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Macrodynamics of Stabilization under Dual Exchange Rate: an Effective Demand Model

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Abstract

The paper examines effects of selected measures of stabilization in a financially repressed economy under two-tier exchange rate. Since financial repression is a generic category, it requires context-specific (model-specific) representation. In this paper financial repression is represented in terms of a very rudimentary asset structure. The models of the dual exchange rate in the existing literature are by and large full-employment models. Consequently the targets of stabilization are inflation and current account balance. This paper attempts to make an intervention in the literature by introducing the problem of effective demand and unemployment. Hence, we get wider range of targets of stabilization namely unemployment, current account balance and inflation. We will utilize the asset approach of the Calvo-Rodriguez model in an otherwise aggregative Dornbusch type model under the assumption that commodity price is sticky and output is demand determined.

- **JEL classification:** E190, F410
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I. Introduction

Recurrence of currency crisis has raised doubts about the desirability of capital account liberalization under full convertibility. The IMF responded to the crisis by

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recommending flexible exchange rate along with fiscal and monetary contraction. In the aftermath of the economic devastation caused by capital flight from Mexico, Russia and the Asian economies, some economists on the other hand stressed the need for some control over short term and speculative capital. It is precisely in this context that we can think of an alternative exchange rate regime, namely dual exchange rate.[1]

Under dual exchange rate, the problem of large capital movements is dealt with by establishing separate exchange rates for current and capital account transactions. Like capital control, dual exchange rate may be useful in insulating an economy from the effects of disturbances in the financial markets. We consider few country-specific examples of the dual rate.

The Mexican exchange rate regime provides an example of a dual exchange regime the primary objective of which was the reduction of private capital outflow. The system was instituted during the August 1982 debt crisis as part of a broader policy package. A two-tier exchange rate system was introduced in Argentina, with a controlled, floating commercial peso rate made applicable to exports and imports and a freely fluctuating financial peso rate applicable to all other transactions. A new three-tier exchange rate system was introduced, replacing the dual rates in 1989. During Asia turmoil, People's Republic of China is the least affected one. Experts attributed it to the success of adopting two- tier exchange. Also Malaysia separated exchange markets to avoid transitory shocks in the financial exchange market affecting the current account, and hence the real economy. It allowed flexibility in setting domestic monetary targets. The potentially harmful effects of volatile capital movements provide a strong argument for conducting transactions of current account and capital accounts at different exchange rates; that is, for conducting a two-tier or dual exchange rate system.

As has already been mentioned, separate exchange rates are established for current account and capital account transactions in a two-tier exchange rate regime. In particular, current account transactions occur under officially pegged exchange rate (called the commercial rate), while exchange rate on capital account (known as the financial rate) is flexible. In most of the developing countries, which have

[1]The dual rate can either be interpreted as a two-tier exchange rate (separate exchange rate for the current account transactions and the capital account transactions) or fixed exchange rate coexisting with the black market exchange rate. However, the paper focuses exclusively on the two-tier exchange rate. It had been emphasized in the literature that different exchange rates for the commercial and financial transactions may be useful in insulating the goods market from the effects of disturbances in the financial markets (Flood and Marison, 1982, Cumby, 1984).

followed this exchange rate regime, the commercial rate is overvalued and accordingly we assume that the market determined financial rate is always greater than the officially pegged commercial rate.

One of the central features of underdevelopment is financial repression, which is represented in terms of two-asset structure, namely domestic money and foreign assets. This type of asset structure has been used in large part of literature on the dual exchange rate regime.[2] The open economy macromodels under dual exchange rate used both the Calvo-Rodriguez (1977) dependent economy framework and the Dornbusch (1976,1983) aggregative framework. Aizenman (1985) retained the asset structure assumption of the Calvo-Rodriguez model and examined the dynamics of tariff-liberalization under dual exchange rate. Park (1995), on the other hand, investigated exchange rate dynamics in dual exchange markets by utilizing both the asset structure and the dependent economy assumptions of the Calvo-Rodriguez model. In particular, he introduced private abritrage activity leading to leakage from the commercial to the financial exchange market and analyzed the behaviour of the dual exchange rate regime under monetary stock and devaluation of the commercial rate. Gros (1988) also addressed the similar problem. The only difference is that Gros worked in terms of the Dornbusch's aggregative full employment sticky price model instead of the Calvo-Rodriguez framework. Gardner (1985) used the framework of the Dornbusch's full employment sticky price model to compare the adjustment process under the dual exchange rate with that flexible exchange rate. The working of dual regime for balance of payments and inflation had been studied in Dornbusch (1986) and Lizondo (1990). Lizondo (1987) discussed the balance of payment implication of switching from a dual rate regime to a unified floating or crawling peg system. However, all these models of the dual exchange rate discussed so far are full employment models. This paper attempts to make an intervention in the literature by introducing the problem of effective demand and unemployment. We will introduce asset approach of the Calvo-Rodriguez model in an otherwise aggregative Dornbusch type model under the assumption that commodity price is sticky (or slowly adjusting) and output is demand determined.

Now, few comments on money supply are in order. Money supply is supposed to adjust in response to current account surplus or deficit. Such adjustment mechanism is known in the literature as the reserve adjustment rule. An alternative

[2]This representation of financial repression is used in the Calvo-Rodriguez model of convertible currency (1977). Similar representation is followed by Aizenman (1985).

adjustment mechanism is the reserve rationing rule under which money supply is kept fixed even in the face of current account surplus or deficit, by appropriate counteracting measures.[3] In our model, we assume reserve-rationing rule based on appropriate tax-transfer schemes. Finally, we assume that our model-economy imports only intermediate inputs. Such imports are empirically significant in the context of developing countries. Moreover, this assumption regarding nature of imports along with our assumption of reserve rationing rule has the advantage from the point of view of analytical tractability of our model.

This paper is organized as follows. In section 1, we assume perfectly elastic supply curve of output and the level of output adjusts in response to excess demand in the commodity market. Interaction between the commodity market or the real sector and the asset market or the financial sector is assumed to operate through the wealth effect on aggregate demand. In this section, we study effects of stabilization policies on output, current account balance and the gap between the financial rate and the commercial rate.

Section 1 is followed by section 2 in which actual output is always equal to aggregate demand and we allow for price adjustment, which is governed by the gap between actual output and full employment output. Thus, in section 2, we get full employment equilibrium in the long run. In this section, our primary concern is to analyze the effects of various stabilization policies on output, inflation and current account balance in the process of adjustment to the long run, full employment equilibrium. Section 3 contains summary of main results of this paper.

II. The Model with Fixed Price

A. Asset Markets

We consider an economy in which individuals allocate their wealth between domestic money and foreign asset at flexible financial exchange rate (ef). The wealth constraint, measured in terms of domestic output is:

$$a = \frac{M}{P} + \frac{e_f F}{P} = \frac{M^d}{P} + \frac{e_f F^d}{P} \tag{1}$$

where M is domestic money, F is nominal value of foreign bond measured in foreign

[3]Such reserve rationing rule is used in models of dual exchange rate. See for example, Kharas and Pinto (1989) and Lizondo (1990).

currency and P is the price level. Hence, $\frac{e_f F^d}{P}$ is real supply of foreign bonds measured in domestic output, $\frac{M}{P}$ is real money supply measured in domestic output and a is wealth measured in domestic output. M^d and F^d denote demand for foreign asset and domestic money.

In the context of asset demand we take interest sensitive transaction demand for domestic currency, following the Baumol-Tobin cash management approach. The relative asset demand is given in equation (2):

$$\frac{e_f F^d}{P} = g\left(r^* + \frac{\dot{e}_f}{e_f}, y\right), \frac{\partial g}{\partial\left(r^* + \frac{\dot{e}_f}{e_f}\right)} > 0, \frac{\partial g}{\partial y} < 0 \qquad (2)$$

y is domestic output, r^* is a exogenously given interest rate of foreign asset in foreign currency and $r^* + \frac{\dot{e}_f}{e_f}$ is the nominal rate of return on foreign asset under the assumption of perfect foresight regarding expected depreciation of the financial rate. An increase in y leads to change in asset demand in favour of domestic currency, whereas an increase in $r^* + \frac{\dot{e}_f}{e_f}$ leads to change in asset composition in favour of foreign asset.[4]

We write asset market equilibrium in terms of equality between relative demand and relative supply:

$$\frac{e_f F}{M} = \frac{e_f F^d}{M^d}$$

or $$\frac{e_f F}{M} = g\left(r^* + \frac{\dot{e}_f}{e_f}, y\right) \qquad (3)$$

Given the wealth constraint equality between relative demand and relative supply of asset implies equilibrium in both the asset markets.

r^* is exogenously given and $\frac{\dot{e}_f}{e_f}$ is known, given the assumption of perfect foresight regarding expected rate of depreciation of the financial rate. Hence, asset market equilibrium determines equilibrium financial rate in each period for any given

[4]Even though $\frac{\dot{e}_f}{e_f}$ may be negative, we assume that $r^* + \frac{\dot{e}_f}{e_f}$ is positive.

output level. Such equilibrium determines time path of the financial rate. Time path of the financial rate can be more clearly represented in the following alternative form of the asset market equilibrium:

$$\frac{\dot{e}_f}{e_f} = f(y, \theta), \frac{\partial f}{\partial \theta} > 0, \frac{\partial f}{\partial y} > 0 \tag{4}$$

where $\theta = \frac{e_f F}{M}$.

We assume a constant stock of foreign asset and also a constant stock of domestic currency over time. Since current account transactions take place at a given commercial rate (ec), domestic currency supply is supposed to change in response to current account surplus or deficit. We assume an accompanying tax-transfer scheme which offsets change in the supply of domestic currency. This tax-transfer scheme is explained in the following sub-section. As already noted in the introduction, such method is known as reserve rationing rule.

B. Production and Aggregate Demand

Output is produced with the help of labour. The production function is as follows:

$$y = F(L), F_L > 0, F_{LL} < 0$$

Output requires imported intermediate input. We assume that import per unit of output is constant. Let *g* denote import per unit of output. Import of intermediate input is the only form of import. We also assume that price of foreign good measured in foreign currency is constant and set equal to unity.

Now, we consider value added or factor income (y_f) income and disposable income. First we consider value added. This is given by the following equation:

$$y_f = y - \frac{e_c}{P}\gamma y$$

We impose the restriction that $\frac{e_c}{P}\gamma < 1$ to ensure positive value added. Next we consider disposable income (y_d). Current account surplus takes the form of lumpsum tax to maintain a constant stock of money under fixed commercial rate. Thus, disposable income is given by the following equation:

$$y_d = y_f - \left(X - \frac{e}{P}\gamma Y\right) = \left(y - \frac{e}{P}\gamma Y\right) - \left(X - \frac{e}{P}\gamma Y\right) = y - X$$

Now we consider consumption expenditure (C) on domestic output. It depends on disposable income and real wealth. This equation can be written as follows:

$$C = \beta_1(y - X) + \beta_2 a, 0 < \beta_1 < 1 \text{ and } \beta_2 > 0$$

Next we consider export (X) demand function. Export positively depends on the real exchange rate, the relevant nominal exchange rate being the commercial rate (e_c) which is fixed by the central bank.

$$X = X\left(\frac{e_c}{P}\right), X' > 0$$

Thus, the aggregate demand (AD) for domestic output is:

$$AD = \beta_1\left\{y - X\left(\frac{e_c}{P}\right)\right\} + \beta_2 a + X\left(\frac{e_c}{P}\right)$$

$$= \beta_1 y + \beta_2 a + (1 - \beta_1)X\left(\frac{e_c}{P}\right)$$

Now output adjusts in response to excess demand in commodity market. In fact, inventories are first decumulated after an increase in aggregate demand, until production is increased to meet the excess demand. The output adjustment mechanism is given by the following equation:

$$\dot{y} = \alpha(AD - y), \alpha > 0$$

$$\Rightarrow \dot{y} = \alpha\left[\beta_2 a + (1 - \beta_1)X\left(\frac{e_c}{P}\right) - (1 - \beta_1)y\right] \quad (5.1)$$

We write output adjustment function in implicit form as follows:

$$\dot{y} = b(y, e_f), \frac{\partial b}{\partial y} < 0 \text{ and } \frac{\partial b}{\partial e_f} > 0 \quad (5.2)$$

The sign restrictions are explained as follows. Rise in output leads to excess supply, since marginal propensity to consume (β_1) is less than unity and hence, output falls over time. On the other hand, rise in the financial rate leads to rise in real wealth and hence, leads to output expansion through the wealth effect. Clearly the integration between the real sector and the financial sector is forged through the wealth effect on consumption expenditure.

C. Equilibrium and Dyanamic Adjustments

In absence of any change in product price, we have two differential equations in ef and y. We repeat equations (4) and (5.2) as they describe the dynamic evolution of the system:

$$\frac{\dot{e}_f}{e_f} = f(y, \theta)$$

$$\dot{y} = b(y, e_f)$$

At equilibrium, $\dot{y} = 0$ and $\dot{e}_f = 0$.

The locus $\dot{y} = 0$ is upward-rising: depreciation of the financial exchange rate raises real wealth and increases the output level through the wealth effect. The slope of $\dot{y} = 0$ locus is:

$$\left.\frac{\partial e_f}{\partial y}\right|_{\dot{y}=0} = \frac{b_1}{b_2} > 0$$

where, $b_1 = \frac{\partial b}{\partial y} = -\alpha(1-\beta_1) < 0$ *and* $b_2 = \frac{\partial b}{\partial e_f} = \alpha\beta_2\frac{F}{P} > 0.$

The locus $\dot{e}_f = 0$ is downward sloping: higher output leads to grater demand for domestic currency such that the financial rate appreciates. The slope of $\dot{e}_f = 0$ locus is:

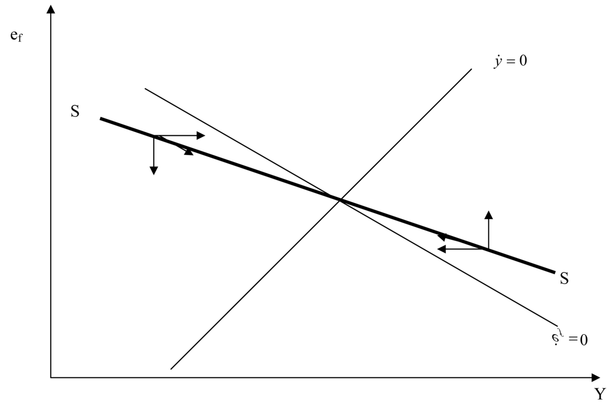
$$\left.\frac{\partial e_f}{\partial y}\right|_{\dot{e}_f=0} = \frac{f_1}{f_2} > 0$$

where $f_1 = \frac{\partial f}{\partial y} > 0$ *and* $f_2 = f_\theta\frac{F}{M} > 0$ *and* $f_\theta = \frac{\partial f}{\partial \theta}$.

In order to depict equilibrium we draw $\dot{y} = 0$ and $\dot{e}_f = 0$ curves on (y, e_f) space. The arrows indicate adjustment of two variables, y and e_f in different quadrants. It is clear from our geometric exposition that the equilibrium is saddle point equilibrium. See figure 1.[5]

[5]See appendix for derivation of condition for saddle path stability.

Figure 1. Saddle path stability under fixed price



We concentrate on the stable arm SS. The stable arm represents the fundamentals, while the divergent paths represent the bubble solutions. We rule out bubble solutions, since they do not give economicaly meaningful results.

D. Comparative Statics

Now we are in position to examine certain comparative static exercises. We consider effects of monetary policy and devaluation.

Effects of Monetary Policy

The issue of tight money policy has received adequate attention in the literature on stabilization. In a Keynesian framework which involves wealth effect, 'tight money' is definitely contractionary. But an important issue at stake is effect on the exchange rate differential in general and in particular the adjustment dynamics of the financial rate. In this context, we consider only unanticipated reduction in money supply.

Fall in money supply reduces real wealth and real spending: the $\dot{y} = 0$ curve shifts to the left. On the other hand monetary contraction increases the ratio of foreign asset to domestic asset leading to expected depreciation of the financial rate, such that the exchange rate appreciates: the $\dot{e}_f = 0$ curve shifts downwards. Clearly the output level decreases, but effect on the financial rate is ambiguous. The output contraction might be so severe that the financial rate actually rises above its initial long run equilibrium value, as shown in figure 2b. Hence, the exchange rate differential might even increase in the wake of monetary contraction.

Let us explain economic mechanisms underlying the effects of monetary contraction. Fall in money supply reduces wealth at constant price and hence, reduces consumption expenditure through wealth effect which in turn reduces output level. On the other hand, monetary contraction tends to generate excess supply in the market for foreign asset. Consequently the financial rate tends to appreciate. However, fall in output level tends to counter this excess supply in market for foreign asset and output contraction may generate excess demand for foreign asset such that financial rate actually depreciates. In case of depreciation of the financial rate, initial contractionary effects on output are partly offset, while appreciation of the financial rate aggravates the initial contractionary effects on output.

It is also important to appreciate the reason behind exchange rate adjustment. First, we note that the equilibrium output level unambiguously falls and equilibrium exchange rate may either depreciate or appreciate. Initially output level does not change and let us suppose that the financial rate attains the value of new equilibrium exchange rate. This causes excess demand in the market for foreign asset, given the fact that the new equilibrium output level is less than the original equilibrium output level. Hence, the initial exchange rate has to be less than the new equilibrium exchange rate to maintain the asset market equilibrium. In case of appreciation of the financial rate, it implies exchange rate overshooting, whereas in case of depreciation of the financial rate, this implies undershooting of the financial rate.

This exercise suggests that monetary contraction leads to rise in unemployment alongside improvement of current account. This is clearly an uneasy trade-off for policy makers in developing countries. It is also to be noted that monetary

Fig. 2a. Tight Money: Exchange rate undershooting with depreciation

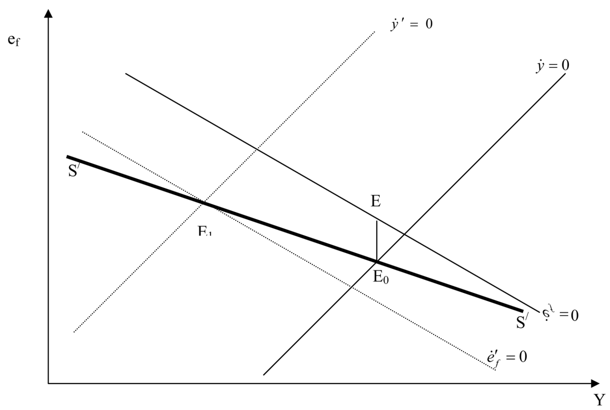
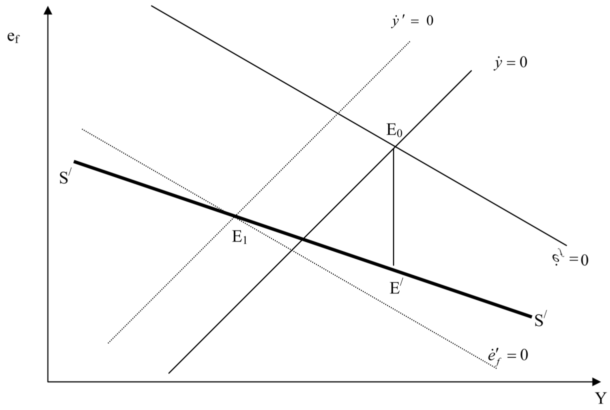


Fig. 2b. Tight Money: Exchange rate overshooting with appreciation



contraction may fail to reduce exchange rate differential between the financial rate and the commercial rate. This failure is attributable to output contraction which tight monetary policy entails. However, in the existing literature, the gap between the market determined financial rate and the fixed commercial rate falls unambiguously, since output is fixed at the full employment level.[6]

Effects of Devaluation of the Commercial Exchange rate

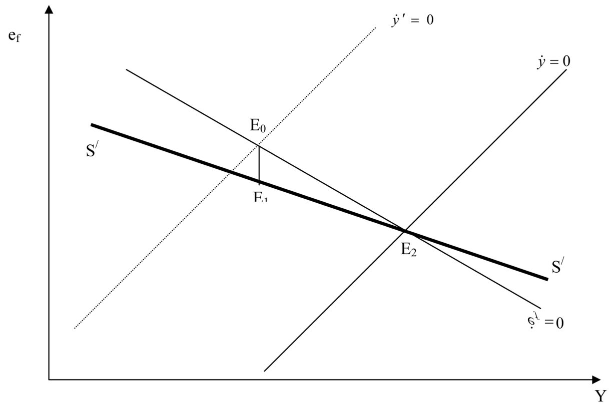
In most dual exchange rate regimes, the path of the nominal commercial exchange rate is fixed by the authorities; in many cases the authorities keep the exchange rate fixed for some time and devalue by discrete amounts, whenever it is judged unavoidable in view of developments on the trade account. This subsection, therefore, analyzes effects of devaluation of the commercial exchange rate. Since the behaviour of the monetary authority is predictable, we explore the implications of anticipated devaluation.

Suppose that devaluation is announced at t0 to be implemented at time t_1, $t_1 > t_0$. The adjustment process is traced out in figure 3.

The export expansion causes output expansion and the $\dot{y} = 0$ curve shifts to the right along with consequent downward displacement of the saddle path. However, the announcement of devaluation is contractionary. The financial rate appreciates at t0 in anticipation of higher output level which reduces the real value of wealth and spending. Consequently output falls within the period between t_0 and t_1. The curve FG corresponds to a given time period (t_1 - t_0). After the implementation of

[6]See appendix for derivation of effects of monetary contraction.

Figure 3. Effects of Anticipated Devaluation



devaluation export increases and so does output leading to further appreciation of the financial rate.

The explanations for the effects of devaluation of the commercial rate are as follows:

Devaluation leads to rise in export and hence, causes output expansion. Since the output level rises, there appears excess demand for domestic money or excess supply in the market for foreign asset. This leads to fall in the financial rate. Appreciation of the financial rate leads to fall in wealth, reduces consumption expenditure and hence, partly offsets the initial output expansion. The trade balance unambiguously improves. It is true that output level increases in response to devaluation leading to increase in use of intermediate input. Since output level does not increase as much as increase in export, the trade balance improves.

It follows from the preceding analysis that devaluation is an effective instrument of stabilization. It reduces unemployment and improves current account position of a country. Moreover, it reduces the differential between the financial rate and the commercial rate.[7]

III. The Model with Price Adjustment

A. Equilibrium and Dyanamic Adjustment

In the preceding section, we have assumed price to be constant. In this section

[7]In the appendix we have shown effects of devaluation on the output level, the financial rate and the current account balance.

we relax this assumption and incorporate slow adjustment in price which might be traced to inflation interia. The simple price adjustment process is:

$$\dot{P} = \pi(AD - \bar{y}),\ \pi > 0$$

where $\bar{y}$ is the full employment output consistent with the natural rate of unemployment. The process of price adjustment suggests that deviation of price from its long run value is due to deviation of aggregate demand from the full employment output level.

Now we have three differential equations in e_f, y and P. To keep the model within the tractable limits without sacrificing any qualitative dimension, we assume that output adjusts instantaneously to aggregate demand, such that the model reduces to two differential equations in ef and P. The equations in the model are:

$$y = (1-\beta_1)y + \beta_2\left(\frac{M}{P} + \frac{e_F}{P}F\right) + (1-\beta_1)X\left(\frac{e_c}{P}\right)$$
$$\Rightarrow y = \frac{\beta_2}{1-\beta_1}\left(\frac{M}{P} + \frac{e_F}{P}F\right) + X\left(\frac{e_c}{P}\right) \tag{6}$$

$$\dot{e}_F = f(y, \theta) \tag{7}$$

$$\dot{P} = \pi(y - \bar{y}) \tag{8}$$

From (6) we obtain output level in terms of the state variables,

$$y = y\ (P, e_f) \tag{9}$$

with $y_1 = \frac{\partial y}{\partial P} = -\frac{\beta_2}{1-\beta_1}\left(\frac{M}{P^2} + \frac{e_F}{P^2}F\right) - X'\frac{e_c}{P^2} < 0$

and $y_2 = \frac{\partial y}{\partial e_F} = \left(\frac{\beta_2}{1-\beta_1}\right)\frac{F}{P} > 0$

Substituting (9) in (7) and (8) we obtain the dynamic adjustments of e_f and P in implicit forms:

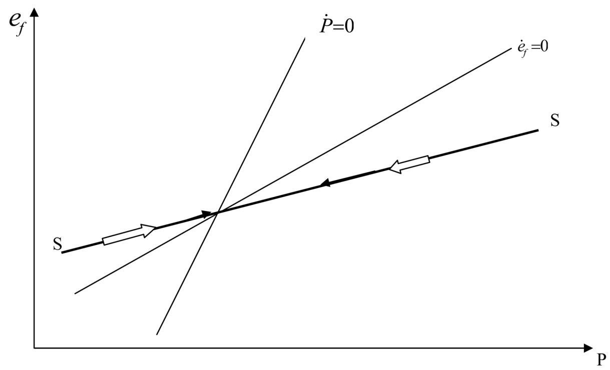
$$\dot{e}_f = \phi(e_f, P) \qquad \phi_1 > 0,\ \phi_2 < 0$$
$$\dot{P} = \psi(e_f, P) \qquad \psi_1 > 0,\ \psi_2 < 0$$

The sign restrictions on partial derivatives are obvious. An increase in price level reduces the output level and hence, demand for domestic asset which in turn causes expected appreciation of the financial rate. Depreciation of the financial rate raises the proportion of foreign asset to domestic asset, generates favourable wealth effect on output level and consequently leads to expected depreciation of the financial rate and increase in price.

In the steady state, $\dot{e}_f = \dot{P} = 0$. The $\dot{e}_f = 0$ locus describes the combinations of P and ef that are compatible with stable financial rate. An increase in price reduces output level and demand for domestic asset which necessitates depreciation of financial rate to maintain asset market equilibrium. Thus $\dot{e}_f = 0$ locus is upward sloping. In the same way, the $\dot{P} = 0$ locus gives combinations of P and ef that are consistent with the full employment output. An increase in ef causes output expansion through the wealth effect such that price increases to maintain the full employment equilibrium. Hence, the $\dot{P} = 0$ locus is upward sloping. The system exhibits saddle path stability with the $\dot{P} = 0$ locus steeper than the $\dot{e}_f = 0$ locus. The saddle path SS is flatter than the $\dot{e}_f = 0$ locus.

Since output in the long run is determined at the full employment level, the model possesses the standard long run neutrality properties alongside short run real effects. However, an important observation is that the real financial rate (e_f / P) changes also in the long run. In what follows, we intuitively explain the comparative static exercises which are already undertaken in section 1 under the assumption of constant price. Specifically, we focus on unanticipated devaluation and monetary contraction.

Figure 4. Saddle path Stability Under Flexible Price



B. Comparative Statics

Devaluation

Unanticipated devaluation of commercial rate raises export demand and causes output expansion. Since output rises, demand for domestic money goes up or demand for foreign asset falls and as a result, the financial rate appreciates on impact. Over time, price increases leading to gradual decline in output level, such that in the new long run equilibrium, the output level remains unchanged. Since output is fixed at the full employment level in the long run, export rises and consumption expenditure falls due to wealth effect. It also follows from the asset market equilibrium that the financial rate remains unchanged in the long run equilibrium. Thus, financial rate overshoots its long run value in the adjustment process.

Let us now examine the effect of devaluation on the trade balance. First, we note that price rises less than proportionately in response to devaluation of the commercial rate so as to permit rise in volume of export. Since import is intermediate input used in fixed proportion to produce final output, volume of import remains unchanged in the long run equilibrium. However, the real cost of import rises. If elasticity of export demand is greater than unity, the trade balance improves. This is a special case of the Marshall-Lerner condition.

Monetary Policy

Next consider unanticipated monetary contraction. The long run effects are easily discernible. In the long run with unchanged output level, a fall in money supply causes an equiproportionate fall in the financial rate to maintain the asset market equilibrium. However, the short run effects are complicated. Monetary contraction reduces aggregate demand and involves output contraction which in turn generates excess demand for foreign asset. On the other hand, tight money policy increases the ratio of value of foreign asset to domestic asset leading to excess supply in the market for foreign asset. Thus, on impact, the financial rate may either depreciate or appreciate. Over time, price level declines which tends to reduce the financial rate. Thus, the transition period shows output contraction and falling price.

Since price falls, export rises and the real cost of import goes up, though the volume of intermediate import remains unchanged in the long run equilibrium. Hence, the trade balance improves if the elasticity of export demand is greater than unity.

One important observation is that the fall in money supply causes an equiproportionate decline in the financial rate, but less than proportionate fall in the price level such that the real wealth and hence, real domestic demand declines to match the increased export demand in the long run, that is, $\left|\frac{dM}{M}\right| = \left|\frac{de_f}{e_f}\right| > \left|\frac{dP}{P}\right|$. It is to be noted that our analysis shows that fall in the money supply does not produce an equiproportionate fall in the price level which is in contrast with the standard open economy macroeconomics of floating exchange rate (see for example Dornbusch, 1976). Under two tier exchange rate, monetary policy can not influence the level of total demand for domestic goods in the long run, but it changes the composition of demand. If the exchange rate is perfectly flexible on both the current and the capital account, not only the level but also the composition of aggregate demand remain invariant with respect to the change in money supply in the long run.

IV. Conclusion

The paper examines the macroeconomic consequences of stabilization in a monetary economy under dual exchange rate. In section 1, we have kept commodity price fixed by assuming perfectly elastic supply curve and in section 2, we have introduced price adjustment which is governed by the gap between actual output level and natural level of output. Naturally in section 2, the long run equilibrium corresponds to the natural output level and policies have no real effects in the long run. We have examined comparative static implications of monetary contraction and devaluation in both the sections.

The major findings of section 1 are as follows.

Monetary contraction involves considerable output cost, but it improves trade balance which is attributable to decline in the use of intermediate inputs on account of output contraction. Moreover, the financial rate may depreciate on monetary contraction due to fall in the level of output and consequently the gap between the market determined financial rate and the fixed commercial rate may increase. However, in the existing literature, this gap always falls in response to monetary contraction, since output is taken to be fixed at the full employment level. Thus, not only monetary contraction involves uneasy trade-off between the fall in output level and improvement in trade balance, it may also widen the gap between the financial rate and the commercial rate. On the other hand, devaluation of the commercial rate has expansionary effect and it unambiguously improves the trade balance under fixed price. Moreover, devaluation leads to appreciation of the financial rate and reduces the gap between the financial rate and the commercial rate. In section 1, we have also distinguished between anticipated and unanticipated changes in policies. In particular, anticipated devaluation involves output contraction between its announcement and implementation. However, output unambiguously rises after implementation of devaluation. Thus, comparative static effects in section1 have shown that devaluation of the commercial rate is a successful instrument of stabilization and is preferred to monetary contraction.

The nature of trade off and the associated ranking of policies in terms of their effectiveness undergo significant change, once we allow for price adjustment, as we have done in section 2.As has already been mentioned, the policies have no long run effects on output. But effects on inflation and current account balance in the adjustment process to the long run equilibrium are worthnoting. Monetary contraction is deflationary during the period of adjustment to the long run equilibrium. Moreover, it improves the current account balance, provided the elasticity of export demand is greater than unity. On the other hand devaluation of the commercial rate involves inflationary implications during the period of adjustment and leads to improvement in the current account balance, provided the elasticity of export demand is greater than unity. If we judge desirability of policy in terms of its effects on price level, monetary contraction is preferred to devaluation under flexible price in section 2 of this chapter.

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Appendix for section II

Dynamics of the system is represented by the following equations:

$$\dot{y} = \alpha(AD - y) = b(y, e_f)$$
$$\dot{e}_f = f(y, \theta)$$

We use the following notation:

$$b_1 = \frac{\partial b}{\partial y} = -\alpha(1-\beta_1) < 0 \ and \ b_2 = \frac{\partial b}{\partial e_f} = \alpha\beta_2\frac{F}{P} > 0$$

$$f_1 = \frac{\partial f}{\partial y} > 0 \ \ and \ \ f_2 = f_\theta\frac{F}{M} > 0, \ \ since \ \ f_\theta = \frac{\partial f}{\partial \theta} > 0$$

The dynamics of the system can be linearized around equilibrium:

$$\begin{bmatrix} \dot{y} \\ \dot{e}_f \end{bmatrix} = \begin{bmatrix} b_1 & b_2 \\ f_1 & f_2 \end{bmatrix} \begin{bmatrix} y - \bar{y} \\ e_f - \bar{e}_f \end{bmatrix}$$

where $(\bar{y}, \bar{e}_f)$ are equilibrium values of the level of output and the financial rate respectively.

The fact that the dynamics are described by a saddle point means that the following determinant is negative:

$$\Delta = \lambda_1 \lambda_2 = b_1 f_2 - b_2 f_1 < 0$$

where λ_1 and λ_2 are the characteristic roots or eigenvalues.

We assume that $\lambda_1 < 0$ *and* $\lambda_2 > 0$. In the context of the saddle path stability of the system we note that the financial rate is a jump variable and the level of output evolves continuously at all times.

The solutions for y and e_f are of the following forms:

$$y = \bar{y} + A_1 e^{\lambda_1 t} + A_2 e^{\lambda_2 t}$$

$$e_f = \bar{e}_f + \left(\frac{\lambda_1 - b_1}{b_2}\right) A_1 e^{\lambda_1 t} + \left(\frac{\lambda_2 - b_1}{b_2}\right) A_2 e^{\lambda_2 t}$$

For bounded solution, we set A_2=0.Thus, the solutions become

$$y = \bar{y} + A_1 e^{\lambda_1 t}$$

$$e_f = \bar{e}_f + \left(\frac{\lambda_1 - b_1}{b_2}\right) A_1 e^{\lambda_1 t}$$

Eliminating $A_1 e^{\lambda_1 t}$, we get

$$e_f - \bar{e}_f = \left(\frac{\lambda_1 - b_1}{b_2}\right)(y - \bar{y})$$

This is the equation of the saddle path. We can also write equation of the saddle path as

$$e_f - \bar{e}_f = \left(\frac{f_1}{\lambda_1 - f_2}\right)(y - \bar{y})$$

Since $\lambda_1 < 0, f_1 > 0 \; and \; f_2 > 0,$ the saddle path is downward sloping and flatter than the locus.

Comparative Statics

1. Monetary Contraction

We write adjustment equations as follows:

$$\dot{y} = b(y, e_f, M, e_c) = 0$$

$$\dot{e}_f = f(y, \theta) = 0$$

Let us use the following notation:

$$b_3 = \frac{\partial b}{\partial M} = \frac{\alpha\beta_2}{P} > 0$$

Differentiating these equilibrium conditions with respect to money supply, we get:

$$\begin{bmatrix} b_1 & b_2 \\ f_1 & f_2 \end{bmatrix} \begin{bmatrix} \frac{\partial y}{\partial M} \\ \frac{\partial e}{\partial M} \end{bmatrix} = \begin{bmatrix} -b_3 \\ \frac{f_\theta e_f F}{M^2} \end{bmatrix}$$

By applying Cramer's rule, we get

$$\frac{\partial y}{\partial M} = \frac{-b_3 f_2 - f_\theta b_2 \frac{e_f F}{M^2}}{\Delta} > 0$$

$$\frac{\partial e_f}{\partial M} = \frac{b_1 f_\theta \frac{e_f F}{M^2} + f_1 b_3}{\Delta} ?$$

Since $b_1 < 0$, effect of monetary contraction on the financial rate is ambiguous.

2. Devaluation of the Commercial Rate

Let us use the following notation:

$$b_4 = \frac{\partial b}{\partial e_c} = \alpha(1 - \beta_1)\xi\frac{X}{e_c} > 0$$

Where ξ = elasticity of export demand.

Differentiating the equilibrium conditions with respect to the commercial rate, we get:

$$\begin{bmatrix} b_1 & b_2 \\ f_1 & f_2 \end{bmatrix} \begin{bmatrix} \dfrac{\partial y}{\partial M} \\ \dfrac{\partial e}{\partial M} \end{bmatrix} = \begin{bmatrix} -b_3 \\ 0 \end{bmatrix}$$

By applying the Cramer's rule, we get:

$$\frac{\partial y}{\partial e_c} = \frac{-b_4 f_2}{\Delta} > 0$$

$$\frac{\partial e_f}{\partial e_c} = \frac{b_4 f_1}{\Delta} < 0$$

Differentiating the trade balance equation with respect to the commercial rate, we get:

$$\frac{\partial CA}{\partial e_c} = \xi \frac{X}{e_c}\left[1 + \frac{e_c}{P}\gamma(1-\beta_1) f_2 \frac{\alpha}{\Delta}\right]$$

Now $\dfrac{\partial CA}{\partial e_c} > 0$ if $1 + \dfrac{e_c}{P}\gamma(1-\beta_1) f_2 \dfrac{\alpha}{\Delta} > 0$

That is, $\Delta + \dfrac{e_c}{P}\gamma(1-\beta_1) f_2 \alpha < 0$, $since \ \ \Delta < 0$

or, $\alpha(1-\beta_1)\left(\dfrac{e_c}{P}\gamma - 1\right) - b_2 f_1 < 0.$

Since $b_2 > 0$ and $f_1 > 0$, condition for devaluation to improve trade balance reduces to $\dfrac{e_c}{P}\gamma - 1 < 0$, that is, $\dfrac{e_c}{P}\gamma < 1$. This is true by assumption, we have made in the text to ensure positive value added.