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REAL VERSUS FINANCIAL OPENNESS UNDER ALTERNATIVE  
EXCHANGE RATE REGIMES

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ABSTRACT

A simple analytical framework is used to consider alternative exchange rate regimes and their bearing on macroeconomic management of a semi-industrial economy. The emphasis is on the implications of different degrees of capital mobility. One of the topics taken up is the conflict between the role of the real exchange rate as a signalling device for long-run resource allocation and the problem of real exchange rate appreciation accompanying the opening up of an economy to short-term capital inflow. Also discussed is the related choice of exchange rate policy as an anti-inflation device.

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## REAL VERSUS FINANCIAL OPENNESS UNDER ALTERNATIVE EXCHANGE RATE REGIMES

### I. Introduction<sup>1</sup>

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 macro-policies 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, 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 in which relative technical progress in export - 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 discrepancy 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<sup>2</sup>, 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 the Latin American Continent<sup>3</sup> 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, 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 tradeable assets and tradeable goods conflicts of price signalling 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 II) 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 III-V). This being a conference on the capital market, we shall put the main emphasis on 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 signalling. The last section (VI) 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 in order to go into analysis of actual examples. The discussion has partly been inspired by the experiences of my own country (see also Bruno and Sussman, 1979, 1980) which hopefully may also be relevant to a wider set of countries.

## II. 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.<sup>4</sup> We shall consider the commodity market, asset supply and demand, and the balance of payments.

### Commodities

Suppose the economy produces a composite good ( $Q$ ), priced  $p$ , which is an imperfect substitute with 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 ( $K$ ), i.e. 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 ( $\pi$ ),<sup>5</sup> and a fiscal impact variable ( $g$ ).

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

$$(1) \quad Q^d - Q^S = f_1 \left( \underset{+}{q}, \underset{+}{m}; \underset{+}{U_1} \right)$$

where  $U_1$  stands for a vector of various exogenous shift factors ( $g, w, \pi, t_x, t_n, -K$ ).<sup>6</sup>

The downward-sloped curve  $QQ$  in Figure 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 inwards with an increase in the government deficit ( $g$ ), the real wage ( $w$ ), expected inflation ( $\pi$ ), 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  $45^\circ$  vector, towards the  $QQ$  curve.

### 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

$$(2) \quad T_1 = T_1(q, U_2)$$

where  $U_2$  is another vector of exogenous shift factors ( $F, t_x, t_n$ ).<sup>7</sup>

Current account balance is represented by the horizontal line in Figure 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-payment 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.<sup>8</sup>

### 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 ( $\epsilon$ ).

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 ( $M$ ).

$$(3) \quad M^d/p = \lambda(i)Q = M/p.$$



For high rates of expected inflation  $\pi$  may be substituted for  $i$  in (3). As is usually assumed, only domestic residents hold  $M$ , 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):

$$(4) \quad eZ^d/M^d = qZ^d/m^d = k(\varepsilon)$$

where  $q = e/p$  as before, and  $\varepsilon$  is the expected rate of depreciation.<sup>9</sup> The more elastic  $k$ , the closer substitutes are  $M$  and  $Z$ .

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:  $q = mk(\varepsilon)/(B-A)$ . This is represented by the line  $ZM$  in Figure 1. To allow for different degrees of financial openness we assume that the actual change in the privately-held foreign exchange asset ( $\Delta Z$ ) 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.)

$$(5) \quad \Delta Z = \beta \left[ k(\varepsilon)m/q - (B_0 - A_0) \right]$$

where  $\beta \geq 0$ .

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

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 BoP surplus ( $T = T_1 + T_2$ ) must equal the net accumulation of Bank reserves ( $\Delta A$ ). We can thus write:

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

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 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 BoP, which was inspired by Frenkel and Rodriguez (1980), is also useful for considering different degrees of capital mobility.<sup>10</sup> A very low level of  $\beta$  (relatively flat TT curve) would correspond to the case of rather effective exchange control. In the extreme case ( $\beta = 0$ ), only the current account matters. The other polar extreme ( $\beta = \infty$ ) is the one in which only asset behaviour ( $T_2 = 0$ ) matters. There is instantaneous adjustment of  $Z$  to  $Z^d$  (as in Dornbusch 1976).

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:

$$(7) \quad M = eA + C_g + C_c + C_p.$$

For subsequent reference we also note that by adding the net foreign exchange asset  $eZ$  to the LHS of (7) and remembering that  $A + Z = B$  we get another constraint on the sum of the two assets.<sup>11</sup>

$$(8) \quad M + eZ = eB + C$$

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

### III. 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 Figure 2). Commodity market equilibrium is given by the curve  $QQ$ , the basic balance is given by  $NX$ . There is limited capital mobility (low  $\beta$ ), so that the balance of payments equilibrium is given by the line  $TT$  whose slope is assumed to be between 0 and 1. There are given 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 due to 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 current account and  $QQ$  is not immediately affected.<sup>12</sup> A possible new equilibrium for the economy would be at the 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 incomes 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 outcome but rather in the dynamic sequence of events that may typically occur once the need for a step devaluation is signalled.

It is in the nature of a fixed exchange-rate regime that there is a considerable lag 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 towards  $TT'$  and foreign exchange reserves start falling ( $\Delta A < 0$ ), two processes may be set in motion, the 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 upwards 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, signalling 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 the 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 (due to an inflationary gap in the goods market) which is represented by an inward move along a  $45^\circ$  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 ( $\epsilon$ ). Once a devaluation has taken place, expectations will stabilize again (at  $\epsilon_0$ , or some lower number). Suppose ZM returns back to its previous position and BoP equilibrium is represented by  $TT'$ . At the 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.<sup>13</sup> This brings us to the second dynamic process which may take place simultaneously with the previously described one. Let us go back to the point A when foreign exchange reserves start falling. Unless sterilized, there will be a fall in M which in Figure 2 would show as a horizontal leftward move from A towards 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  $45^\circ$  vector from D to E. If expectations of a devaluation are kept at zero, the BoP 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.<sup>14</sup> It is the capital flows in response to the interest rate gap<sup>15</sup> 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 BoP equilibrium is given by  $IT'$ . 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 2 there will be a movement along a horizontal line from  $H$  towards  $IT'$ . At the same time inflationary pressure develops causing a rise in prices (move back towards  $QQ$ ).

The large swings in short-run capital movements and in the money pre- and post- large devaluations are hard to contain even under exchange control 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 BoP deficit, unless the devaluation is coupled with the appropriate measures that will shift  $QQ$  outwards.<sup>16</sup>

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 tradeable goods, as  $IT'$  gradually shifts up. Only a larger budget cut to  $QQ'$  (and/or larger drop in the real wage, coupled with a rise in  $m$  and  $q$ ) can keep all markets in new current-account equilibrium at the point  $B$ .

The main problems that arise in the operation of a fixed peg which is adjusted in large jumps thus center around the sizeable 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 tradeable 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  $t_x$  so as to keep the  $NX$  line in place, while manipulating the budget so as 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 upwards gradually. The problem with such a system is usually twofold. One 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 (GATT, 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.

#### IV. 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.<sup>17</sup>

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 tabu attached to an act of currency depreciation and shifts the exchange rate adjustments from the front pages of the newspaper 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 mini-devaluations may paradoxically sometimes also be 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 incomes policy discipline.<sup>18</sup> The fact that devaluations now take on a more continuous form make for built-in inflationary expectations ( $i = \pi = \epsilon = \dot{e}/e$ ), 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  $\epsilon_1$  and the relevant asset demand curve is  $ZM'$  in Figure 2, with equilibrium momentarily at  $K$ . Say a small step adjustment to a new BoP curve  $IT''$  is required. The small triangle marked by the points  $K, L, H$  marks the policy trade-offs. If fiscal policy can be used along with a mini-devaluation 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  $(i^* + \epsilon)$ . This is shown by the fact that at the point K on ZM', m has to be lower than at N or at B.

#### V. 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 BoP need not be in momentary equilibrium and foreign exchange reserves are the short-run buffer. In the Introduction we posed the problem of conflicting long-term and short-term price signalling. 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 ( $\Delta A = 0$ ).

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 Figure 3). The asset market curve can be transformed by substituting from equation (8) into (4) and writing  $Z^d = B - A$  to get:

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

Equation (9) is represented by the curve ZC in Figure 3 which has analogous properties to the curve ZM. It is a ray through the origin whose slope increases with  $\epsilon$  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 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 ( $\epsilon$ ) and a longer-run effect on the total supply of foreign exchange assets (B). Suppose there is a one-time effect on  $\epsilon$  rotating ZC to ZC'. The nominal (and real) exchange rate will overshoot to the point E and may quickly be eroded by inflation with real appreciation moving the economy from E to G along the line ZC'. At the point G the BoP 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 upwards. 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 the 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 signalled by the asset market (at the 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 signalling 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 3 this can be shown by noting that the imposition of a tax ( $\tau$ ) 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.<sup>19</sup> 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  $ZC$  anti-clockwise.

What happens when capital mobility is not perfect and we don't 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 BoP 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 is the TT line the more important is the basic balance in the determination of market signals and the closer will a float bring us to the long-run signal.

Does this analysis imply that it is always advantageous to control capital movements, i.e., 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 may 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 control 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 closedness may often be confined to particular short-term situations.

#### VI. 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 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, i.e.  $\pi = \hat{p}$  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 labour markets and represents the price-wage-price dynamic adjustment process. In reduced form this can be written as follows:

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

The 'path-through' coefficient  $\alpha$  incorporates the role of the direct and indirect import coefficient as well as the implied wage-price linkages.  $\alpha$  is most likely to be less than one, providing we do not have 100 percent indexation. The intercept  $\pi_0$  summarizes the role of excess demand factors in the commodity and labour markets as well as autonomous cost-push factors (world price of raw materials, indirect taxes on consumer goods, etc.).<sup>20</sup>

Equation (10) appears as the line PP in Figure 4, with intercept  $\pi_0$  on the  $\pi$ -axis and slope  $\alpha < 1$ . Given any rate of depreciation ( $\epsilon$ ) this curve gives the implied inflation rate that will be propagated by the real system given its underlying behavioural and institutional parameters. This inflation rate can in principle be lowered either by a reduction in the extent of linkage ( $\alpha$ ) or by fiscal and other stabilization measures, lowering  $\pi_0$ . 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 4 represents the long-run real depreciation that keeps the current account in balance. The intercept  $\epsilon_0$  (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.).<sup>21</sup>

A crawl that achieves steady state equilibrium under these assumptions is given at the rate  $\epsilon_2$ , which is consistent with an inflation rate of  $\pi_2$  (see point A in the diagram). More restrictive internal policies (showing in a lower PP' curve) will allow a lower rate of depreciation,  $\epsilon_1$ , with a correspondingly reduced inflation rate (cf. point C with A).

If there is a high degree of capital mobility in the system, the momentary equilibrium rate of inflation will not be given by the line XX, however, but rather by the combination of  $\hat{\epsilon}$  and  $\hat{p}$  that keep the asset market in balance over time (line ZZ in Figure 4).

This can be obtained by time differentiation of equation (9), leading to an asset equilibrium rate of real depreciation  $\hat{\epsilon} - \hat{p} = \tau_0$ , where  $\tau_0$  is a positive function of the rate of change of real credit ( $\hat{c}$ ), central bank intervention in reserves ( $\Delta A$ ), and the rate of change of expectations ( $\hat{\epsilon}$ ),<sup>22</sup> and depends negatively on the basic balance ( $T_1 = \Delta B$ ).

In Figure 4 the intercept of ZZ on the  $\hat{p}$  axis measures  $-\tau_0$ . If ZZ happens to coincide with the line XX ( $\tau_0$  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 the point E with A).<sup>23</sup> If left to itself, the fall in  $T_1$  will gradually shift the ZZ curve down towards XX. Now suppose that the ZZ curve is deliberately shifted up to its position in Figure 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 the point B), providing these steps are credible.<sup>24</sup> If the stabilization program also affects the real economy,  $\pi_0$  is brought down to  $\pi_0'$  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 ( $\epsilon_1$ ) 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,  $\epsilon$  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 signalling. The main problem in practice is the speed at which these adjustments can be made so as to be credible and the size of the real social cost in terms of transitional production and employment slowdown.

Footnotes

- 1 Helpful comments by Rudiger Dornbusch and other participants at the Conference are gratefully acknowledged.
- 2 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, in so far as the interest rate has to be renegotiated at short-run intervals.
- 3 As noted in Diaz-Alejandro's paper for this Conference, this problem was also relevant in the 1930s.
- 4 At a later stage we shall put total real banking credit, instead of  $m$ , on the axis - see Section V.
- 5  $m$  and  $\pi$  enter firm asset market equilibrium (see below).
- 6 In this formulation we implicitly assume some real wage ( $w$ ) rigidity, in which case the labour 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.
- 7 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  $m$ .
- 8 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.
- 9 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



9 (Contd.)

the demand for real bonds ( $b^d$ ) is :  $b^d = a - \lambda(i) Q [1 + k(\epsilon)]$ .

10 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 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  $[\bar{i} - (i^* + \epsilon)]$ . There is some advantage in relating the capital flow to the underlying asset behaviour.

11 If one adds  $B$  on the LHS 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 finance to the private sector ( $C_c + C_p$ ).

12 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 inwards to  $QQ$ . Assuming the line  $AB$  to be on a  $45^\circ$  vector, inflation will move the economy back to equilibrium at  $A$ . From here on the analysis is the same.

13 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.

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

15 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.

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

- 17 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).
- 18 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.
- 19 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.
- 20 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.
- 21 If we denote the autonomous time shift of  $T_1$  by  $\eta_t$  and the elasticity of  $T_1$  with respect to  $q$  by  $\eta_q$ , one can show that  $\epsilon_0 = -(\hat{F} + \eta_t)/\eta_q$ .
- 22  $\Delta A$  and  $\hat{\epsilon}$  will be zero in equilibrium, but appear here since they can be used as policy instruments, along with  $\hat{c}$ .
- 23 One could argue that in this case the expected rate of inflation may be  $\pi_3$  while the actual rate is  $\pi_2$ . If  $\epsilon_2$  is maintained and expectations play an important role, actual inflation may gradually rise above  $\pi_2$  (does this accord with developments during a hyperinflation?).
- 24 Also in line with the previous footnote - inflation may for a time rise above  $\pi_2$  before it eventually comes down to  $\pi_1$ .

References

- Bruno, M. (1976), "The Two-Sector Open Economy and the Real Exchange Rate", American Economic Review, 66, September, pp. 566-577.
- Bruno, M., and Z. Sussman (1979), "Exchange-Rate Flexibility, Inflation and Structural Change: Israel under Alternative Regimes", Journal of Development Economics, 6, pp. 483-514.
- (1980), "Floating versus Crawling: Israel 1977-79 by Hindsight", Falk Institute Discussion Paper No. 803, January.
- Calvo, G.A. and C.A. Rodriguez (1977), "A Model of Exchange Rate Determination under Currency Substitution and Rational Expectations", Journal of Political Economy, 85, June, pp.617-626.
- Dornbusch, R. (1976), "Expectations and Exchange Rate Dynamics", Journal of Political Economy, 84, December, pp.1161-1176.
- Frenkel, J.A. and C.A. Rodriguez (1980), "Exchange Rate Dynamics and the Overshooting Hypothesis", NBER, August.
- Liviatan, N. (1979), "Anti-Inflationary Monetary Policy and the Capital Import Tax", Working Paper, Department of Economics, The Hebrew University of Jerusalem.
- Miles, N. (1978), "Currency Substitution, Flexible Exchange Rates and Monetary Independence", American Economic Review, 68, June, pp.428-436.

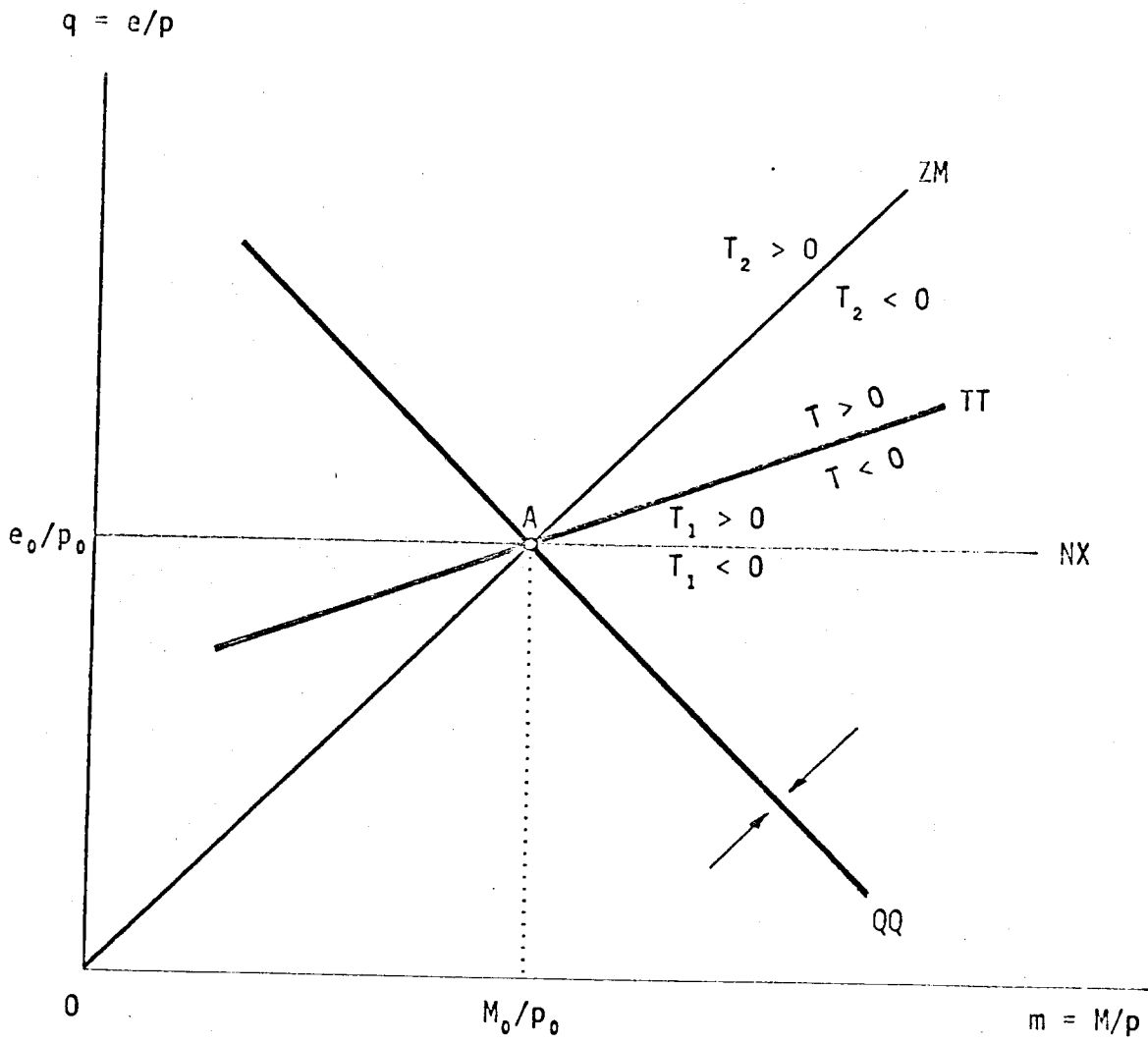


Figure 1

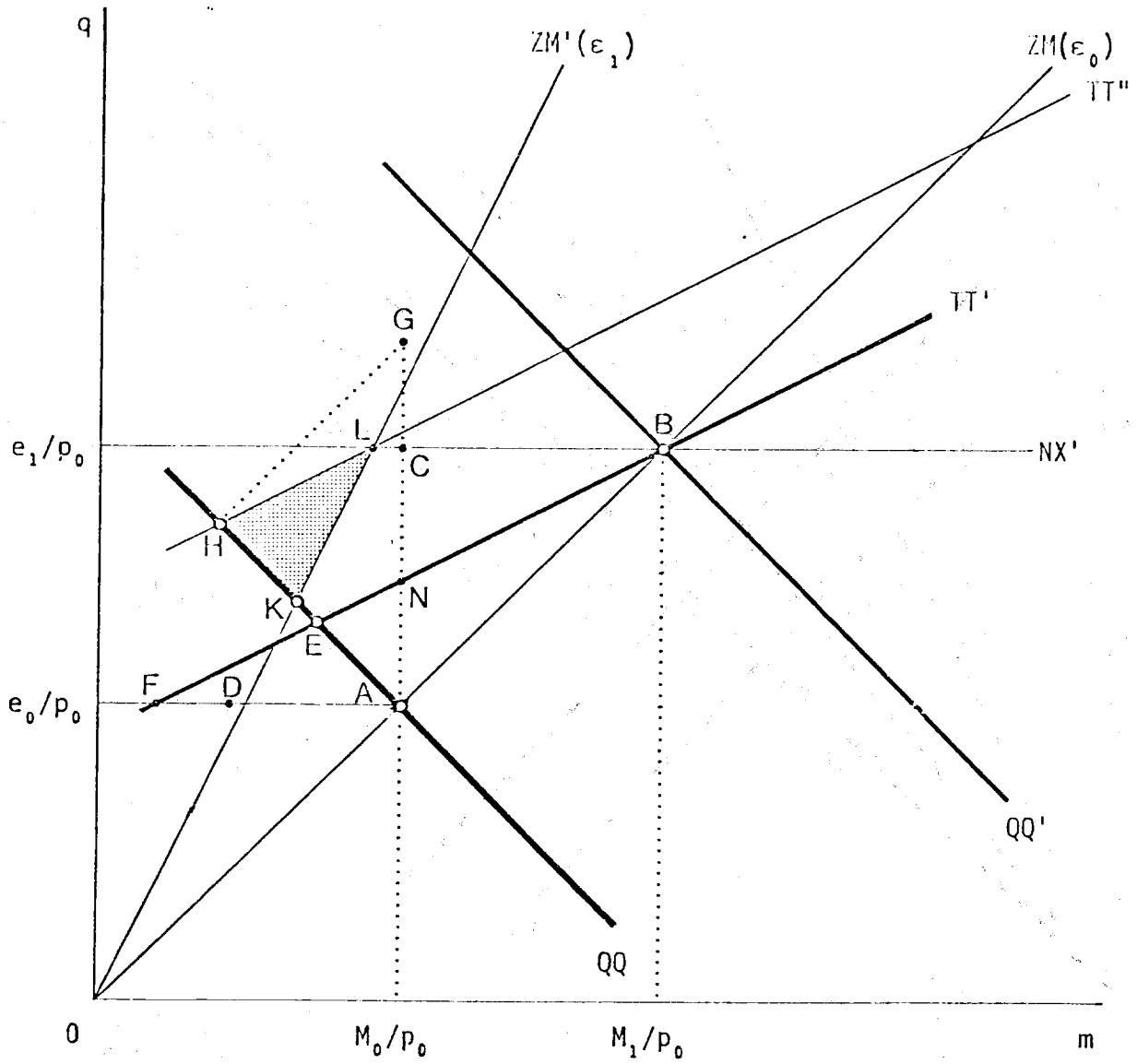


Figure 2

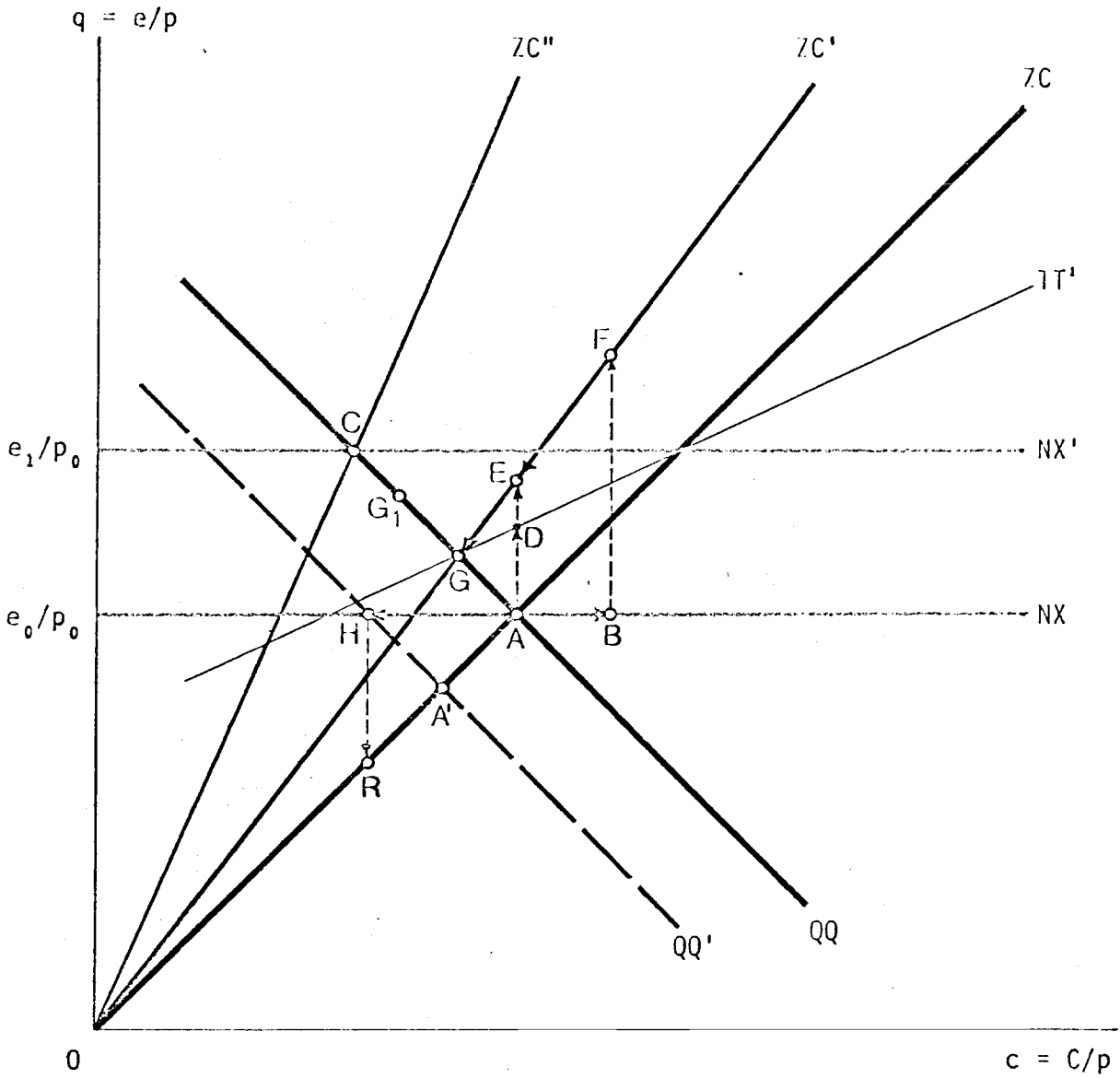


Figure 3

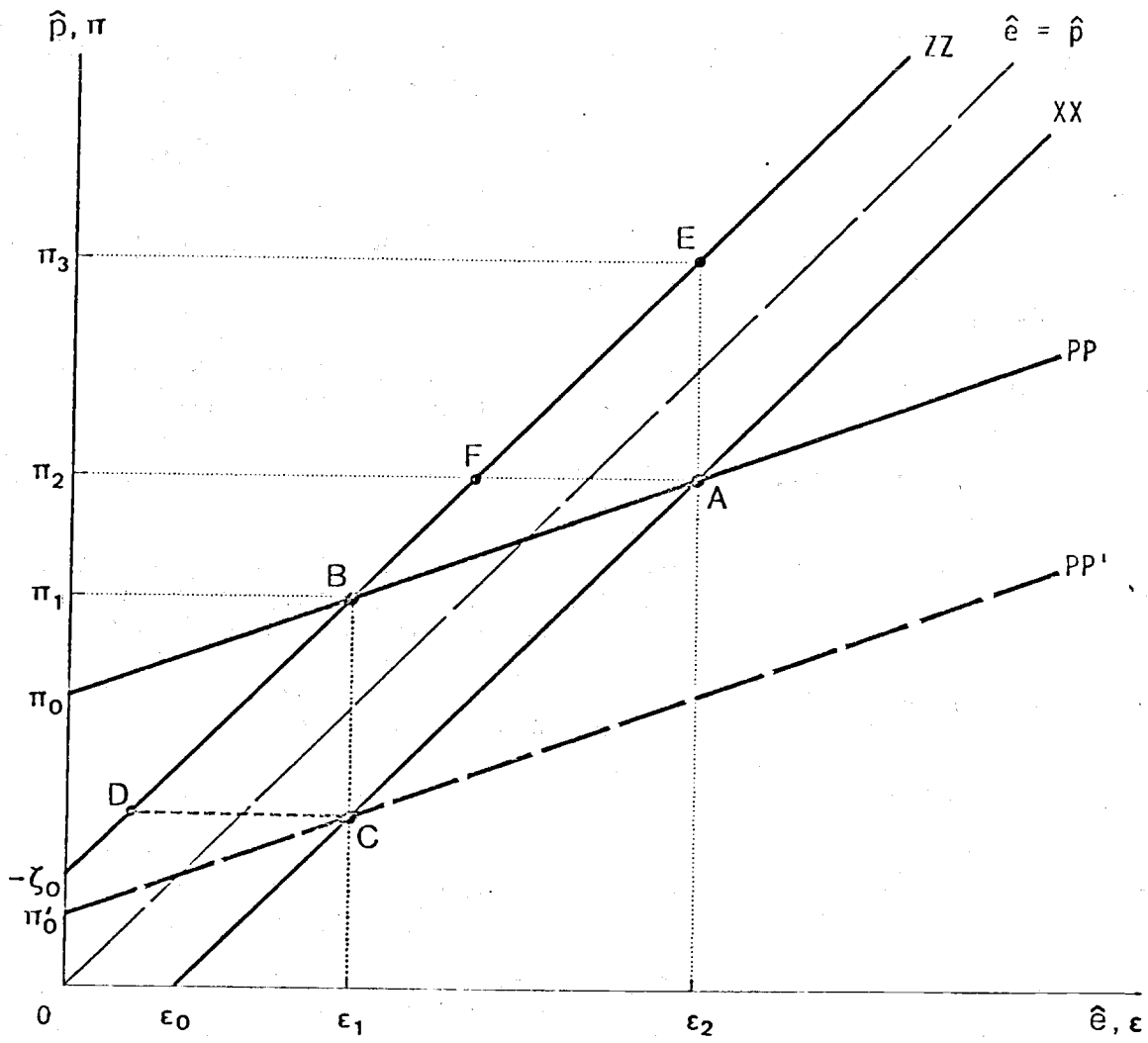


Figure 4