in the foreign exchange market. Moreover, our paper examines the effect of exchange rate on aggregate demand not only in terms of the price effect on net exports but also the balance sheet effect of exchange rate depreciation on investment demand.

Among the major findings of our paper include the following:

Expansionary monetary policy results in depreciation of exchange rate. The immediate effect is the short run deterioration of trade balance. However, the steady state equilibrium corresponds to the improved trade balance. Moreover, the monetary expansion may reduce the output level and level of employment both in the short and long run if balance sheet effect of exchange rate depreciation offsets other favourable effects of monetary expansion on the level of output. The exchange rate overshoots in the short run. An expansionary fiscal policy has ambiguous effect on both exchange rate and trade balance. The fiscal expansion may cause output contraction and fall in level of employment if trade balance deteriorates in the long run.

We suggest a couple of extensions of the model. One possible extension is to recast the model in a dependent economy framework by introducing traded and non-traded goods. Moreover, issues of capital accumulation and debt dynamics can also be addressed.

APPENDIX

A.1: $\dot{B} = 0$ and $\dot{e} = 0$ locus:

The slope of $\dot{B} = 0$ locus can be derived as follows:

$$\dot{B} = f(B, e) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

$$a_{11} = \frac{\partial \dot{B}}{\partial B} = f_1 < 0$$

$$a_{12} = \frac{\partial \dot{B}}{\partial e} = f_2 > 0$$

Now slope of the $\dot{B} = 0$ curve is

$$\left.\frac{de}{dB}\right|_{(\dot{B}=0)} = -\frac{a_{11}}{a_{12}} > 0$$

The slope of $\dot{e} = 0$ curve is obtained from the following equation

$$\dot{e} = g(B, e) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

$$a_{21} = \frac{\partial \dot{e}}{\partial B} = g_1 > 0$$

$$a_{22} = \frac{\partial \dot{e}}{\partial e} = g_2 > 0$$

Now slope of the $\dot{e} = 0$ curve is

$$\left.\frac{de}{dB}\right|_{(\dot{e}=0)} = -\frac{a_{21}}{a_{22}} < 0$$

A.2: Saddle Path

The matrix of first partial derivatives for (9) and (10) is

$$\mathrm{J} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} f_1 & f_2 \\ g_1 & g_2 \end{bmatrix}$$

Since $f_1 < 0, f_2 > 0, g_1 > 0 \; and \; g_2 > 0$, $|J|$ is negative. As $|J|$ is negative, one of the characteristic roots must be negative for saddle point stability.

Time paths of B and e

$$\mathrm{B(t)} = \mathrm{B}^* + \mathrm{A}_1 \mathrm{e}^{\mu_1 \mathrm{t}} + \mathrm{A}_2 \mathrm{e}^{\mu_2 \mathrm{t}}$$
$$\mathrm{e(t)} = \mathrm{e}^* + \frac{a_{21}}{[\mu_1 - a_{22}]} \mathrm{A}_1 \mathrm{e}^{\mu_1 \mathrm{t}} + \frac{a_{21}}{[\mu_2 - a_{22}]} \mathrm{A}_2 e^{\mu_2 \mathrm{t}}$$

with B^* and e^* being the equilibrium values of B and e; A_1 and A_2 are constants; and μ_1, μ_2 are two characteristic roots. Here we assume that $\mu_1 > 0$ and $\mu_2 < 0$.
Let $\mathrm{A}_1 = 0$. Thus,

$$\mathrm{B(t)} = \mathrm{B}^* + \mathrm{A}_2 \mathrm{e}^{\mu_2 \mathrm{t}}$$
$$\mathrm{e(t)} = \mathrm{e}^* + \frac{a_{21}}{[\mu_2 - a_{22}]} \mathrm{A}_2 \mathrm{e}^{\mu_2 \mathrm{t}}$$

The equation that describes the saddle path is:

$$e(t) - e^* = \frac{a_{21}}{[\mu_2 - a_{22}]}[B(t) - B^*]$$

Slope of the Saddle Path

$$\left.\frac{de}{dB}\right|_{SS} = \frac{a_{21}}{[\mu_2 - a_{22}]} < 0 \quad [\text{since}, \mu_2 < 0]$$

Slope of the $\dot{e} = 0$ schedule

$$\left.\frac{de}{dB}\right|_{(\dot{e}=0)} = -\frac{a_{21}}{a_{22}}$$

Hence, the slope of saddle path is less than that of the $(\dot{e} = 0)$ schedule.

A.2 Comparative Static Results

The steady-state effects of monetary policy and fiscal policy can be obtained from the following equations:

$$\dot{B} = f(B,e) = 0 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (9')$$

$$\dot{e} = g(B,e) = 0 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (10')$$

A.2.1. Expansionary Fiscal Policy:

The Steady State Effects:

$$\dot{B} = f(B,e) = 0 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (9')$$

$$\dot{e} = g(B,e,M,G) = 0 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (10')$$

Differentiating Equation (9') and (10') with respect to G and setting $\dot{B} = 0$ and $\dot{e}$ =0 respectively and arranging them in matrix form we get,

$$\begin{bmatrix} f_1 & f_2 \\ g_1 & g_2 \end{bmatrix} \begin{bmatrix} \frac{dB}{dG} \\ \frac{de}{dG} \end{bmatrix} = \begin{bmatrix} 0 \\ -g_G \end{bmatrix}$$

Applying Cramer's Rule we get,

$$\frac{dB}{dG} = \frac{f_2 g_G}{|J|} > 0 \quad if \;\; g_G = \frac{\partial \dot{e}}{\partial G} < 0$$

$$\ldots\ldots\ldots\ldots\ldots\ldots < 0, \quad otherwise$$

$$\frac{de}{dG} = \frac{f_2 g_G}{|J|} > 0 \quad if \;\; g_G = \frac{\partial \dot{e}}{\partial G} < 0]$$

$$\ldots\ldots\ldots\ldots\ldots\ldots < 0, \quad otherwise$$

A.2.2. Expansionary Monetary Policy:

The Steady State Effects:

$$\dot{B} = f(B,e) = 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (9')$$

$$\dot{e} = g(B,e,M,G) = 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (10')$$

Differentiating Equation (9') and (10') with respect to M and setting $\dot{B} = 0$ and $\dot{e} = 0$ respectively and arranging them in matrix form we get,

$$\begin{bmatrix} f_1 & f_2 \\ g_1 & g_2 \end{bmatrix} \begin{bmatrix} \dfrac{dB}{dM} \\ \dfrac{de}{dM} \end{bmatrix} = \begin{bmatrix} 0 \\ -g_M \end{bmatrix}$$

Applying Cramer's Rule we get,

$$\frac{dB}{dM} = \frac{f_2 g_M}{|J|} > 0, \quad \sin ce \;\; g_M = \frac{\partial \dot{e}}{\partial M} < 0]$$

$$\frac{de}{dM} = -\frac{f_1 g_M}{|J|} > 0 \quad \sin ce \;\; g_M = \frac{\partial \dot{e}}{\partial M} < 0]$$

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