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Volume Title: Financial Policies and the World Capital Market: The Problem of Latin American Countries

Volume Author/Editor: Pedro Aspe Armella, Rudiger Dornbusch, and Maurice Obstfeld, eds.

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-02996-4

Volume URL: http://www.nber.org/books/arme83-1

Publication Date: 1983

Chapter Title: Real versus Financial Openness under Alternative Exchange Rate Regimes

Chapter Author: Michael Bruno

Chapter URL: http://www.nber.org/chapters/c11190

Chapter pages in book: (p. 131 - 152)

6 Real versus Financial Openness under Alternative Exchange Rate Regimes

Michael Bruno

6.1 Introduction

The semi-industrialized economy to be discussed here mainly imports raw materials and capital goods and is past the stage of using quantitative restrictions for import substitution of consumer goods. Traditionally it depended mainly on primary exports and is now rapidly moving into industrial exports. While it may still have a multiple protective tariff system and thus be more "closed" in the real sense than some optimum degree of free trade might dictate, it will rely quite heavily on the use of the formal exchange rate system to handle current account problems.

The typical problem for such an economy, unless it happens to be an oil exporter, is how to manage its exchange rate and internal macropolicies over time in face of a large structural deficit, as part of its long-run trade and development strategy.

Under reasonable assumptions it will be an optimal strategy for this economy to borrow abroad to finance a large deficit in the early stages of industrialization and to use these funds to develop its exports, providing the internal rate of return lies above the marginal social cost of foreign borrowing. Subsequently it will pay back these loans as the economy approaches independence. In the course of the growth process the real effective exchange rate will usually be required to grow over time, and it should do so at a rate that equals the difference between the internal and external real rate of return to capital (see Bruno 1976). This statement must be modified in the case where relative technical progress in export—

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Helpful comments by Rudiger Dornbusch and other participants at the conference are gratefully acknowledged.

as compared to home—industries (or when the country's relative export price in world markets) is sufficiently high to make actual growth in the real exchange rate unnecessary. Even then it is usually the case that a real exchange rate level has to be maintained over time.

Governments, of course, seldom know how to solve optimality problems, nor do they know the path of long-run foreign credit availabilities with any certainty. More often than not, they have to live from hand to mouth. Yet the logic of theoretical constructs may still be followed in at least some respects. The marginal cost of foreign loans must not exceed the internal profitability of the resulting investment, and the tariff (or subsidy) inclusive real exchange rate must be related to the size of the allowable structural deficit. The main point is that there should be a clear long-run relationship between the ratio of present and future real exchange rates and between the internal and external real rates of interest. These simultaneously affect long-run borrowing, domestic savings and investment policies, as well as the real exchange rate as an allocative device.

Problems occur when short-term market prices do not give the "correct" long-run allocation signals for producers or consumers. Two major sources for such discrepancies may arise in the present context, both working in the same direction. The world financial market may temporarily register very low (or even negative) real rates of interest for short- and medium-run loans,[1] as it has done for some time in the 1970s and until very recently. The other, often more important, problem is that domestic stabilization policy, with its associated restrictive monetary policy, may cause the real marginal cost of domestic credit to rise considerably above the desired long-run rate. Either one of these or a combined opening up of the gap between the two interest rate signals will, in the absence of other intervention, cause substantial short-run capital inflows and a real appreciation of the exchange rate, depressing manufacturing exports and profits, an experience recently shared by a number of countries in Latin America[2] and elsewhere.

Prolonged periods of real exchange appreciation accompanying short-run capital inflow, when the long-run horizon dictates the converse, may not be harmful from the point of view of financial portfolio allocations. These are easily reversed at the cost of a phone call. They may, however, be costly in terms of irreversible production and investment decisions, which by nature have long gestation periods. This argument, of course,

1. The typical loan in the new post-1973 private capital market, even if taken for a long-run investment purpose, is basically short-run in nature, insofar as the interest rate has to be renegotiated at short-run intervals.

2. As noted in Díaz Alejandro's chapter in this volume (chapter 1), this problem was also relevant in the 1930s.

depends on some myopia in the expectation formation process of investors. Given the market imperfections in a typical semi-industrialized country, this is a reasonable assumption to make.

This type of conflict between short-term and long-term asset pricing also raises the question of financial openness, as distinct from real openness of a country. Real openness relates to the degree of substitutability of goods across borders and the efficiency advantages to be reaped from reducing intervention in the free flow of real trade. Financial openness has to do with the substitutability of foreign and domestic financial assets and the extent of interference with free capital mobility. Since the exchange rate enters the pricing of both tradable assets and tradable goods, conflicts of price signaling may occur when financial openness is pursued along with real openness.

We shall assume here that the problem of relating long-term borrowing (and investment) to the development strategy has somehow been taken care of, and we may, for our purposes, consider the long-run capital imports as largely determined outside the present framework. This leaves the question of openness toward the world financial market for short-run capital movements. Also, how does financial, as distinct from real, openness relate to the operation of the economy under alternative exchange rate regimes?

After laying out a simple analytical framework (section 6.2), we shall consider the main alternative exchange rate regimes and their bearing on macroeconomic management in the light of the extent of real and financial openness of the country. The regimes to be considered are a fixed peg, with or without a "crawling" commercial policy; the crawling peg; and the managed float (sections 6.3–6.5). This being a conference on the capital market, we shall emphasize the implications of different degrees of capital mobility under these regimes.

There is a separate question of how the extent of real and financial openness restricts or enhances domestic stabilization policy. Thus for brief transition periods it may pay to use the exchange rate as a price-stabilizing device, even at the cost of "wrong" long-term signaling. The last section (6.6) considers the two-way relationship of exchange rate adjustment and the inflationary process. Should the exchange rate always accommodate to the inflation rate (or overtake it), or can it sometimes be used in the opposite direction to moderate an excessive rate of inflation?

While this and other problems seem to be a hot subject of debate in the Latin American scene, I do not pretend to know enough about the empirical background of these countries to go into analysis of actual examples. This discussion has partly been inspired by the experiences of my own country (see also Bruno and Sussman 1979, 1980) which we hope may also be relevant to a wider set of countries.

6.2 Analytical Framework

We can represent the general equilibrium of the economy in a diagram in which the real exchange rate ($q = e/p$) and real money balances ($m = M/p$) appear on the two axes.[3] We shall consider the commodity market, asset supply and demand, and the balance of payments.

6.2.1 Commodities

Suppose the economy produces a composite good (Q), priced p, which is an imperfect substitute for a world export good priced abroad at $p^* = 1$. Exports will be a positive function of their relative prices, $q(1 + t_x)$, where $q(= p^*e/p)$ is the real exchange rate, and t_x is a possible export subsidy. Imports (N) in this economy are assumed to be an input into the productive system, together with labour (L), and capital (K), that is, we have $Q = Q(L, N, K)$. The short-run supply function is given by $Q^s [w, q(1 + t_n)p_n^*; K]$, where w is the real wage ($= W/p$), t_n is a tariff rate, and p_n^* is the relative world price of the import. Domestic absorption depends on real income, the real money supply ($m = M/p$), expected inflation (π),[4] and a fiscal impact variable (g).

Under the usual assumptions, we can represent the excess demands for goods in the form:

$$(1) \qquad Q^d - Q^s = f_1(\underset{+}{q}, \underset{+}{m}; \underset{+}{U_1}),$$

where U_1 stands for a vector of various exogenous shift factors ($g, w, \pi, t_x, t_n, -K$).[5]

The downward-sloped curve QQ in figure 6.1 gives the combinations of real exchange rate and real balances that keep the commodity market in equilibrium ($Q^d = Q^s$). It will shift inward with an increase in the government deficit (g), the real wage (w), expected inflation (π), or any of the other factors listed under U_1. Above the curve there is excess demand, and prices will tend to increase; below it there is excess supply, and prices may or may not decrease depending on price stickiness. Since the price level appears in the denominator of both variables on the axes, the movement of prices in this diagram will always take place along a 45° vector, toward the QQ curve.

3. At a later stage we shall put total real banking credit, instead of m, on the axis, see section 6.5.

4. The variables m and π enter firm asset market equilibrium (see below).

5. In this formulation we implicitly assume some real wage (w) rigidity, in which case the labor market need not clear. In a fully flexible wage case, one should include $-\bar{L}$ as the alternative parameter in U_1, assuming full employment. The basic form of equation (1) would remain the same. The negative sign placed on K makes the vector U_1 consist only of positive shift factors.

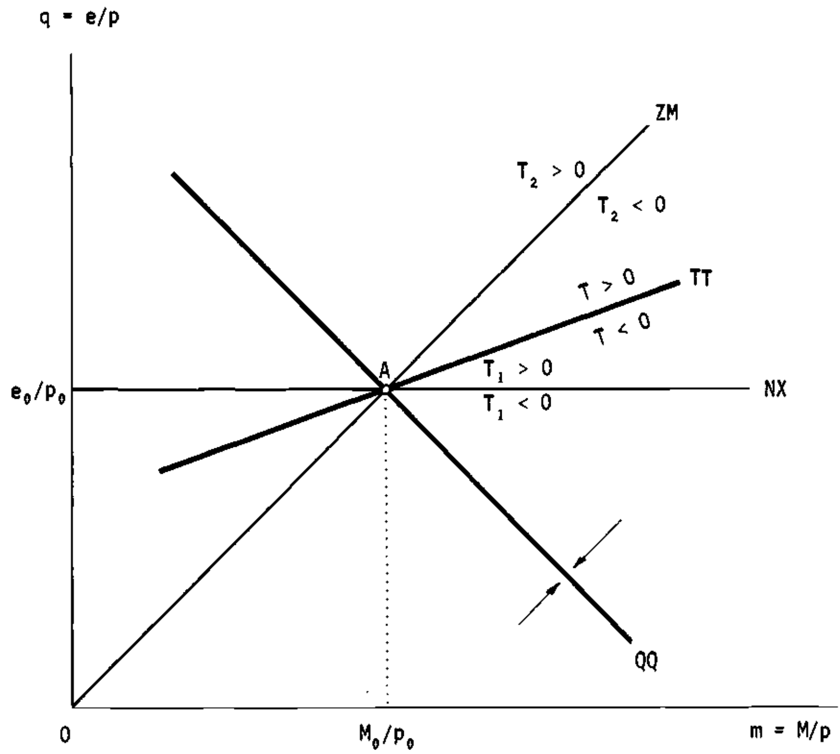

Fig. 6.1

6.2.2 The Basic Balance

The basic balance (T_1) will here be defined as the difference between exports and current import requirements plus exogenously given long-run capital flows (F).

The reason for distinguishing between current import requirements and what are normally registered as imports is to separate out the hoarding element in imports and add it to the capital account. Thus, import inventory movements will be a form of savings (in addition to being part of investment). The idea of separating out part of capital imports as receipts in the current account is meant to distinguish between long-run transfers and loans, which are usually handled and determined centrally by governments and will not affect private sector wealth directly, and short-term capital flows (and changes in exchange reserves), which are the only ones to be considered endogenous here. For simplicity, we assume F to include foreign investment and to be defined net of interest payments on the outstanding debt.

We can now write

$$T_1 = T_1(\underset{+}{q}, \underset{+}{U_2}), \tag{2}$$

where U_2 is another vector of exogenous shift factors (F, t_x, t_n).[6]

Current account balance is represented by the horizontal line in figure 6.1, at a given real exchange rate $q_0 = e_0/p_0$. Below the line there is a deficit in the basic balance ($T_1 < 0$), above it there is a surplus ($T_1 > 0$). The adjustment when out of balance depends on the total balance of payments position and the exchange rate regime of which discussion is deferred for the moment. The NX line shifts up with a fall in F or an overall reduction in import tariffs and export subsidies.[7]

6.2.3 Money and Other Assets

There are three kinds of privately held assets in the system in addition to the capital stock: government bonds (B_g) carrying a nominal interest rate i, domestic money (M), and a foreign currency denominated asset (Z). The latter could, in principle, include paper money, an interest-bearing asset (net of debt and carrying an interest rate i^*), or inventories of imported goods. For simplicity, we shall ignore the foreign interest rate and only take into account the expected rate of devaluation (ϵ).

Money demand (M^d) is a negative function of the nominal rate of interest (i) and is proportional to gross output (Q). The money market is in equilibrium with given money supply (M).

$$M^d/p = \lambda(\underset{-}{i})Q = M/p. \tag{3}$$

For high rates of expected inflation, π may be substituted for i in (3). As is usually assumed, only domestic residents holds M, while both domestic and foreign residents may hold Z. The relative demand for the foreign asset (Z^d) is assumed to take the following simple form (see Miles 1978; Calvo and Rodriguez 1977):

$$eZ^d/M^d = qZ^d/m^d = k(\underset{+}{\epsilon}), \tag{4}$$

where $q = e/p$ as before, and ϵ is the expected rate of depreciation.[8] The more elastic k, the closer substitutes are M and Z.

6. For simplicity we ignore the need to modify (2) when the commodity market is not balanced. Actually the NX line should have a kink at the point of intersection with QQ. When $Q^d < Q^s$, imports are a function of Q^d which in turn depends positively on m.

7. When we are in a multiple-tariff world, this need no longer be the case. Sometimes a tariff-cutting process may actually *improve* the current account. Even the case schematically given here, where there may be a common tariff on imports which is different from the export subsidy, could lead to this result.

8. The demand for government bonds (B_g) is not specified separately since it can be derived as a residual once total asset demand (supply) is given. If the latter is denoted by a, we get from (3) and (4) that the demand for real bonds (b^d) is: $b^d = a - \lambda(i)\ Q[1 + k(\epsilon)]$.

If total short-term foreign exchange assets held in the economy are B and central bank foreign exchange reserves are A, actual private assets (Z) will always equal the difference $Z = B - A$. B may change only as a result of an imbalance in the basic account as defined above, thus it will be assumed to be given at any moment of time. Foreign exchange reserves (A) may or may not be determined by the central bank, depending on the foreign exchange regime (see below).

If both the markets for M and Z are in balance, equation (4) can be turned into an asset market equilibrium relationship: $q = mk(\epsilon)/(B - A)$. This is represented by the line ZM in figure 6.1. To allow for different degrees of financial openness, we assume that the *actual* change in the privately held foreign exchange asset (ΔZ) is proportional to the *desired* change $Z^d - Z_0$ from any initial level, $Z_0 = B_0 - A_0$, while the money market (3) equilibrates. (This assumes that the bond market adjusts more slowly.)

(5) $$\Delta Z = \beta[k(\epsilon)m/q - (B_0 - A_0)],$$

where $\beta \geq 0$.

The relationship between asset formation and the balance of payments is taken up next.

6.2.4 The Balance of Payments

The balance of payments consists of the sum of the basic balance (T_1) and the short-run capital account (T_2), which in turn equals the net sale of private foreign exchange assets ($-\Delta Z$). The overall balance of payments surplus ($T = T_1 + T_2$) must equal the net accumulation of bank reserves (ΔA). We can thus write:

(6) $$T = T_1(q) + \beta[B_0 - A_0 - k(\epsilon)m/q] = T(\underset{+}{q}, \underset{-}{m}; U_3) = \Delta A,$$

where U_3 includes all the shift variables appearing in U_2 as well as $(B_0 - A_0, -\epsilon)$.

The line ZM in figure 6.1 represents the short-run capital account balance ($T_2 = 0$). Its slope is $k(\epsilon)/(B_0 - A_0)$. Above it $T_2 > 0$ and below it $T_2 < 0$. The curve TT which represents the overall balance ($T = 0$) must lie between the lines NX and ZM. Below it $T < 0$ and above it $T > 0$.

This two-part graphical representation of the balance of payments, which was inspired by Frenkel and Rodriguez (1980), is also useful for considering different degrees of capital mobility.[9] A very low level of β (relatively flat TT curve) would correspond to the case of rather effective

9. We differ from their presentation in using the pair of real variables (q, m) on the axes rather than the nominal e and p and in having T_1 separate from the goods market. The capital flow term in their paper is written directly as a function of the interest differential $[i - (i^* + \epsilon)]$. There is some advantage in relating the capital flow to the underlying asset behavior.

exchange controls. In the extreme case ($\beta = 0$), only the current account matters. The other polar extreme ($\beta = \infty$) is the one in which only asset behavior ($T_2 = 0$) matters. There is instantaneous adjustment of Z to Z^d (as in Dornbusch 1976).

6.2.5 The Banking Balance Sheet

We end this preliminary description by stating the basic balance-sheet restriction of the banking system, within which monetary policy operates. Denoting central bank credit to the government by C_g, to the private sector by C_c, and private banking credit to the private sector by C_p we have:

$$M = eA + C_g + C_c + C_p. \tag{7}$$

For subsequent reference we also note that by adding the net foreign exchange asset eZ to the left-hand side of (7) and remembering that $A + Z = B$, we get another constraint on the sum of the two assets:[10]

$$M + eZ = eB + C, \tag{8}$$

where $C = C_g + C_c + C_p$ is total bank credit.

6.3 Operating a Fixed Peg under Limited Capital Mobility

We first consider the process of large-step adjustment of the exchange rate in response to shifts in the basic balance under a pegged exchange rate regime. An important issue in the present context is the limitation imposed by the role of expectations of exchange rate change and of short-run capital movements even when the economy is relatively (though not absolutely) closed to financial capital movements. These pose considerable short-term stabilization problems, especially for monetary policy. Let us discuss these problems and possible remedies.

Consider a fixed exchange rate economy with initial equilibrium at a nominal exchange rate e_0, quantity of money M_0, and price level p_0 (see fig. 6.2). Commodity market equilibrium is given by the curve QQ, the basic balance is given by NX. There is limited capital mobility (low β), so that the balance of payments equilibrium is given by the line TT whose slope is assumed to be between 0 and 1. Given are low expectations of exchange rate change ($\epsilon = \epsilon_0$, which may be zero). Suppose now that for some reason there is a shift in the basic balance (NX shifts up) which may be caused by a long-term fall in lending (F). A real devaluation from q_0 to q_1 is called for. For simplicity, assume that the change is confined to the

10. If B is added on the left-hand side, we get total financial assets ($M + eZ + B_g$) as financed from the three major sources: the basic balance (eB), the government deficit ($C_g + B_g$), and the banking system's finance to the private sector ($C_c + C_p$).

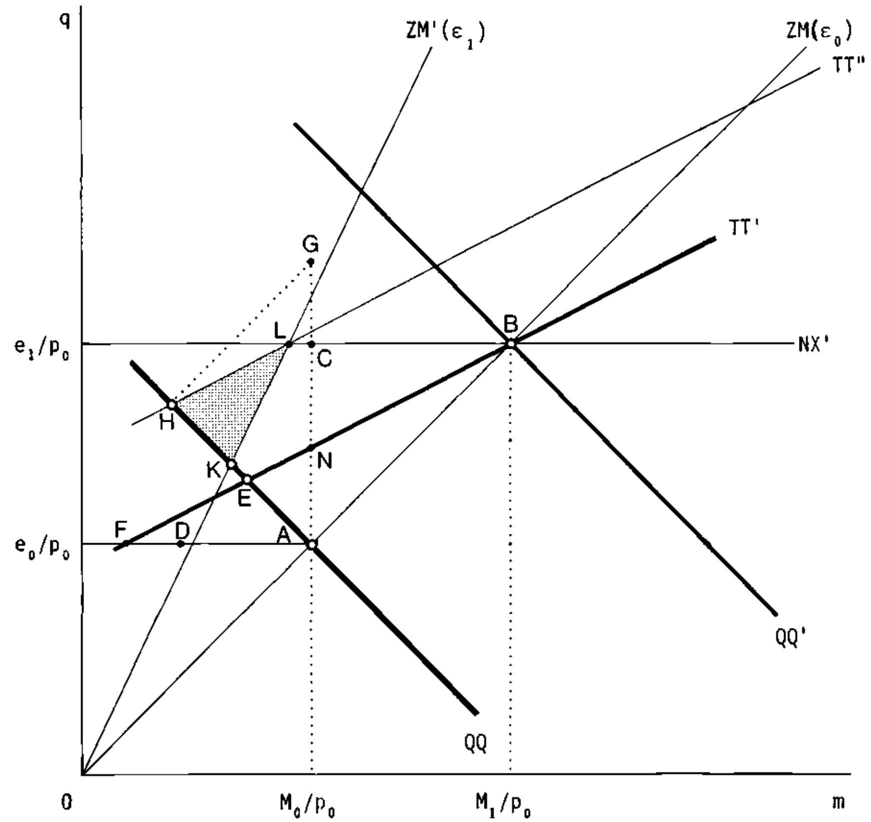

Fig. 6.2

current account and QQ is not immediately affected.[11] A possible new equilibrium for the economy would be at point B which is given at the intersection of NX' and the old ZM line, assuming that after the change its slope $k(\epsilon_0)/(B - A)$ and Z remain the same. A set of policies that might bring this about could be a combination of a nominal devaluation to e_1, fiscal and income restraint, a reduction in g or w (shifting QQ to QQ'), plus an increase in M to M_1 so that $M_1/M_0 = e_1/e_0$. Unless prices are downward rigid, the same real movement in M/p and e/p could also be achieved by a fall in p, keeping M constant ($= M_0$), coupled with a smaller nominal devaluation. We are less interested in the exact final

11. An exactly analogous situation would be created by an inflationary shift in the commodity market. Suppose we start at B on QQ' and NX' and for some reason (e.g., an increase in the budget deficit or in the real wage) QQ' shifts inward to QQ. Assuming the line AB to be on a 45° vector, inflation will move the economy back to equilibrium at A. From here on the analysis is the same.

outcome than in the dynamic sequence of events that may typically occur once the need for a step devaluation is signaled.

It is in the nature of a fixed exchange rate regime that a considerable lag exists between the first signal of a required change in e and the actual act of a devaluation, let alone the implementation of the internal demand restrictions that have to accompany it. The moment TT shifts toward TT' and foreign exchange reserves start falling ($\Delta A < 0$), two processes may be set in motion, one having to do with expectations, the other with fluctuations in the money base. As expectations of a devaluation rise ($\epsilon_1 > \epsilon_0$), there is import hoarding and delayed repatriation of export proceeds. The asset equilibrium curve rotates upward to ZM', say, with the balance of payments equilibrium line shifting to TT''. The result is a more intensive fall in reserves than would otherwise take place, signaling a larger devaluation than may objectively be required.

This can be illustrated as follows: given the expectation of a devaluation, a new temporary equilibrium could take place at point H. One way of exactly reaching H could be a nominal devaluation from A to G, keeping M constant, followed by a price increase (because of an inflationary gap in the goods market) which is represented by an inward move along a 45° vector from G to H. Whether the real exchange rate is above or below the level balancing the new basic account (NX') depends on the extent of the excessive, expectations-induced shift of TT'' which, in turn, depends on the asset-demand response to expectations change ($\partial k/\partial \epsilon$) and the effectiveness of foreign exchange control (β). Once a devaluation has taken place, expectations will stabilize again (at ϵ_0, or some lower number). Suppose ZM returns to its previous position and balance of payments equilibrium is represented by TT'. At point H, for example, there is now a surplus with renewed capital inflow (repatriation of export proceeds, dishoarding of import inventories, etc.) which more than compensates for the remaining basic deficit, and reserves will start rising again.

So far we have ignored changes in nominal money which can be assumed away only if there is central bank sterilization of the fluctuations in exchange reserves.[12] This brings us to the second dynamic process which may take place simultaneously with the one previously described. Let us go back to point A when foreign exchange reserves start falling. Unless sterilized, there will be a fall in M which in figure 6.2 would show as a horizontal leftward move from A toward D. Excess supply and unemployment develop unless prices (and wages) are downward flexible. Again, a possible move under price flexibility would be a fall in M by the amount DA and a reduction of prices along a 45° vector from D to E. If

12. Equilibrium at H or at E here implies a fall in real balances from M_0/p_0 to M_0/p_1 through a price rise.

expectations of a devaluation are kept at zero, the balance of payments would have reached temporary equilibrium at E without a devaluation but through a monetary squeeze and a forced deflation.

If prices are inflexible, the monetary contraction and the deepening slump could in principle continue until an unemployment equilibrium is reached at F.[13] It is the capital flows in response to the interest rate gap[14] that will finance the basic deficit. Obviously, this is neither a sustainable nor a socially desirable equilibrium. What usually happens is that the internal pressure on the monetary authorities makes for monetary expansion to counterbalance the loss of reserves.

The counterpart of this phenomenon, after an excessive devaluation, is the reverse upward pressure on the money supply coming from the renewed capital inflow and the rising reserves. Suppose we are temporarily at H when the balance of payments equilibrium is given by TT'. Lack of monetary restraint (and legitimate pressure on the part of sectors hurt by the real credit squeeze) will cause M to rise. In terms of figure 6.2, there will be a movement along a horizontal line from H toward TT'. At the same time inflationary pressure develops causing a rise in prices (move back toward QQ).

The large swings in short-run capital movements and in the money before and after large devaluations are hard to contain even under exchange controls and constitute one of their main drawbacks (see Bruno and Sussman 1979 for an account of the Israeli experience). The pressure to keep real money and credit high (e.g., for investment) may cause a continued inflationary process driving down the real exchange rate to a renewed balance of payments deficit, unless the devaluation is coupled with the appropriate measures that will shift QQ outward.[15]

If exchange controls are tight ($\beta = 0$) and the original level of real balances is desired, an equilibrium devaluation could be reached at C providing there is a sufficient accompanying budget cut to move the QQ line through that point. If controls are not tight and there are capital flows, temporary equilibrium could be reached at N, say, with a smaller budget cut and smaller real devaluation. This, however, can only be temporary since the current account deficit will gradually erode foreign exchange assets and require further cuts in the budget deficit, and an additional increase in e/p to make room for the expanded production of tradable goods, as TT' gradually shifts up. Only a larger budget cut to

13. Strictly speaking, equilibrium will probably take place at a point right of F (since now $Q = Q^d < Q^s$).

14. This may sometimes take the form of active government encouragement to firms to take foreign credit, which is expensive from a social point of view but is relatively cheap given the prevailing higher domestic interest rates.

15. The analysis was conducted with a given commodity market curve. When QQ shifts inward due to a rise in inflationary expectations or in real wages, these problems are clearly accentuated.

QQ' (and/or a larger drop in the real wage, coupled with a rise in m and q) can keep all markets in new, current-account equilibrium at point B.

The main problems that arise in the operation of a fixed peg which is adjusted in large jumps thus center around the sizable accompanying fluctuations in real reserves and in the money supply and the large one-time adjustments required in other expenditure items. The latter are unavoidable under any exchange rate regime, since a real resource transfer will always be required (unless there is a slack in the system which can be diverted to the tradable goods sector). On the other hand, the monetary upheavals and the real loss of reserves could in principle be delayed if the real exchange rate corrections are confined to the current account. Short of moving to a regime of small-step adjustment in the formal rate, one may operate the fixed formal peg on capital account transactions while correcting the real effective exchange rate in smaller steps through adjustments in commercial policy.

Consider the case in which we have a pure dual rate on the two accounts—a uniform tariff (t_n) on imports and a subsidy of the same rate ($t_x = t_n$) on exports. When F falls, as in the above discussion, one could in principle increase t_n and t_x to keep the NX line in place, while manipulating the budget to compensate for the loss in revenue (when the balance is in deficit). In that case the economy may stay in equilibrium at A while at the same time reducing the basic deficit.

Countries hardly ever operate a uniform tariff rate on imports. However, a close substitute for the above idea is a flat export subsidy based on value added. Israel had operated such a system quite successfully through the 1960s and part of the 1970s. Large devaluations would take place only once every few years and in between the rate of export subsidy (and sometimes also the tariff rate on imports) would be adjusted upward gradually. The problem with such a system is usually two-fold. One problem is that it tends to get abused once the subsidy rate reaches high levels. There is considerable incentive to cheat in the calculation of value added which leads to trade distortions and the like. The other difficulty is that such measures usually meet with strong disapproval of the international agencies (e.g., GATT and IMF). It can be claimed that when used in small measure and with some prudence such a system may nonetheless have its merits. The alternatives, as we shall see, have their drawbacks too.

6.4 The Pros and Cons of a Crawling Peg

We now keep the assumption of a formal peg but assume that the adjustments are made in very small steps and at frequent intervals.[16]

16. In the Israeli case the crawling peg was operated for two years, between June 1975 and October 1977, and at first followed rather rigid rules but then became quite flexible in terms of size of change and allowed frequency of adjustment (see Bruno and Sussman 1980).

The advantage of a crawling peg over the previous regime lies in the two areas where the large-step adjustment regime is weakest. It usually avoids the political and social taboo attached to an act of currency depreciation and shifts the exchange rate adjustments from the front pages of the newspapers to back-page financial columns. The major exchange reserve crises and monetary upheavals may be avoided.

One by-product of the crawling peg is that no major political decisions or restrictive internal policies have to be taken at each step. This apparent advantage of minidevaluations sometimes may also be, paradoxically, a source of major weakness. In a government-deficit and inflation-prone economy the operation of the exchange rate is delegated to a ministerial or bank committee without the accompanying continuous urge for small-step fiscal and income policy discipline.[17] The fact that devaluations now take on a more continuous form make for built-in inflationary expectations ($i \simeq \pi = \epsilon = \dot{e}/e$), thus exacerbating inflationary pressures.

Under a crawling peg, especially if it is predetermined, the capital account curve no longer fluctuates. Suppose expectations are fixed at ϵ_1 and the relevant asset demand curve is ZM' in figure 6.2, with equilibrium momentarily at K. Say a small-step adjustment to a new balance of payments curve TT'' is required. The small triangle marked by the points K, L, and H marks the policy trade-offs. If fiscal policy can be used along with a minidevaluation, we may move from K to L or at least refrain from getting a fall in real balances (i.e., maintain real credit levels). If fiscal or real wage restraint cannot take place, real money balances will have to fall as we move from K to H, by a cut in nominal money, by inflation, or by both. One of the problems of the crawling peg is the continuous built-in pressure for monetary restraint to keep domestic interest rates high relative to ($i^* + \epsilon$). To illustrate, at point K on ZM', m has to be lower than at N or at B.

6.5 High Capital Mobility and Flexible Rates

So far we have considered regimes in which the authorities directly peg the exchange rate, in which case the balance of payments need not be in momentary equilibrium and foreign exchange reserves are the short-run buffer. In section 6.1 we posed the problem of conflicting long-term and short-term price signaling. This may occur in a situation of relatively high capital mobility and exchange rate flexibility, to which we now turn. Consider the case in which the exchange rate automatically adjusts to equilibrate the exchange market. It helps to discuss first the case of a flexible rate under perfect asset mobility ($\beta = 0$) and no intervention ($\Delta A = 0$).

17. E.g., it may be easier to convince the trade unions of the need to forego one step in the indexation mechanism in a national crisis situation than to reduce indexation on a continuous basis.

In an inflationary situation and when the foreign asset is highly liquid [$k(\epsilon)$ is elastic], it may sometimes be advantageous to use total bank credit ($C = C_g + C_c + C_p$) rather than M as the financial instrument. The commodity market equilibrium curve QQ can be expressed in terms of $c = C/p$ (instead of m) and e/p, keeping all other properties as before (see fig. 6.3). The asset curve can be transformed by substituting from equation (8) into (4) and writing $Z^d = B - A$ to get:

$$e/p = \frac{k(\epsilon)}{\beta - [1 + k(\epsilon)]A} C/p . \qquad (9)$$

Equation (9) is represented by the curve ZC in figure 6.3 which has analogous properties to the curve ZM. It is a ray through the origin whose slope increases with ϵ and A and falls with B. Equilibrium takes place at the intersection of the asset market line (ZC) and the commodity market QQ (point A). In case of a disturbance, the exchange rate immediately adjusts to equilibrate the asset market first. Consider, as before, the case

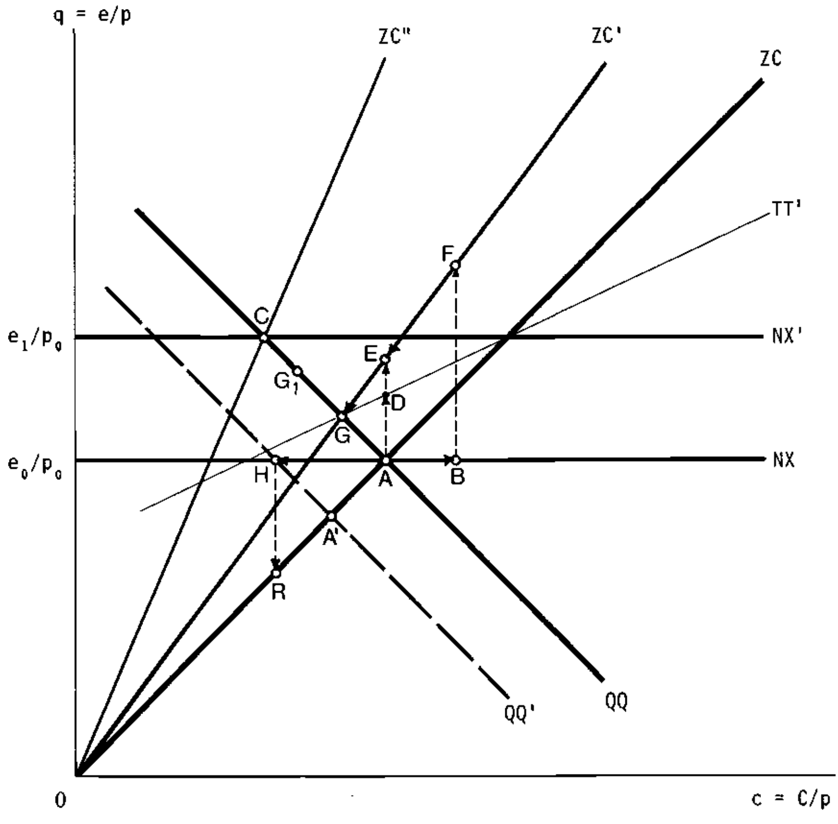

Fig. 6.3

in which there is an increase in the basic deficit (NX to NX') and, for simplicity, assume first that there is no change in the commodity market. The only channel by which this may have an effect on the economy is the asset market, through a possible impact effect on expectations (ϵ) and a long-run effect on the total supply of foreign exchange assets (B). Suppose there is a one-time effect on ϵ rotating ZC to ZC'. The nominal (and real) exchange rate will overshoot to point E and may quickly be eroded by inflation with real appreciation moving the economy from E to G along line ZC'. At point G the balance of payments is in short-run equilibrium, but there is a sustained basic deficit. This may disappear over time only gradually as B falls and the ZC curve continues to rotate upward. Final equilibrium will take place only when the asset equilibrium line and the commodity market line intersect at the new basic balance equilibrium (see point C). The story is only slightly modified if we consider that the disturbance that has shifted the basic balance (NX) also shifts the commodity market (e.g., shift of QQ to $Q'Q'$ as would happen in the case of an increase in import prices).

There are some clear drawbacks to this automatic adjustment process. One is that in the first stage there may be an excessive price increase with no real benefits to the current account. This is only one example of the "overshooting" tendency of an exchange regime in which the asset market takes a major role in the short-run determination of the exchange rate (cf. Dornbusch 1976, and the related literature). Similar effects characterize the case of unexpected domestic monetary changes. For example, a monetary expansion from A to B raises expectations of a depreciation, causes a jump of the exchange rate to point F on ZC', say, followed by inflation (more from F to G). The case of monetary contraction, from A to H, which may be needed to correct a commodity market imbalance (at QQ') leads to an appreciation (point R) coupled with excessive unemployment, unless prices are downward flexible.

The main drawback of asset market determination in the present context, quite apart from overshooting, is that the process of adjustment to a new long-run situation may be much too slow. The real exchange rate that is signaled by the asset market (at point G, say) does not reflect the true long-run rate from the point of view of real resource allocation. Given the gestation lags of exports and of investment in export industries and the imperfections in the expectation formation mechanism, this would seem to be the major cost of allowing short-run capital movements to determine the exchange rate.

One way of avoiding this signaling problem is to impose a direct tax on capital imports as was done in a recent Israeli episode (see Liviatan 1980; Bruno and Sussman 1980). In figure 6.3 this can be shown by noting that the imposition of a tax (τ) on capital imports is the same as raising the expected cost of foreign borrowing and thus causing the asset market curve to rotate in the required direction (say, from ZC' to ZC''). This may not overcome the overshooting problem but may, at least, avoid overvaluation of the currency.[18] A managed float, which takes the form of intervention in the foreign exchange market, in principle works in the same direction. Purchase of foreign exchange by the central bank raises foreign exchange reserves (A) and also rotates ZC counterclockwise.

What happens when capital mobility is not perfect and we do not have instantaneous arbitrage? Overshooting will clearly be mitigated. Consider again the case in which the current account flows also play a role in the market. Suppose that with the projected increase in the basic deficit balance of payments equilibrium is represented by the curve TT' (shifted from TT and assuming no immediate change in expectations). Under a float the exchange rate jumps to D and then adjusts along TT' to G. Note that there is less overshooting (and less inflation) in this case. If we now also assume a shift in expectations, the new equilibrium will be at a higher point, G_1, on QQ. Obviously, the flatter the TT line, the more important the basic balance is in the determination of market signals and the closer a float will bring us to the long-run signal.

Does this analysis imply that it is always advantageous to control capital movements, that is, limit financial openness for the sake of real openness? One should be careful not to jump to hasty conclusions. If it were possible to draw an absolute distinction between short-run and long-run capital movements in practice, then such a conclusion could perhaps be justified. However, we should bear in mind that the way we have distinguished between capital movements in terms of exogenously determined long-run funds (F) and endogenous short-term capital is somewhat artificial. Excessive foreign exchange controls could also drive away legitimate long-run capital, which may thus affect the options for the real economy (i.e., shift the NX curve). The costs and benefits must be weighed against each other. In any case, the argument for financial closeness may often be confined to particular short-term situations.

6.6 Exchange Rate Adjustment and Inflation: Accommodation versus Moderation

The last issue to be discussed briefly is the relationship between exchange rate change and inflation. This brings up the case in which short-run stabilization may take the lead over long-run objectives in exchange rate pricing. Specifically, should the rate of devaluation always be made to accommodate (or overtake) the inflation rate for the sake of

18. Note, however, that the imposition of a tax on capital imports has another negative by-product in the form of high domestic interest rates which may harm investment. The movement from A to C obviously involves a real credit squeeze which may be voluntary, through a fall in C, or involuntary, through inflation.

the long-run external balance? Or are there situations in which it pays to moderate exchange rate changes as a short-run stabilization device even at the cost of a real loss of reserves?

For simplicity, we shall conduct the discussion in terms of steady state rates of change, $\hat{p}$ and $\hat{e}$, and assume consistency of expectations, that is, $\pi = \hat{p}$ and $\epsilon = \hat{e}$.

One basic short-term relationship between the rates of inflation and depreciation in an open economy can be derived from the commodity and labor markets and represents the price-wage-price dynamic adjustment process. In reduced form this can be written as follows:

$$(10) \qquad \hat{p} = \pi_0 + \alpha\hat{e}.$$

The "path-through" coefficient α incorporates the role of the direct and indirect import coefficient as well as the implied wage-price linkages. The α is most likely to be less than one, providing we do not have 100 percent indexation. The intercept π_0 summarizes the role of excess demand factors in the commodity and labor markets as well as autonomous cost-push factors (world price of raw materials, indirect taxes on consumer goods, etc.).[19]

Equation (10) appears as the line *PP* in figure 6.4, with intercept π_0 on the π-axis and slope $\alpha < 1$. Given any rate of depreciation (ϵ), this curve gives the implied inflation rate that will be propagated by the real system given its underlying behavioral and institutional parameters. This inflation rate can in principle be lowered either by a reduction in the extent of linkage (α) or by fiscal and other stabilization measures, lowering π_0. In practice it is unlikely that the slope can be changed much (except momentarily under special circumstances), while the intercept of the *PP* line is more amenable to policy change.

Line *XX* in figure 6.4 represents the long-run depreciation that keeps the current account in balance. The intercept ϵ_0 (which may be zero or even negative) reflects the effect of the expected long-run reduction in capital flows net of autonomous time shifts in the basic balance (due to productivity growth, relative world price changes, etc.).[20]

A crawl that achieves steady state equilibrium under these assumptions is given at the rate ϵ_2, which is consistent with an inflation rate of π_2 (see point *A* in fig. 6.4). More restrictive internal policies (showing in a lower *PP'* curve) will allow a lower rate of depreciation, ϵ_1, with a correspondingly reduced inflation rate (cf. point *C* with *A*).

If there is a high degree of capital mobility in the system, the momen-

19. If we write $\hat{p} = \beta\hat{e} + (1 - \beta)\hat{W} + d$, $\hat{W} = \gamma\hat{p} + \ell$, we get $\hat{p} = \pi_0 + \alpha\hat{e}$, where $\alpha = \eta\beta$, $\pi_0 = \eta[d + (1 - \beta)\ell]$, and $\eta = [1 - (1 - \beta)\gamma]^{-1}$. $\alpha = 1$ if and only if $\gamma = 1$. This can also be expanded to incorporate real balance effects.

20. If we denote the autonomous time shift of T_1 by η_t and the elasticity of T_1 with respect to q by η_q, we can show that $\epsilon_0 = -(\hat{F} + \eta_t)/\eta_q$.

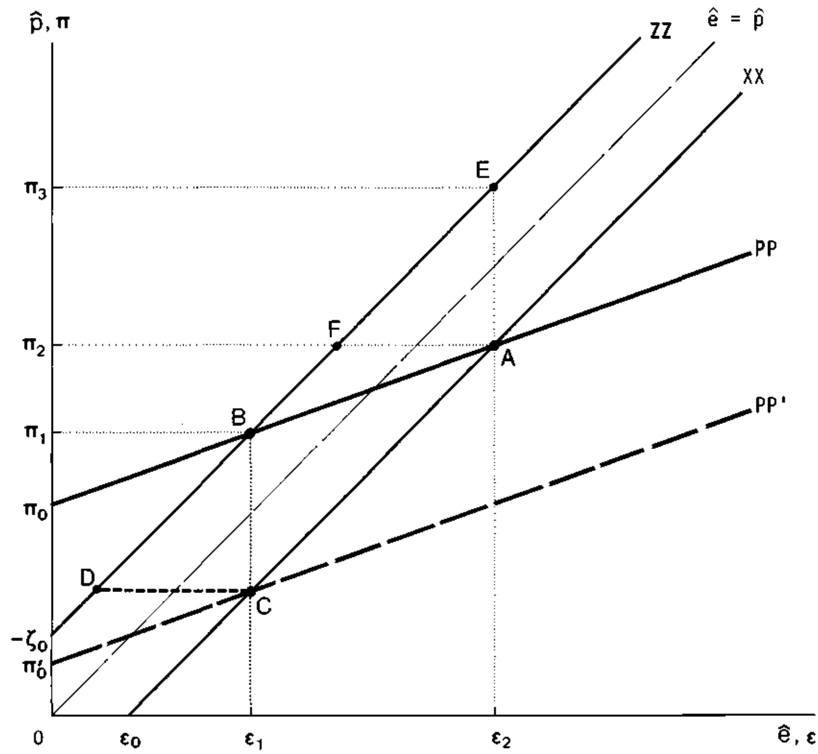

Fig. 6.4

tary equilibrium rate of inflation will not be given by the line XX, however, but rather by the combination of $\hat{e}$ and $\hat{p}$ that keep the asset market in balance over time (line ZZ in fig. 6.4).

This can be obtained by time differentiation of equation (9), leading to an asset equilibrium rate of real depreciation $\hat{e} - \hat{p} = \zeta_0$, where ζ_0 is a positive function of the rate of change of real credit ($\hat{c}$), central bank intervention in reserves (ΔA), and the rate of change of expectations ($\hat{\epsilon}$),[21] and depends negatively on the basic balance ($T_1 = \Delta B$).

In figure 6.4 the intercept of ZZ on the $\hat{p}$ axis measures $-\zeta_0$. If ZZ happens to coincide with line XX (ζ_0 is then positive), the system is in full steady state equilibrium at A. If ZZ lies to the left and above XX, however, there may be a difference between the rate of inflation that keeps the asset market in balance and that which is propagated by the real economy, at any given announced rate of depreciation (compare point E with A).[22] If left to itself, the fall in T_1 will gradually shift the ZZ curve

21. ΔA and $\hat{\epsilon}$ will be zero in equilibrium, but appear here since they can be used as policy instruments, along with $\hat{c}$.

22. One could argue that in this case the *expected* rate of inflation may be π_3 while the *actual* rate is π_2. If ϵ_2 is maintained and expectations play an important role, actual inflation may gradually rise above π_2 (Does this accord with developments during hyperinflation?).

down toward *XX*. Now suppose that the *ZZ* curve is deliberately shifted up to its position in figure 6.4 through a credit squeeze and by allowing reserves to fall ($-\Delta A > 0$). At the same time the authorities preannounce a lower rate of depreciation ($\epsilon_1 < \epsilon_2$). Equilibrium can now take place at a lower rate of inflation ($\pi_1 < \pi_2$ at point *B*), providing these steps are credible.[23] If the stabilization program also affects the real economy, π_0, is brought down to π_0' while the crawl and the expected inflation rate are further reduced (point *D*). At this stage the economy may be ready for renewed growth (raise $\hat{c}$, $\hat{\epsilon}$) and a shift to a new long-run rate of devaluation (ϵ_1) at *C*.

The sequence of steps *A–B–D–C* may be a more feasible one to achieve than an attempt at a direct move from *A* to *C*. The main difference is that one uses the exchange rate much more drastically as a stabilizing device (at *D*, ϵ is almost zero), but one pays the cost in terms of short-term debt (or loss of reserves). This is an example in which short-term capital flows are deliberately used as a stabilizing device at the expense of long-term signaling. The main problem in practice is the speed at which these adjustments can be made to be credible and the size of the real social cost in terms of transitional production and employment slowdown.

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23. Also, in line with note 22, inflation may for a time rise above π_2 before it eventually comes down to π_1.

Comment Peter M. Garber

In his paper, Michael Bruno constructs a framework for exploring the effects of various policy combinations on the dynamics of the real exchange rate, real interest rates, income, and elements of the balance of payments accounts. The focus of the study is to determine how such policy combinations may affect the reestablishment of an economy's long-term equilibrium after a disturbance in markets entering the current account balance. The discussion of policy choice is complicated because it considers a number of government objectives, many potential economic environments, and a large number of possible policy tools. Government objectives include a desire to maintain full employment, to allocate properly available capital among different investment projects, and to establish equilibrium in the balance of payments. The environment in which the economy operates may have either fixed or flexible prices and wages. Local capitalists may lack the ability or information to predict optimally the future course of the real interest rate dictated by the dynamics of the economy's path to a new equilibrium. More generally, expectations of other price changes may move sluggishly or they may display perfect foresight. Finally, the available policy tools are the use of commercial policy, the ability to impose exchange controls on short-term debt movements, control of domestic credit, fiscal policy, and the use of fixed versus flexible exchange rates.

Since many combinations of these objectives, policies, and environments are possible, the paper constructs an analytical framework of loci of equilibrium in the goods market, the current account, the short-term capital account, and the balance of payments. The framework is then used to gain a qualitative notion of the dynamics that may arise under alternative policies.

My comments are intended to suggest that these myriad scenarios can be unified by treating them as policies to be imposed by a government *conditional* on the behavior of some endogenous variables of interest to the government. Thus, the policies need not be treated as independent alternatives used to impose a single dynamic path on the economy. Rather, in line with the paper's emphasis on dynamics, they can be viewed as a sequence of policies which switch the economy's laws of motion from time to time as particular contingencies arise. That the government's policies may switch in the future will affect current prices and their dynamics if rational expectations or, as in this paper, perfect foresight is assumed. In this light, Bruno's paper can be interpreted as an exploration of the dynamics associated with a large number of "pure"

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policies; the next step is to weight these policies together to determine prices, using the probabilities that the contingencies on which they depend will materialize.

Of course, given the large number of possible policy combinations and contingency rules of thumb for their implementation, this is no easy task. The mere notion that there is one metapolicy which imposes policies according to given contingencies leads, as Sargent (1980) suggests, to the problem of the existence of free will. Aside from the philosophical problem, to study the system's dynamics, even with only a few markets and a few policy choices available, is a very large problem in differential or difference equations. Here I will simply point out a few examples of work that has been done to give a flavor of the potential of employing Bruno's results in this direction.

In the context of a fixed exchange rate model with a drain on a country's foreign reserve holdings, it is possible to foresee a run on a country's reserve which will either force a devaluation or a system of floating exchange rates. Bruno discusses this sort of situation in which the policy generating domestic credit may be incompatible with a viable fixed exchange rate system. Krugman (1979) and Flood and Garber (1981*b*) have shown how a foreseeable exchange market collapse will affect the dynamics of a country's exchange holdings. In these models the time of the end of a fixed exchange rate and a switch to a floating rate can be determined both by the agents in the economy and by the researcher.

Conversely, under certain contingencies a country may wish to switch from a floating exchange rate to a monetary policy which would fix the exchange rate, as in the British case in the 1920s. In Flood and Garber (1981*a*) the effects of such a regime switch on the current exchange rate and its dynamics are derived, together with a probability density function over the time of the switch.

Similarly, in the dual exchange rate system mentioned by Bruno in the context of using commercial policy, one can foresee situations in which the exchange rates will be unified. This affects the current values of the exchange rates in both the current and capital accounts, as demonstrated by Flood and Marion (1981).

The above papers deal with switches in the exchange rate regime. However, switches in other policies are possible. One of the major features of Bruno's paper is the explicit statement of short-term asset dynamics after exchange controls are imposed. Thus, we can envisage a foreseeable policy switch from a situation of perfect capital mobility ($\beta = \infty$) to a situation of exchange controls ($\beta < \infty$), with the switch imposing different laws of motion on the system. More concretely, suppose that the system is one of fixed exchange rates and that initially there are no controls. Also, the government has a rule which states that under some contingencies (e.g., too large a cumulative deficit in the balance of payments) a switch will be made to exchange controls. Finally, suppose that the process determining domestic credit is such that foreign reserve losses will eventually reach this limit. Then the knowledge that controls will be imposed will affect both the current deficit and the time that the limit is reached.

These examples all examine cases of a single policy switch. More complicated are cases in which various policies will be imposed in sequence. Alternatively, a given contingency may cause a random switch to a single policy from a set of possible alternatives. The tools used to study the above examples would be applicable to this more complex problem. While to my knowledge such multiple policy switches have not been extensively studied, the numerous scenarios studied by Bruno would fit naturally into such a framework.

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