

MACROECONOMIC POLICIES, REAL EXCHANGE RATE MISALIGNMENT,
AND DEVALUATION*

by

Sebastian Edwards

University of California at Los Angeles

and

National Bureau of Economic Research

UCLA Working Paper Number 509
September 1988

*This is a draft of Chapter 3 of S. Edwards's Real Exchange Rates, Devaluation and Adjustment, (forthcoming, The MIT Press 1989).

Draft: June 1987
Revised: September 1987
Revised: November 1987
Revised once again: March 1988
Final Version: July 1988

C H A P T E R 3
MACROECONOMIC POLICIES, REAL EXCHANGE RATE MISALIGNMENT,
AND DEVALUATION*

by

Sebastian Edwards

University of California, Los Angeles

and

National Bureau of Economic Research

*This is a draft of Chapter 3 of S. Edwards' Real Exchange Rates, Devaluations and Adjustment.

ABSTRACT

This paper corresponds to Chapter 3 of the forthcoming book Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries. This work investigates several aspects related to exchange rates in developing nations. Theoretical models of equilibrium and disequilibrium exchange rates are developed; the behavior of real exchange rates is investigated for a large cross section of countries; and the effectiveness of devaluation is assessed for a group of 39 developing nations.

CHAPTER 3

Macroeconomic Policies, Real Exchange Rate Misalignment and Devaluation

Even though long run equilibrium real exchange rates are a function of real variables only, actual real exchange rates respond both to real and monetary variables. The existence of an equilibrium real exchange rate does not mean that the actual real rate has to be permanently equal to this equilibrium value. In fact, the actual RER will normally exhibit departures from its long run equilibrium; short run and even medium run deviations of the actual from the equilibrium RER, that are typically not very large and that stem from short term frictions and adjustment costs, can be quite common. However, there are other types of deviations that can become persistent through time, generating major and sustained differentials between actual and equilibrium real exchange rates, or real exchange rate misalignments.

In the optimizing model of Chapter 2 the RER was always in equilibrium. In this chapter, on the other hand, we deal with situations where the actual real exchange rate can become misaligned, exhibiting sustained departures from its long run equilibrium value. In order to analyze these RER misalignments we develop a monetary model with a highly stylized real side. This, however, is not a serious limitation since Chapter 2 has provided an exhaustive analysis on equilibrium movements of real exchange rates.¹

In this chapter the interaction between macroeconomic policies and the behavior of the actual real exchange rate is carried out for two different nominal exchange rate regimes: (1) fixed nominal exchange rates, and its variants including managed and crawling rates; and (2) nonunified exchange rate systems, including dual rates and the case where a significant parallel foreign exchange market coexists with the official market. The chapter also

deals with the role of nominal devaluations in generating a real exchange rate realignment or return to long run equilibrium. Here we emphasize the interaction between nominal devaluations and macroeconomic policies, and focus on both a fixed and a dual nominal rate regimes.

3.1 Macroeconomic Policies and Real Exchange Rate Misalignment In A Unified Fixed Nominal Exchange Rate Regime

A fundamental principle of open economy macroeconomics is that in order to have a sustainable macroeconomic equilibrium it is necessary that monetary and fiscal policies are consistent with the chosen nominal exchange rate regime. This means that the selection of an exchange rate system imposes certain limitations on the extent of macropolicies. If this consistency is violated severe disequilibrium situations, which are usually reflected on real exchange rate misalignment, will take place.

Perhaps the case of a "high" fiscal deficit under fixed nominal exchange rates is the most clear example of macro and exchange rate inconsistencies. In most developing countries fiscal imbalances are partially or wholly financed by money creation. The inflation required to finance a fiscal deficit equal to a fraction δ of GDP can be calculated as:

$$\pi = \delta/\lambda \tag{3.1}$$

where π is the rate of inflation required to finance the government deficit, and λ is the ratio of high-powered money to GDP. If the required rate of inflation is "too high," it will possibly result in the price of nontradables (P_N) growing faster than the international price of tradables (P_T^*) and in a real appreciation. This type of "inconsistent" fiscal policy will result in domestic credit creation above money demand growth. This, in turn will be translated into an excess demand for tradable goods,

nontradable goods, and financial assets. While the excess demand for tradables will be reflected in a higher trade deficit (or lower surplus), in a loss of international reserves, and in an increase in (net) foreign borrowing above its long run sustainable level, the excess demand for nontradables will be translated into higher prices for those goods, and consequently into a real exchange rate appreciation. If there are no changes in the fundamental real determinants of the ERER this real appreciation induced by the expansive domestic credit policy will represent a departure of the actual RER from its equilibrium value, or real exchange rate misalignment. Naturally, since this policy is unsustainable, something will have to give. Either the inconsistent macropolicies will have to be reverted, or at some time the central bank will "run out" of reserves and a balance of payments crisis will ensue.

The consistency between monetary and exchange rate policies is not only needed under fixed rates, but also under most types of predetermined and managed nominal exchange rates such as an active crawling peg. Perhaps Argentina in the late 1970s is the most notorious recent case of an inconsistent fiscal and crawling nominal exchange rate policies. During that period the Argentinian government implemented the by-now famous preannounced rate of devaluation or "tablita" as a means to reduce inflation. However, the preannounced rate of crawl was clearly inconsistent with the inflation tax required to finance the fiscal deficit (Calvo 1986). This inconsistency not only generated a real appreciation, but also a substantial speculative activity where the public basically bet on when the "tablita" would be abandoned.

A number of authors have analyzed the relation between macroeconomic policies, real exchange rates and the external sector. Rodriguez (1978), for example, constructed a model of a small dependent economy with no

capital mobility where inconsistent fiscal policies lead to real exchange rate overvaluation, losses in reserves, and eventually to a devaluation crisis. As long as the devaluation is not accompanied with a reversal of the unsustainable fiscal policies, all the nominal devaluation can accomplish is generate a temporary improvement in the balance of payments. In the Rodriguez model without fiscal restraint there will be recurrent balance of payments crises that will lead to a devaluation-inflation spiral. More recently, Khan and Lizondo (1987) have extended the Rodriguez model, allowing for a richer menu of policies. They also emphasize the relation between fiscal inconsistencies, real exchange rate overvaluation and eventual balance of payments crises.

Neither of these papers incorporates the role of expectations of devaluation into the analysis. This, however, has been extensively done in the literature on speculative attacks and devaluations pioneered by Krugman (1979). A problem with most work along those lines, however, is that in these models, contrary to most historical episodes, the process leading to a devaluation crisis is not accompanied by a real exchange rate overvaluation. An exception to this is given by Calvo's (1987) optimizing model of a cash-in-advance economy where this real overvaluation does precede the devaluation crisis.² In Section 3.3 we construct a model of a small economy that captures the most salient stylized facts of devaluation crises in the developing world.

3.2 Macroeconomic Policies and the Real Exchange Rates in the Presence of Parallel Nominal Exchange Rate Markets

Nonunified (or multiple) nominal exchange rates have traditionally had some appeal for the developing countries, and have recently become fairly common. Under this type of system different international transactions are

subject to differential nominal exchange rates, giving rise to the possibility of having more than one real exchange rate.

Under nonunified exchange rates, the relation between macroeconomic policies and the rest of the economy will depend on the nature of the multiple rates system. If, for example, the multiple rates regime consists of two (or more) predetermined (i.e., fixed) nominal rates, the system will work almost in the same way as under unified predetermined nominal rates. This is because multiple fixed nominal exchange rates are perfectly equivalent to a unified rate system with taxes on certain external transactions. In this case, as with unified predetermined rates, inconsistent macroeconomic policies will result in loss of international reserves, a rate of domestic inflation that will exceed world inflation, and in real exchange rate overvaluation. This situation, of course, will be unsustainable in the long run and the authorities will have to introduce corrective macropolicies.

A different kind of nonunified nominal exchange rates consists of a fixed official rate for current account transactions and an (official) freely fluctuating rate for capital account transactions. Although this type of arrangement has been more prevalent in the more advanced countries, in recent years a number of developing nations (i.e., Mexico, Venezuela) have experimented with it. The main purpose of this system is to delink the real side of the economy from the effects of supposedly highly unstable capital movements. In this dual exchange rate system, portfolio decisions are highly influenced by the differential between the free and fixed rates or exchange rate premium. The private sector decisions on what proportion of wealth to hold in the form of foreign currency denominated assets is directly influenced by the expected rate of devaluation of the free rate.

Under a dual exchange rate regime, even if no current account transactions slip into the free rate, changes in the fluctuating nominal rate will exercise an influence on the real exchange rate. Consider, for example, the case of an increase of domestic credit at a rate that exceeds the increase in the demand for domestic money. As before this will provoke an excess demand for goods and financial assets. As a result of this policy there will be a decline in the stock of international reserves, an increase in the price of nontradable goods, and consequently a real appreciation. In addition, there will be an increase in the demand for foreign assets, which will result in a nominal devaluation of the free rate, and in changes in the domestic interest rate. The devaluation of the free rate will, in turn, have secondary effects over the official real exchange rate via a wealth effect. The bottom line, however, is that in this case inconsistent macropolicies will eventually be also unsustainable, as international reserves are drained. By partially delinking the current from the capital account, all the dual rates system can hope to do is delay the eventual crisis.

3.3 A Dual Nominal Exchange Rate Model

In this section we construct a model to analyze the behavior of the key macroeconomic variables -- including the real exchange rate -- in a country with nonunified nominal exchange rates. This model provides a number of important insights regarding the relation between macroeconomic policies, real exchange rate misalignment and devaluations. The model is an extension of the Calvo-Rodríguez (1977) model for the case where there are dual nominal rates and a government sector.³ In this model the exportable and importable sectors are aggregated into a tradable sector.⁴ It is assumed, consequently, that this small country produces and consumes two goods: tradables (T) and nontradables (N). Nationals of this country hold

either domestic money (M) or foreign money (F). There is a government that consumes tradables and nontradables, and uses both nondistortionary taxes and domestic credit creation to finance its expenditures. Initially it is assumed that the government, as the private sector, cannot borrow from abroad. Later, however, we discuss several ways in which this assumption can be relaxed. Also, it is assumed that there is no domestic public debt. By assuming debt away we can ignore interest rates, greatly simplifying the exposition. Finally, it is assumed that there is a fixed nominal exchange rate for commercial transactions (E) and a freely floating nominal exchange rate (δ) for financial transactions. This latter rate takes whatever level is required to achieve asset market equilibrium. It is assumed that the price of tradables in terms of foreign currency is fixed and equal to $1(P_T^*-1)$. Throughout the analysis it is also assumed that there is perfect foresight. The model is given by equations (3.2) through (3.16) below:

Portfolio Decisions

$$A = M + \delta F \quad (3.2)$$

$$a = m + \rho F, \text{ where} \quad (3.3)$$

$$a = A/E; m = M/E; \rho = \delta/E$$

$$m = \sigma(\dot{\delta}/\delta)\rho F; \quad \sigma' < 0 \quad (3.4)$$

$$\dot{F} = 0 \quad (3.5)$$

Demand Side

$$e = E/P_N \quad (3.6)$$

$$C_T = C_T(e, a); \quad \frac{\partial C_T}{\partial e} < 0, \quad \frac{\partial C_T}{\partial a} > 0 \quad (3.7)$$

$$C_N = C_N(e, a); \quad \frac{\partial C_N}{\partial e} > 0, \quad \frac{\partial C_N}{\partial a} > 0 \quad (3.8)$$

Supply Side

$$Q_T = Q_T(e); \quad \frac{\partial Q_T}{\partial e} > 0 \quad (3.9)$$

$$Q_N = Q_N(e); \quad \frac{\partial Q_N}{\partial e} < 0 \quad (3.10)$$

Government Sector

$$G = P_N G_N + E G_T \quad (3.11)$$

$$\frac{E G_T}{G} = \lambda \quad (3.12)$$

$$G = \tau + \dot{D} \quad (3.13)$$

External Sector

$$CA = Q_T(e) - C_T(e, a) - G_T \quad (3.14)$$

$$\dot{R} = CA \quad (3.15)$$

$$\dot{M} = \dot{D} + E \dot{R} \quad (3.16)$$

Equation (3.2) defines total assets (A) in domestic currency as the sum of domestic money (M) plus foreign money (F) times the free market nominal exchange rate (δ). Equation (3.3) defines real assets in terms of tradable goods, where E is the (fixed) commercial rate and $\rho = \delta/E$ is the spread between the free and the commercial nominal exchange rates. Equation (3.4) is the portfolio composition equation and establishes that the desired ratio of real domestic money to real foreign money is a negative

function of the expected rate of depreciation of the free rate δ . Since perfect foresight is assumed, in equation (3.4) expected depreciation has been replaced by actual depreciation $\dot{\delta}/\delta$. Equation (3.5) establishes that there is no capital mobility and that no commercial transactions are subject to the financial rate δ . It is assumed, however, that this economy has inherited a positive stock of foreign money, so that $F_0 \neq 0$.

Equations (3.6) through (3.10) summarize the demand and supply sides. Demand for nontradable and tradable goods depend on the real exchange rate and on the level of real assets; supply functions, on the other hand, depend on the real exchange rate only. Notice that a simplification is that taxes do not appear in the demand functions. Equations (3.11) through (3.13) summarize the government sector, where G_N and G_T are consumption of N and T respectively. It is convenient to express real government consumption in terms of tradables as:

$$g = g_T + g_N, \quad (3.11')$$

where $g = G/E$, $g_T = G_T$ and $g_N = \frac{P_N G_N}{E} = G_N/e$. Equation (3.12) defines the ratio of government consumption on tradable goods as λ . Notice that λ is also equal to (g_T/g) . Equation (3.13) is the government budget constraint and says that government consumption has to be financed via nondistortionary taxes (t) and domestic credit creation (\dot{D}). However, under a fixed nominal exchange rate for commercial transactions a positive rate of growth of domestic credit ($\dot{D} > 0$) is not sustainable in the long run. Stationary equilibrium, then, is achieved when $G = t$ and $\dot{D} = 0$. If, however, a crawling peg is assumed for the commercial rate (i.e., $(\dot{E}/E) > 0$), it is possible to have a positive \dot{D} consistent with the rate of the crawl.

Equations (3.14), (3.15) and (3.16) are the external sector. Equation (3.14) defines the current account in foreign currency as the difference between output of tradables and total (private plus public sector) consumption of T . Equation (3.15) establishes that in this model, with no capital mobility and a freely determined financial exchange rate, the balance of payments (\dot{R}) is identical to the current account, where R is the stock of international reserves. It is also assumed that initially the Central Bank holds a positive stock of international reserves R_0 .⁵ Finally, the model is closed with equation (3.16), which provides the link between changes in international reserves, changes in domestic credit and changes in the domestic stock of money.

As in Chapter 2, long run sustainable equilibrium is attained when the nontradable goods market and the external sector (current account and balance of payments) are simultaneously in equilibrium. In this model this means that long run sustainable equilibrium implies that the current account is in equilibrium in every period. In the short and even medium run, however, there can be departures from $CA = 0$. This, of course, will result in the accumulation or decumulation of international reserves. A steady state is attained when the following four conditions hold simultaneously: (1) the nontradables market clears; (2) the external sector is in equilibrium $\dot{R} = 0 = CA = \dot{m}$; (3) fiscal policy is sustainable, $G = t$ and $\dot{D} = 0$; and (4) portfolio equilibrium holds. The real exchange rate prevailing under these steady state conditions is the long run equilibrium real exchange rate (\bar{e}_{LR}). This long run equilibrium real exchange rate is equivalent to \bar{RER} in Chapter 2.

The nontradables good market clears when:

$$C_N(e, a) + e g_N = Q_N(e) \quad (3.17)$$

where g_N is real government consumption of N in terms of tradable goods. From (3.17) it is possible to find an equilibrium relation between e , a and g_N .

$$e = v(a, g_N); \quad \text{where } \frac{\partial v}{\partial a} < 0, \quad \frac{\partial v}{\partial g_N} < 0 \quad (3.18)$$

A higher value of real assets increases the demand for nontradables, requiring a higher P_N -- or lower RER -- to maintain equilibrium. The case of g_N is equivalent. Notice that equation (3.18) gives us the value of e that equilibrates the nontradables good sector, without any reference to the external sector. In order to find the long run equilibrium real exchange rate we have to also look at current account and balance of payments equilibrium.

Since the commercial rate is fixed, $(\dot{\delta}/\delta)$ in the money demand equation (3.4) can be substituted by the rate of change of the spread $(\dot{\rho}/\rho)$. Thus we can write $m/\rho F = \sigma(\dot{\rho}/\rho)$. Inverting this equation and solving for $\dot{\rho}$ we obtain:

$$\dot{\rho} = \rho L\left(\frac{m}{\rho F}\right); \quad L'(\) < 0. \quad (3.19)$$

In steady state equilibrium $\dot{\rho} = 0$. In Figure 3.1, the $\dot{\rho} = 0$ schedule has been drawn; it is positively sloped because in order for the public to hold larger amounts of m we need a higher ρ : the higher the spread the lower the expectations of further increases of the free rate, and thus, the higher the amount of (real) domestic money the public is willing to hold.

From equations (3.11), (3.14) (3.15) and (3.16), the following expression for \dot{m} can be derived:

$$\dot{m} = Q_T(e) - C_T(e, a) + \frac{G_N}{e} - \frac{t}{E} \quad (3.20)$$

Equilibrium of the external sector requires that $\dot{m} = 0$. When government

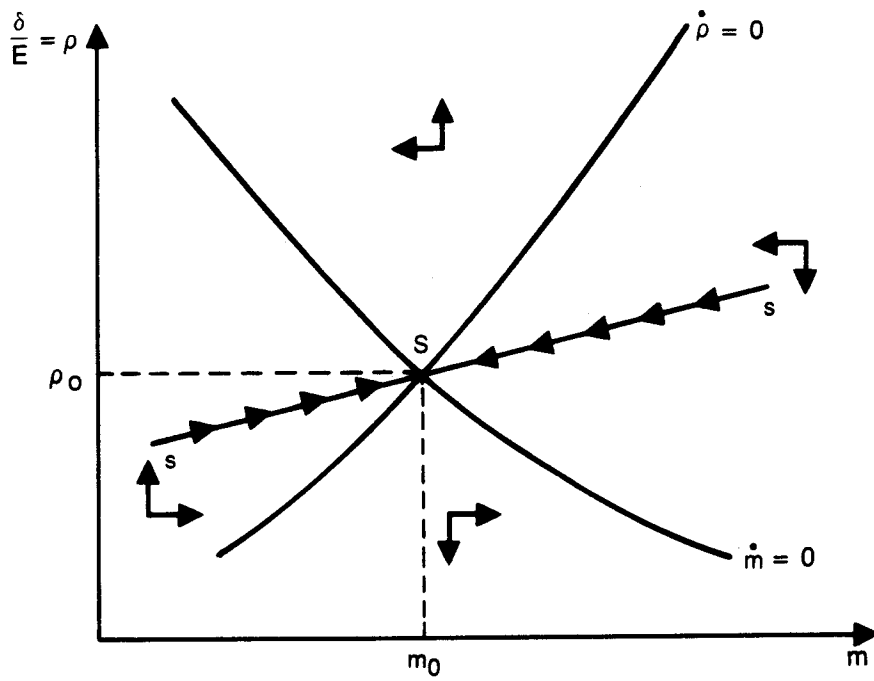


Figure 3.1

expenditures are fully financed with taxes, the $\dot{R} = 0$ schedule will coincide with the $\dot{m} = 0$ schedule. In Figure 3.1 the $\dot{m} = 0$ schedule has been drawn. The intuition for its negative slope is related to the effects of wealth changes on the current account and on relative prices. An increase in m results in higher real wealth (a) and in a current account deficit; in order to regain equilibrium real wealth (a) should go down via a decline in δ .

Long run sustainable equilibrium is depicted in Figure 3.1 by the intersection of the $\dot{\rho} = 0$ and the $\dot{m} = \dot{R} = 0$ schedules. S is the long run equilibrium point with a steady state level of real balances m_0 and a steady state spread ρ_0 . It is easy to show that this system is characterized by saddle path equilibrium. ss is the saddle path, and the arrows denote the dynamic forces at work in this system. Once the steady state values of ρ and m are determined, equation (3.18) can be used to find, for the corresponding value of g_N , the long run equilibrium real exchange rate:

$$\bar{e}_{LR} = v(m_0 + \rho_0 F_0, g_{N_0}) \quad (3.21)$$

Although the real side of this model is significantly simpler than the general equilibrium model of Chapter 2, it is still the case that changes in the real fundamental determinants of the real exchange rate will affect the long run sustainable equilibrium real exchange rate.⁶ For example, a change in the composition of government consumption or λ , will result in a change in e_{LR} . If we assume that expenditure on tradables increases at the expense of government consumption of N -- with total real government consumption constant -- there will be an equilibrium real depreciation (increase in e).⁷ In terms of the diagram this means that there will be a

downward shift of the $\dot{m} = 0$, with an unchanged $\dot{\rho} = 0$ schedule; the new steady state will be characterized by lower m and δ . From (3.21) we can then see that the new \bar{e}_{LR} will be higher.

Macroeconomic Policies. Misalignment and Dual Market Spread

Consider now how monetary disturbances will affect the real exchange rate and the external sector. In particular, we are interested in investigating how monetary disturbances will affect the evolution of the actual (as opposed to equilibrium) real exchange rate. This will allow us to discuss misalignment issues.

The simplest way to illustrate the working of the model is to consider a once-and-for-all unanticipated increase in the stock of domestic credit (D). On impact, this means that there will be a jump in the real stock of money, since $m = M/E = R + D/E$. This is illustrated in Figure 3.2 by the new real stock of domestic money m_1 . On impact the system moves from S to Q on the stationary saddle path, with a higher m_1 and spread ρ_1 .⁸ From equation (3.18) it is easy to see that at Q the actual real exchange rate has appreciated relative to its long run equilibrium value:

$$de = \left(\frac{\partial v}{\partial a}\right) dm + \left(\frac{\partial v}{\partial a}\right) F_0 d\rho < 0 \quad (3.22)$$

The reason for this lower short run real exchange rate e is that the demand for nontradables is a function of real assets and e . At Q, the higher m and the higher ρ , imply a higher $a(-m + \rho F)$ and, consequently, an incipient excess demand for N. This in turn requires a lower e to reestablish nontradable equilibrium. The higher δ , on the other hand, is required for the money market to be in equilibrium. In order to induce the public to (temporarily) hold the higher m relative to F , it is required for them to expect an appreciation of δ (i.e., $(\dot{\delta}/\delta) < 0$). This is

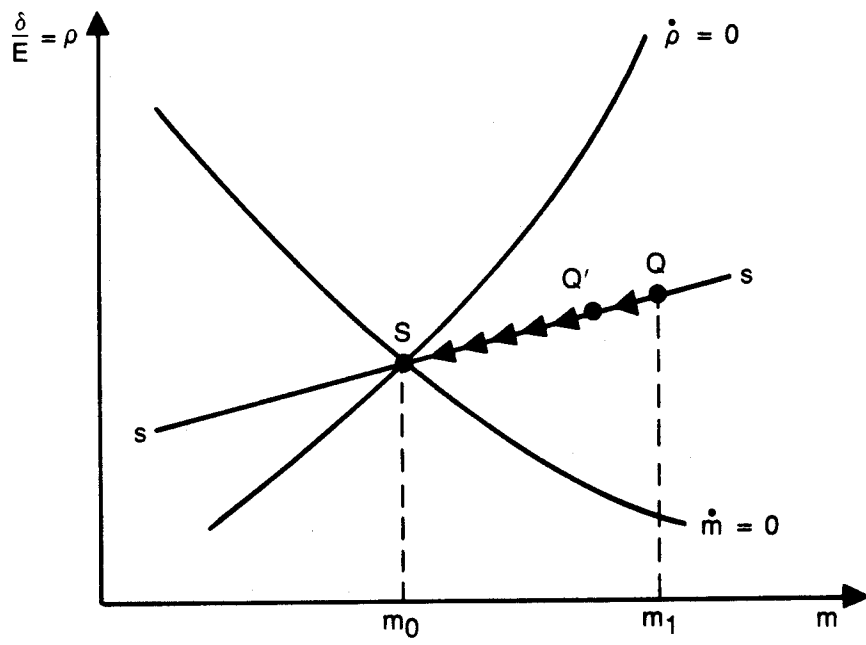


Figure 3.2

exactly what will happen during the transition period.

The difference between the actual short run real exchange rate e and its long run equilibrium level is defined as real exchange rate overvaluation. In this case, however, the overvaluation will be short lived, since there will be forces moving the system back towards equilibrium.⁹

Adjustment With Sufficient Reserves

After the initial once-and-for-all increase in D the economy will adjust along the saddle path ss moving from Q to S , with reductions of m and ρ . Throughout the transition two things will happen: (1) the stock of international reserves will decline as the public gets rid of the excess of domestic money; and (2) the real exchange rate will continuously depreciate -- via reductions in P_N -- moving back towards its long run sustainable level. However, throughout the adjustment the actual real exchange rate will still be overvalued. (i.e., throughout the transition the actual e will be below \bar{e}_{LR}). Only once the system gets back S has real exchange rate equilibrium been reestablished. In the final equilibrium m , ρ and e are the same as before the domestic credit disturbance. However, now there is a new composition of domestic money with a higher level of D and a lower level of R . Figure 3.3 depicts the evolution of our key variables through time. At time t_0 D unexpectedly increases; the transition is assumed to be finished at time t_1 . In panel (a) we depict the behavior of the real exchange rate, where as before \bar{e}_{LR} is the long run sustainable level. Notice that since there are no changes in fundamentals, the equilibrium RER remains at its original level. The actual RER, however, moves down (i.e., appreciates) at time t_0 remaining below \bar{e}_{LR} throughout the transition. Finally at time t_1 it gets back to its equilibrium value. Panel (b) depicts international reserves. Throughout the transition they

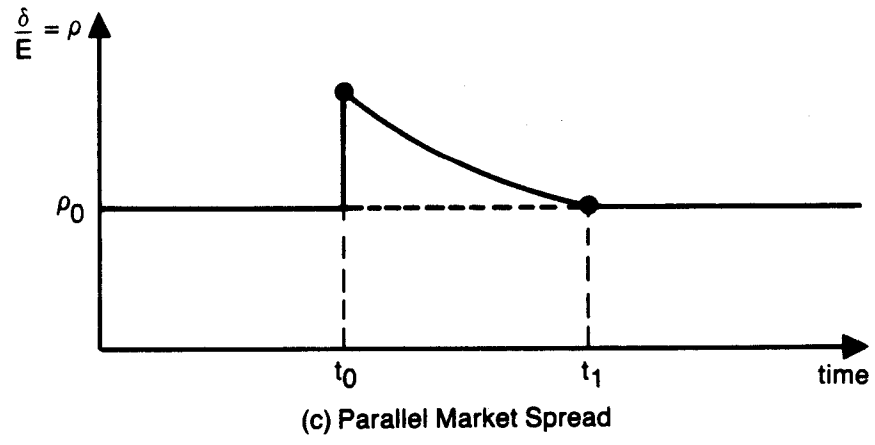
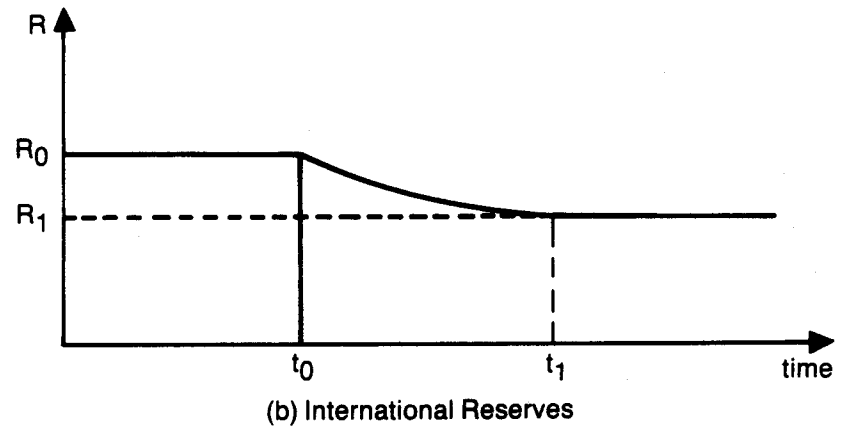
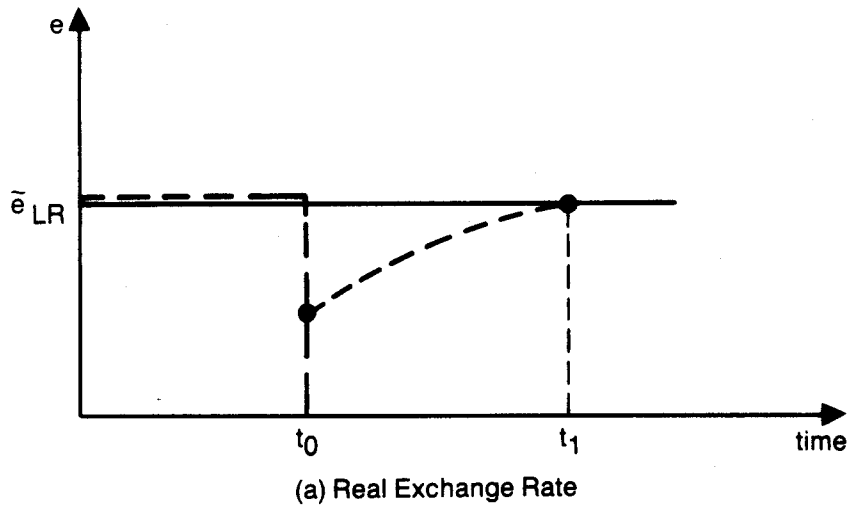


Figure 3.3

decline reaching at time t_1 their new long run equilibrium level R_1 . Finally, panel (c) depicts the evolution of the dual market spread.

The time taken to move back from Q to S in Figure 3.2 will depend on a number of variables including the magnitude of the original shock and the different elasticities involved. One possible way to accelerate the adjustment is by implementing an unanticipated discrete nominal devaluation of the commercial rate (E). From an economic perspective this once-and-for-all adjustment in E is the reverse of the increase in D. As a result of the higher E the real stock of money (M/E) will jump down. Notice, however, that an important characteristic of discrete nominal devaluations is that if undertaken from the situation of equilibrium they will only have short run effects on the real exchange rate. If, on the other hand, they are engineered when the economy is out of equilibrium -- such as in point Q' in Figure 3.2 -- they can help speed up the adjustment process. For example, in our case, an unanticipated nominal devaluation of the commercial rate of the "right amount" implemented when the economy is at Q' in Figure 3.2, will result in a jump from Q' to S. The adjustment having been much faster than if the system was left to work its way back to S on its own. Moreover, with the discrete devaluation the total loss of reserves would have been reduced.

The Adjustment When International Reserves are Insufficient

For the move from Q to S in Figure 3.2 to be a feasible adjustment path we have to assume that the initial stock of reserves (R_0) is sufficiently high as to cover the loss of reserves that takes place during the transition. If, however, initial reserves are not high enough, the public will anticipate a balance of payments crisis that will include a discrete devaluation of the commercial rate. In this case the adjustment will be

quite different from our previous discussion, and is depicted in Figure 3.4. Now, at the time of the actual increase in D the public anticipates a future devaluation of E , and will want to get out of domestic money. As a result there is a further jump in the free rate δ and thus in the spread ρ . On impact then, the system moves to point C in Figure 3.4. As before, at this point the real exchange rate suffers an appreciation relative to its long run equilibrium level (i.e., it becomes overvalued). The system then moves along the divergent path CG . Throughout this path reserves are being lost, and the actual real exchange rate is still overvalued -- that is it is below its long run sustainable level. The actual depreciation of the fixed rate E takes place when the Central Bank "runs out" of reserves -- or more precisely when reserves reach a predetermined threshold. In Figure 3.4 it is assumed that this happens when the system reaches point G . Exactly at this time E is devalued and the system jumps to point H ; from there onwards the adjustment continues on the saddle path ss . At the time of the devaluation the real stock of money is abruptly reduced, since $m = M/E$. The nominal free rate δ , however, does not jump.¹⁰ The spread $\rho = \delta/E$, on the other hand, does jump down. In terms of the diagram the fact that δ does not jump when the anticipated devaluation of E actually takes place is captured by point H on the saddle path being along a ray from the origin that goes through G .

It is assumed that the magnitude of the devaluation is determined by the amount by which the Central Bank wants to replenish its international reserves. In Figure 3.4 the magnitude of the devaluation of E is such that the new after-devaluation real stock of money m_2 is below the steady state level. This means that the final part of the adjustment will take place along the saddle path from H to S with some of the reserves

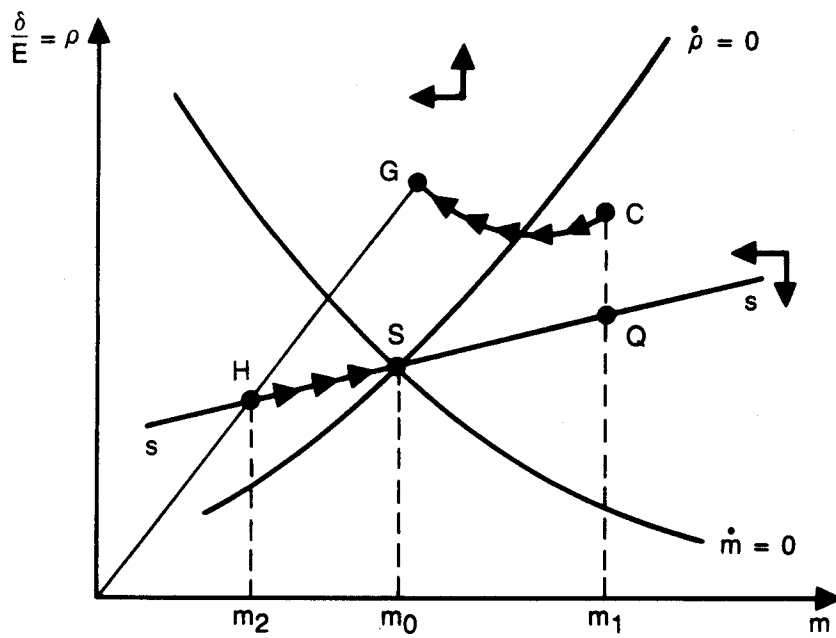


Figure 3.4

previously lost being replenished. Notice that on H the real exchange rate has depreciated by more than what is required to achieve RER equilibrium. If the central bank wants to return to the initial stock of international reserves, the integral of \dot{R} between points C and G has to be equal to (minus) the integral of \dot{R} between H and S.

Figure 3.5 depicts for the case of unanticipated once-and-for-all domestic credit expansion with exchange rate crisis, the evolution through time of the real exchange rate, international reserves, the free market rate δ and the spread. We now distinguish between three points in time:

(1) the unanticipated increase in D takes place at time t_0 . At this time the public also realizes that since reserves are low there will be a nominal devaluation of the official rate in the future. (2) At time t_1 the official devaluation actually takes place. (3) At time t_2 the adjustment has been completed. Notice that in panel (a) we have depicted two possible paths for the RER between periods t_0 and t_1 . The reason is that, as can be seen in Figure 3.4, during part of the transition m declines and ρ increases. Depending on which of these two forces dominates, e will go up or down (see equation 3.18). In panel (b) it has been assumed that the devaluation only partially replenishes the stock of international reserves. As discussed above this need not be the case.

Figure 3.5 is highly revealing, since it provides a good depiction of the way the key variables behave during the period preceding a balance of payments crisis and devaluation. Basically our model predicts that before the devaluation we will observe:

- (a) Real exchange rate overvaluation;
- (b) Drainage of international reserves;
- (c) Increase in the dual market spread.

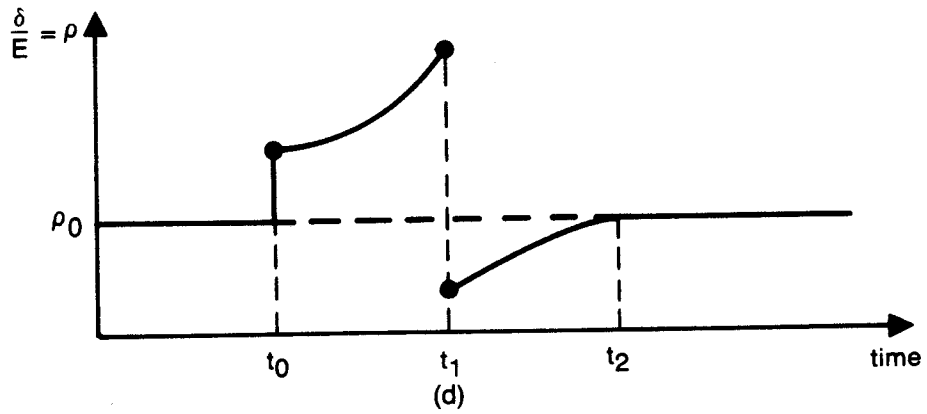
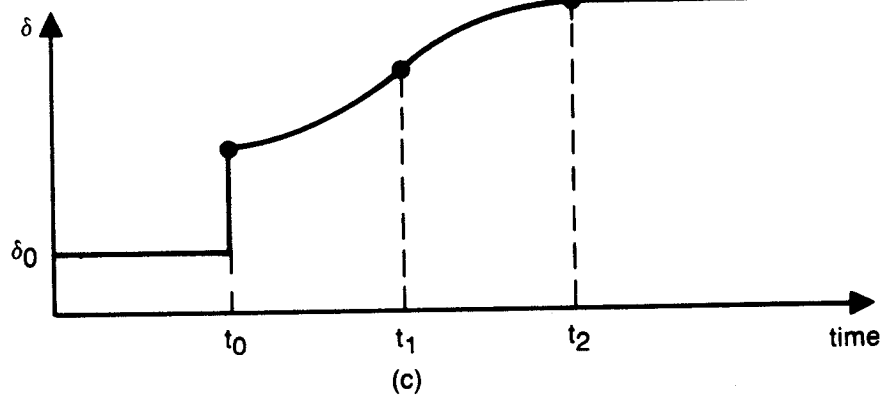
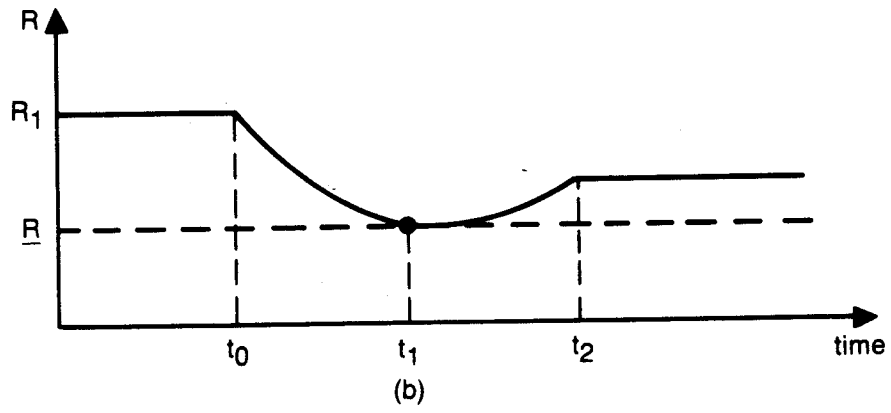
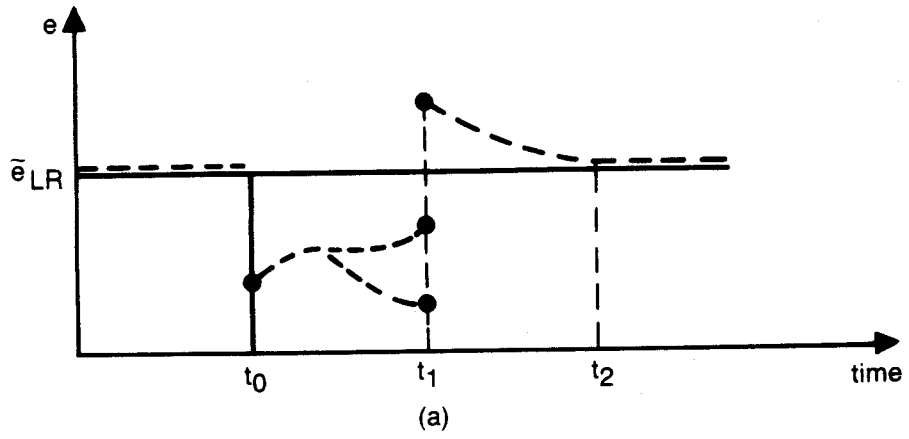


Figure 3.5

As mentioned, the initial level of international reserves plays an important role in determining the exact dynamic path followed by this economy. We know that throughout the transition from C to G reserves are being lost. Moreover, we know that the integral of reserves losses along the path from C to G has to be equal to the difference between initial reserves and the threshold level that triggers the devaluation. If the initial level of reserves is relatively large, we can have a relatively long transition. However, if initially reserves are very low the transition period will be much shorter. In fact, in terms of Figure 3.4, the initial level of reserves will determine the location of point C. If reserves are low, the crisis will take place soon after time t_0 , and the initial jump in δ will be relatively large. The case of a shorter transition from the time of the domestic credit shock to the crisis is depicted by Figure 3.6 where C is now above the $\dot{\rho} = 0$ schedule.

Changes in the Rate of Growth of Credit

Up to now we have considered once-and-for-all increases in domestic credit D . Let's now briefly analyze what happens when for a limited period of time \dot{D} becomes positive. The easiest way to think about this is by considering an unanticipated temporary reduction in taxes t , that results in a temporary positive \dot{D} . This exercise allows us to focus on the macro-economic aspects of the problem without getting sidetracked by real issues associated with increases of g .

It can be easily seen from equation (3.20) that the temporary reduction in taxes will result in a temporary shift of the $\dot{m} = 0$ schedule to the right. This is captured in Figure 3.7 where $\dot{m}' = 0$ is the new schedule. Naturally, once the policy is reversed, the $\dot{m}' = 0$ schedule will shift back. On impact the spread will jump from S to B, below the

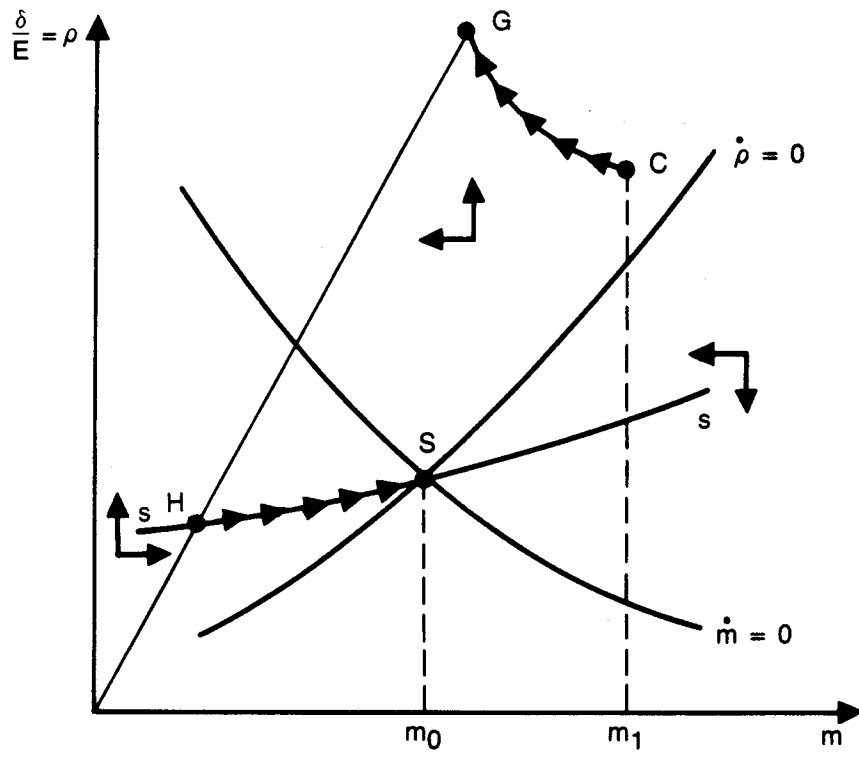


Figure 3.6

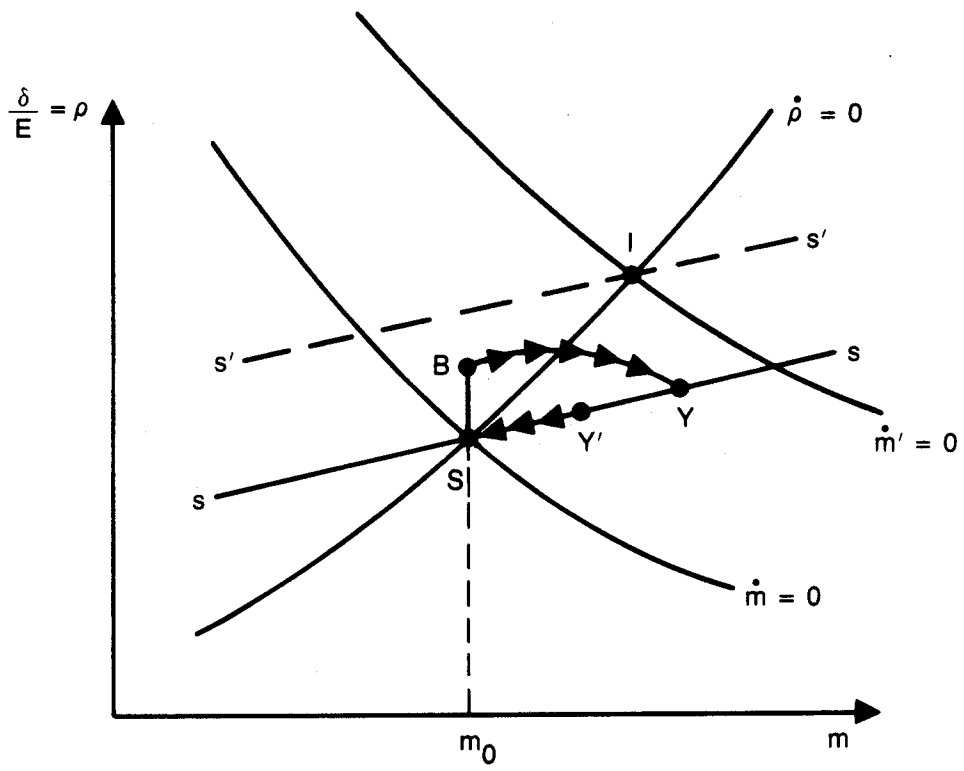


Figure 3.7

"hypothetical" saddle path that goes through I. At this point, however, the dynamics are governed by the schedules $\dot{\rho} = 0$ and $\dot{m}' = 0$. Thus, the system will follow the divergent path BY, until the policy is reversed. Exactly at that time the system will reach point Y on the stationary saddle path ss, with the system now moving from Y to S. Throughout this process reserves are lost and there is a real exchange rate overvaluation. Notice that, as before, at any point during the second part of the adjustment a devaluation of E will help speed up the return to S, allowing the country to complete the adjustment with lower losses in international reserves.

Again, in order for this adjustment path to be a feasible one it is required that initial reserves R_0 exceed the losses that take place during the transition. If this is not the case, a balance of payments crisis and a devaluation of the commercial rate will take place. Figure 3.8 captures this case where it has been assumed that the devaluation of E takes place exactly at the same time as the temporary cut in taxes is reversed. At time t_0 when taxes are temporarily reduced the public realizes that the stock of international reserves is insufficient and that there will be a devaluation of the commercial rate E. The public wants to reduce its holdings of domestic money; the free rate jumps by more than before moving to B. From there on the system follows the divergent path BY. Throughout international reserves are again being lost and the spread continues to go up. Moreover the RER becomes overvalued, and during most of the path increasingly so. At time t_1 when the system is at Y the lower bound of reserves is reached. At that time the official rate is devalued and taxes are hiked to their sustainable level. This latter measure means that the $\dot{m}' = 0$ schedule shifts back to $\dot{m} = 0$. Due to the nominal devaluation, on the other hand,

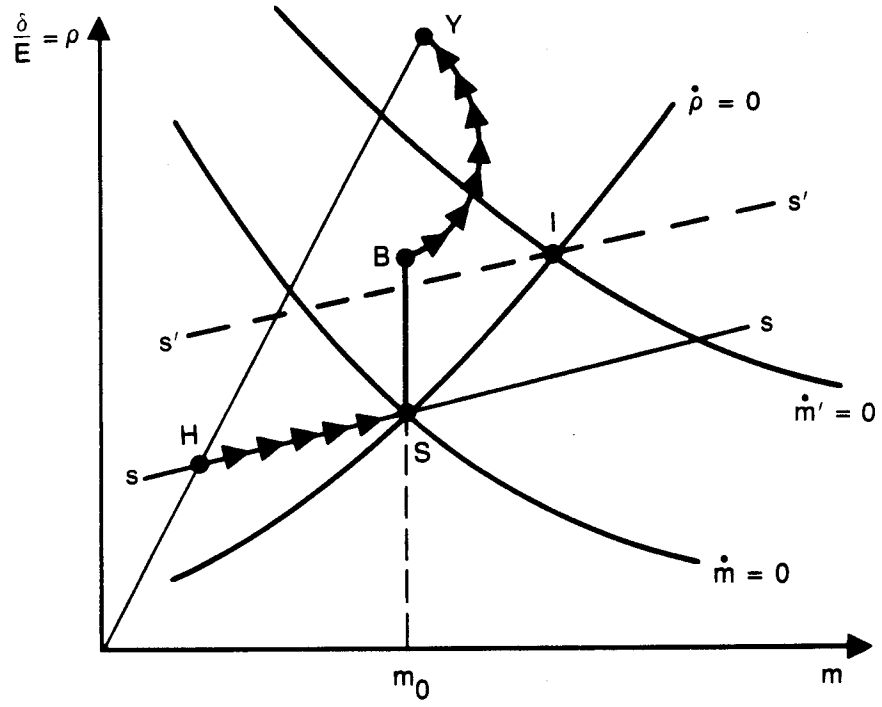


Figure 3.8

the system jumps from Y to H, with no jump in the free market rate. At that point the system is back on the sustainable saddle path and moves from H to S with international reserves being (partially) replenished.

A simplifying assumption made in this model refers to the absence of capital flows. Perhaps the simplest way to incorporate capital movements is to assume that these are restricted to the government and to model them as (autonomous) transfers. In that sense foreign borrowing can be analyzed as a positive transfer today and a (larger) negative transfer in the future.¹¹ In this case it is easy to show that an (exogenous) increase in capital inflows into the country will result in an upward shift of $\dot{m} = 0$, generating an equilibrium real appreciation.¹²

Summary

Summarizing, the model developed here has illustrated some of the essential aspects of the functioning of an economy with dual exchange rates. It was shown that expansive macroeconomic policies will generally be associated with: (1) a loss in international reserves; (2) a current account deficit; (3) an increase in the spread between the free and the fixed nominal rates during the initial period; and (4) a real exchange rate overvaluation. The form in which the disequilibria is resolved will depend on the nature of the disturbances, the nominal exchange rate policy pursued, and the existing initial stock of international reserves. Although the assumption of perfect foresight has introduced some limitations into the analysis, the model is still able to capture some of the more important stylized facts related to macroeconomic expansions in small open economies. In fact the empirical analysis of Chapters 6 and 7 will be firmly based on this model.

3.4 Black Markets and Other Extensions

The analysis is somewhat more complex if some current account transactions are subject to the free nominal exchange rate. In this case we will have an additional real exchange rate -- defined as the price of tradables subject to the free nominal rate relative to nontradables, and macro-policies will affect both real exchange rates.¹³ For example, an increase in domestic credit that exceeds growth of domestic money demand will now result in lower reserves, higher prices on nontradables, a higher "free" market nominal exchange rate, and increased foreign indebtedness if there is capital mobility. The higher price of non-tradables will generate a decline (i.e., appreciation) in the real exchange rate applicable to those goods subject to the official foreign exchange market. What will happen to the RER relevant to those goods subject to the free nominal rate? This will depend on whether as a result of the higher domestic credit the nominal exchange rate determined in the free market will increase by more or less than the price of non-tradable goods. If the same type of behavior as under a freely floating rate is observed, we will likely encounter exchange rate overshooting in this market, with the free rate nominal exchange rate increasing -- at least on impact -- by more than the price of domestic goods. The real exchange rate applicable to this type of good will, at least in the short run, depreciate. It is perfectly possible, then, that under this dual exchange rate system an expansionary monetary policy results in a real appreciation for a subset of goods -- those subject to the official market --, and a real depreciation for a different subset of goods -- those subject to the free market for the nominal exchange rate.

Although as a first approximation we can think of a dual system of the type modelled above as equivalent to an economy with a black market for

foreign exchange this is not completely accurate. The case of a regime consisting of an official pegged (or predetermined) nominal exchange rate that coexists with an illegal black market for foreign exchange is rather complex. Although when there are exchange controls some kind of black market for foreign exchange always exist, there are times when this parallel market becomes very significant, and even dominant. Even though the combination of a fixed official rate with a black market works in a way similar to the dual rates regime, there are some important differences. First, to the extent that the black market is illegal, the expectations and costs of detection play an important role in determining the premium, or difference between the official and freely determined nominal exchange rates. Second, expectations regarding political events are fundamentally important, since they reflect possible future changes in the extent of exchange controls, and other important policies. Third, in this case exporters have to decide in each period what proportion of their foreign exchange earnings to surrender legally and what proportion to bring into the country via the parallel market. This decision, of course, will partially depend on the level of the premium itself.

An important question in the case of generalized black markets relates to determining what is the marginal exchange rate. Under these circumstances the black market rate will generally be the marginal rate for import and import competing sectors. In the case of exports, the marginal rate will depend on the institutional arrangement and on whether exporters "have" to surrender a certain proportion or a certain dollar amount of their export proceeds, via the official market. If a certain proportion of these proceeds has to be surrendered, the marginal rate for exporters is a weighted average between the official and the black market rate. If on the contrary

exporters have to surrender a given number of dollars, the black market rate is the marginal one.

In the case of a generalized illegal parallel market, an increase in domestic credit creation will result in higher domestic prices and in an increase in the black market premium. If the Central Bank has already lost all its international reserves, the increase in domestic credit will not be translated, as before, in losses of the official stock of foreign exchange. This expansive monetary policy will result in an appreciation of the official real exchange rate as well as in a decline of the relative price of exports surrendered via the official market relative to those that use the parallel market. As a result of this a relatively smaller proportion of export proceeds will be surrendered at the official rate, making the crisis even worse. Eventually, the inconsistent macropolicies will become unsustainable, and corrective policies will have to be implemented. At this point the issue of nominal exchange rate unification becomes important, since the authorities will usually try to devalue the nominal rate, and eliminate the (legal or de facto) multiple rates system.

Devaluations and Trade Impediments

In the model of the previous section there was no independent role for commercial policies. It is, however, quite straightforward to incorporate tariffs into the analysis. In that case it is necessary to distinguish between importables and exportables and specify, as in Chapter 2, the relation between the domestic price of importables, the world price of importables and tariffs. In this case the phase diagrams will still be the same, and as long as tariffs do not change our analysis from the previous section will still hold.

A model similar to that of Section 3.3, can be derived for the case of three goods (Edwards 1988-). That model can be summarized in a diagram identical to Figure 3.1. In this case, however, changes in import tariffs will shift the $\dot{m} = 0$ schedule. Depending on the signs and magnitudes of the different cross elasticities of demand the $\dot{m} = 0$ schedule can go either up or down as a consequence of a tariff change. In the presence of import tariffs -- and assuming that these don't change -- devaluations will operate in exactly the same way as discussed above. They will help speed up the transition from a disequilibrium position to the long run sustainable steady state equilibrium.

However, if as in many developing countries trade restrictions take the form of quotas rather than tariffs, devaluations will have some different effects. The main difference in the quota case is that a devaluation will not (necessarily) affect the domestic price of importable goods; instead it will result in a reduction of the rents received by the holder of the quota. This means then, that under quotas devaluations will reduce the domestic relative price of importables to exportables (Krueger 1982, Bhagwati 1978).

Although the model of the previous section cannot capture this aspect of devaluations under quotas, this can be easily illustrated by means of Figure 3.9. Here D is the demand curve for a particular importable good, E_0 is the initial nominal exchange rate and P_M^* is the (given) world price of the importable. \bar{Q}_M is the amount of the quota. Consequently, the domestic price that clears the market is P_M higher than $E_0 P_M^*$. What the devaluation does is increase E_0 to E_1 reducing the rents, but not affecting the clearing price P_M .¹⁴ In spite of this additional relative price effect, in an economy with quantitative restrictions, devaluations still play an important role in helping speed up the adjustment process.

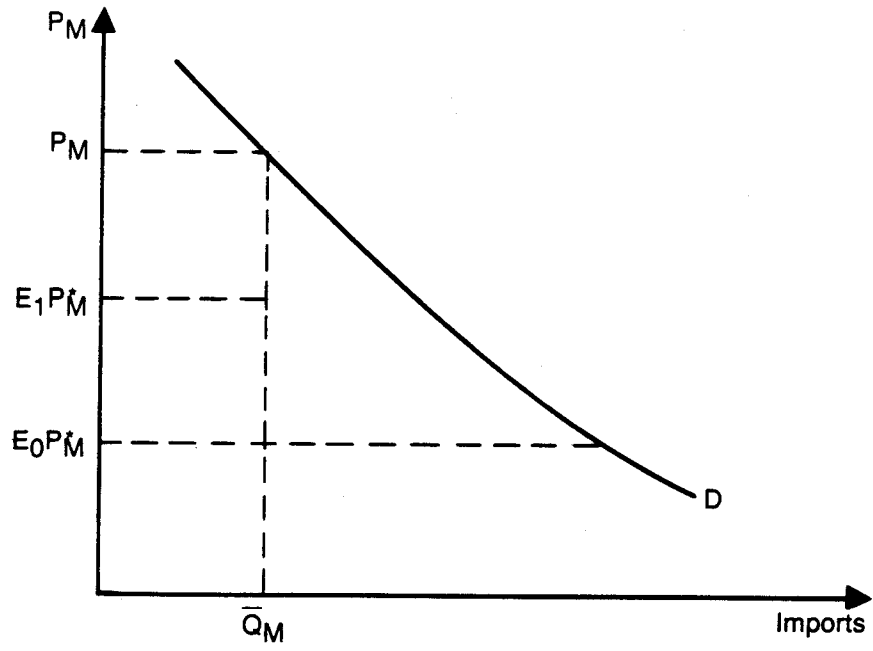


Figure 3.9

Again, however, if the sources of the initial disequilibrium condition -- that is, the expansive macroeconomic policies -- are not altered the effects of the devaluation on the relative prices of nontradables will be short lived.

3.5 Real Exchange Rate Misalignment, the Limits of Automatic Adjustment and Nominal Devaluation

An important source of welfare and efficiency costs of real exchange rate misalignment, not captured by the stylized model of Section 3.3, is related to the fact that RER overvaluation is usually accompanied by the imposition of a battery of exchange and trade controls aimed at slowing down the drainage of foreign exchange reserves that accompanies the process of RER overvaluation. These exchange and trade controls, on one hand, introduce major inefficiency costs, and on the other, encourage the creation of strong lobbies which compete for the rents generated by the protective measures (see Krueger 1974, Edwards 1989-). Also, a situation of exchange rate overvaluation greatly hurts exports, and if prolonged for a long period of time it can generate irreversible costs by wiping out the agricultural infrastructure (see World Bank 1984, Pfefferman 1985). These types of costs can be significant if there are imperfections in local capital markets. Situations of RER misalignment are also conducive to speculation, and usually generate massive capital flight out of the country. Although these capital flights may be optimal from a purely private perspective, they can represent substantial social welfare costs (Cuddington 1986).

Since RER misalignment generate major costs, how should policymakers deal with them? In the case of macroeconomic induced misalignment, a necessary step is to eliminate the source of the macroeconomic disequilibrium -- i.e., the inconsistency between macroeconomic policy and the nominal

exchange rate. The authorities can then supplement this policy with other measures or can simply wait for the economy to adjust on its own; that is, wait for the actual RER to converge on its own to the equilibrium RER.¹⁵ However, this type of policy, based on disinflation with automatic adjustment has a number of limitations which can be particularly severe under predetermined nominal exchange rates.

Once the inconsistent macroeconomic forces generating the macroeconomic induced real exchange misalignment are controlled, the RER will still differ from the ERER. The question then is how will the RER return to its equilibrium value? Consider the most common case where the real exchange rate misalignment takes the form of real overvaluation and loss of competitiveness in the international market. In this case, and under fixed nominal rates for commercial transactions, a rapid return to real exchange rate equilibrium will require a decline of the nominal domestic price of nontradables. In terms of Figure 3.2 this automatic adjustment corresponds to the move from Q to S on the saddle path. Naturally, if nominal prices of nontradables are fully flexible, as in our model of Section 3.3, this adjustment will be attained at no cost. If, however, there are some rigidities or adjustment costs a rapid reduction in this nominal price is, under most circumstances, quite unlikely. This implies that an automatic adjustment could take a substantial period of time, prolonging the situation of RER misalignment with all its related costs.

Under (nominal) domestic price and wage rate inflexibility the automatic adjustment approach can generate additional costs in the form of unemployment and reduced domestic output. The cut in aggregate expenditure resulting from the macro-corrective measures will generate an excess supply (or smaller excess demand) for all types of goods and assets. At the

tradables goods level this will be reflected in a smaller trade deficit and, with capital mobility, in a reduction in (net) foreign indebtedness. In the nontradables market, if nominal prices are rigid, the required relative price realignment will not take place, and unemployment will result.

The restoration of real exchange rate equilibrium can be greatly aided by policies, such as nominal devaluations, that help the domestic price of tradables to adjust. In terms of the real exchange rate definition, ($RER = P_T/P_N$), these policies are aimed at generating a higher RER via an increase in P_T ($= EP_T^*$). This contrasts with the disinflation automatic adjustment approach whose aim is to generate the complete return of the RER to equilibrium via its effect on P_N . Once again, in terms of Figure 3.2, a nominal devaluation taken at point Q' will allow the system to jump to S , rather than continue to move along the saddle path.

In theory, and under the most common conditions, nominal devaluations will affect an economy via three main channels. First, a devaluation will have an expenditure reducing effect. To the extent that as a result of the devaluation the domestic price level goes up, there will be a negative wealth effect that will reduce the real value of domestic currency denominated nominal assets, including domestic money. In terms of our model this expenditure reduction effect of a devaluation is manifested via the reduction in real domestic money m and real assets a . A lower value of real assets (a) will reduce expenditure on all goods. Second, a nominal devaluation will tend to have an expenditure switching effect. If the nominal devaluation succeeds in altering the real exchange rate there will be a substitution in expenditure away from tradables, and a substitution in production towards tradables. In the model of Section 3.3 it is clear that a higher e will result in higher Q_T and lower C_T . The opposite will

happen to nontradable goods. The combination of the expenditure reducing and expenditure switching effects will, of course, result in an improved external situation for the country. While the expenditure switching effect results in an increased demand for nontradables, the expenditure reducing effect generates a decline in demand for those goods. Depending on which of these effects dominate there will be an increase or a decline for the demand for domestic home goods. Third, a devaluation will result in an increase in the domestic currency price of imported intermediate inputs. This will result in an upward shift of the supply schedules for the final goods including nontradables.¹⁶

An important characteristic of nominal devaluation is that, under unified nominal exchange rates and with no quantitative restrictions, it is not discriminatory, and increases the domestic price of all tradable goods, services, and assets. This, however, will not be the case if there is a parallel (or dual) market, with some commercial transactions subject to the free rate, and the devaluation refers to the official rate only. In this case, only those transactions affected by the official rate will be directly affected by the devaluation. Of course, since the parallel (or free) market will be affected by the devaluation, transactions conducted in that market will be subject to an indirect effect. Notice, however, that in general it is not possible to know a priori whether a devaluation of the official rate will increase or reduce the parallel market premium. Naturally, with parallel markets there will be additional relative price changes, with the price of transactions subject to the official rate changing relative to those subject to the parallel rate.

Whether a nominal devaluation will be successful in accomplishing these objectives will depend on: (a) accompanying policies implemented alongside

with the devaluation, and (b) on the initial conditions prevailing prior to the devaluation. If the country implements a devaluation at a time when the real exchange rate is greatly misaligned (i.e., overvalued) the nominal devaluation will generally be helpful to restore equilibrium in the external sector. Under these starting conditions a nominal devaluation, if accompanied by the appropriate macropolicies, will generally have a medium to long run positive effect on the real exchange rate. In practice what the nominal devaluation will do is help the country follow a smoother transition path toward reestablishing equilibrium in the external sector. If the initial condition of real exchange rate misalignment has been generated by unsustainable macroeconomic policies, a discrete once-and-for-all devaluation will only have a lasting effect on the real rate if at the same time as the devaluation the unsustainable policies are corrected. If, however, the initial condition is one of equilibrium -- that is, the actual real exchange rate does not diverge from its long run equilibrium level -- a nominal devaluation will have no medium or long run effect. Very quickly after the nominal devaluation has been implemented, the price of nontradables will increase and the real exchange rate will not be affected. It should be noticed, however, that devaluations -- and in particular those devaluations that succeed in generating a RER change -- can have severe fiscal effects by hiking the domestic currency costs of servicing the foreign debt. This was, in fact, an important source of fiscal pressures in Latin America during the 1980s (Edwards 1988-).

Import Tariffs and Export Subsidies as Alternatives to Devaluations

Many times policymakers are confronted with the question of whether the simultaneous imposition of import tariffs and export subsidies (of the same rate) will replicate the effects of a devaluation. The answer is that the

tariffs cum subsidies policy will only replicate some of the effects of a devaluation. Import tariffs will result in an increase in the domestic price of the importable goods; export subsidies will likewise result in an increase of the domestic price of the exportable goods. As long as both the tariffs and the subsidies are of the same rate the relative price between importables and exportables (the tradables) will not be affected, but their relative price with respect to nontradables will increase. In this way, thus, the domestic relative price of tradables as a group will increase, which is indeed what will happen in the case of a successful devaluation. In that respect, then, both policies are equivalent.

There are however a number of other important respects in which these two policies differ quite sharply. First, while a devaluation affects both visible and invisible trade, (i.e., trade on goods and services), the tariff cum subsidies policy affects only visible trade. Consequently the relative price between goods and international traded services is altered in the case of the tariffs cum subsidies policy, but not in the case of a devaluation. Second, a devaluation affects the domestic currency price of both tradable goods and tradable assets. A tariff cum subsidies policy, on the other hand, affects only the domestic price of tradable goods and services. Third, under some circumstances devaluations may affect the level of the domestic interest rate. This will happen as long as a devaluation generates expectations of further devaluations. In this case, as pointed out in Edwards (1985b), some fraction of the expected devaluation will be passed on to the domestic interest rate, even if the capital account of the economy in question is partially closed. On the other hand the tariffs cum subsidies policy will not have this type of effect on the domestic interest rate. Fourth, devaluations and tariffs cum subsidies policies will usually have

different fiscal effects. While, in general, devaluations will not have first order direct effects on the fiscal budget, the tariffs cum subsidies policy will generally result in fiscal imbalances. Finally (fifth), perhaps the most important differences between the devaluation and tariff cum subsidies policies are related to the political economy of these two strategies. Generally, the imposition of tariffs and export subsidies will generate important reactions from the affected interest groups which will seek an exemption to the application of this measure to their particular industry. As the history of many cases has shown, more often than not these interest groups partially succeed in getting exemption applied to their products. The argument used by the interest groups lobbyists are well known -- the good in question is a necessity, or vital to the geopolitical survival of the country.

3.6 Summary

In this chapter we have discussed the relation between macroeconomic policies, real exchange rates, the external sector and devaluation. Once monetary and fiscal sectors are introduced into the analysis it is possible to start talking about real exchange rate misalignment, or departures of the actual real rate from its long run equilibrium value. The discussion presented in this chapter has emphasized the causality that goes from inconsistent macro -- fiscal and monetary -- policies to real exchange rate misalignment and eventual balance of payments crises.

A perfect foresight model of an economy with a dual exchange rates regime was constructed to analyze formally the behavior of some key variables in the process leading to a balance of payments crisis. The model assumes that a fixed nominal rate is applied to commercial transactions

while a fully fluctuating rate applies to the financial sector. It was shown that even temporary inconsistent macropolicies may lead to a balance of payments crisis and devaluation of the rate for commercial transactions. The process leading to a devaluation is characterized by:

- (a) Real exchange rate overvaluation.
- (b) Loss of international reserves, and current account deficits,
- (c) Increasing spread between the commercial and free rate.

It was shown that nominal devaluations are only effective if accompanied by a reversal of the inconsistent macropolicies. It was shown that even if there is not a crisis (in the sense of a required abandonment of the peg) a nominal devaluation, if supplemented by the appropriate macropolicies, can greatly help the country regain equilibrium.

Although this model is highly stylized, it captures very neatly some of the more salient aspects of exchange rate and macroeconomic disequilibrium. This model and its complementary model developed in Chapter 2, will provide the general analytical framework used in much of the empirical analysis in Part 3 of this book.

Footnotes for Chapter 3

¹Although the model developed here complements that of Chapter 2, its purpose is to focus on aspects of the problem ignored in that chapter. For that reason in this chapter the real side has been simplified significantly.

²See also, Conolly and Taylor (1986). On speculative attacks see the work by Obstfeld (1986) and Flood and Garber (1984).

³Lizondo (1987a,b), Dornbusch (1986b), Kiguel and Lizondo (1987), and Edwards (1988) have developed similar models based on Calvo-Rodriguez.

⁴Since in this chapter as do not consider disturbances to the relative price of exportables to importables, it is highly convenient to aggregate these goods into tradables. See Edwards (1988-) for a version of the model with X, M and N.

⁵If we assume that the central bank has a well defined and stable demand for international reserves, R_0 can be considered as the desired long run level of official reserves. On the demand for reserves by the developing nations see Edwards (1983, 1985-). For a model somewhat similar to the one in this chapter that incorporates an explicit demand for reserves see Edwards and Montiel (1988).

⁶In Edwards (1988-) the implications of different real disturbances, including tariffs and terms of trade changes, are analyzed in detail.

⁷This assumes that the direct effect of the change dominates indirect effects.

⁸Instead of assuming an unanticipated increase in D we can think of a fully expected increase in D . In this case ρ will jump when the public anticipates the future increase of D . Then the system will move towards the northwest on a divergent path; the spread will continue to increase, and

reserves will begin to go down even before the shock. At the time when D actually goes up we will observe the jump in m . The free rate δ , and the spread however, will not jump at that time. The system will then move to the saddle path, and the more conventional adjustment will take place.

⁹This assumes that the central bank holds a sufficiently large stock of international reserves. If it does not a devaluation will have to take place. See below.

¹⁰The reason for this is that even without capital mobility a fully anticipated jump in δ will result in infinite capital gains. On this see any of the many papers on speculative attacks under perfect foresight.

¹¹There are some difficulties associated with the incorporation of interest rates and endogenous capital movements. Under most cases within this setting an expansive domestic credit policy will not result in a real exchange rate overvaluation. See, however, Calvo (1987).

¹²The effect of capital inflows on the real exchange rate has played a central role in recent interpretation of the experience of the Southern Cone countries with liberalization and stabilization during the late 1970s and early 1980s. See Edwards and Cox-Edwards (1987) and Corbo and deMelo (1987).

¹³See Lizondo (1987a,b) for such an analysis.

¹⁴Notice, however, that with imperfect competition or externalities the results may differ. See Bhagwati (1978) for a thorough discussion of devaluations in the presence of QRs.

¹⁵Recall the discussion in Section 3.3.

¹⁶The simple model of Section 3.3 doesn't have intermediate inputs. See, however, the model in Chapter 8.