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Capital Account Liberalization, Interest Rates and the Real Exchange Rate

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1. Introduction

The purpose of this paper is to investigate the behavior of interest rates and the real exchange rate in a small country that liberalizes its capital account. The analysis is developed with the recent (1975-1982) Chilean experience in mind. As part of a set of economic reforms, Chile recently eliminated some of its capital movements restrictions. Even though this process has not eliminated all restrictions (for example only medium and long term capital movements are allowed), by the end of 1980 the capital account was substantially more open than two years before (see Arellano and Ffrench-Davis, 1981).

During 1981, Chile experienced a number of economic problems that have puzzled a number of economists (see, for example, A.C. Harberger, 1982). First, in 1981 a large current account deficit — which reached 14% of GNP — developed. Second, during 1981 and the first part of 1982, real interest rates experienced a sharp increase. For example, the borrowing real interest rate increased from an annual rate of 3.2% in the third quarter of 1980 to 38% in the third quarter of 1981 (see Edwards 1982a). During the first half of 1982 real interest rates remained at these high levels. Also, and partially due to these high rates, real activity experienced a sharp decline (the most "optimistic" forecasts indicate a reduction in real income of 7% in 1982!) Finally, between mid-1979 and mid-1982 (May) the "real" exchange rate appreciated by more than 25%. In this paper a simple model of a small fixed-exchange rate economy that analyzes the effects of a process of capital account liberalization on the real exchange rate and real interest rate is developed. It is argued that the recent behavior of these variables in Chile is consistent with the model's implications.

The plan of the paper is as follows: in Section 2 the effect of a liberalization of the capital account on the real exchange rate is analyzed. It is shown that a larger equilibrium capital inflow into a small country will result in a long run real appreciation of the domestic currency. Section 3 extends the model, and investigates the effects of a capital account liberalization on the real exchange rate and real interest rates. In this section the dynamics of the model are also investigated. Finally, in Section 4 some concluding remarks are presented.

2. Financial Liberalization and Relative Prices

The purpose of this section is to analyze the effect of an exogenous increase in foreign capital inflows on the real exchange rate in a small open economy. It is assumed that this exogenous capital flow is the result of a capital account liberalization process. In Section 3 the model is extended, allowing for an endogenous determination of capital inflows and incorporating the interest rate effect of financial liberalization.

2.1. The Model

Assume a fixed exchange rate economy that produces two goods: tradables and nontradables. The model is given by equations (1) through (7):

$$N^S = N^S \underset{(+)}{\left(\frac{P_N}{P_T}\right)} \tag{1}$$

$$T^S = T^S \underset{(-)}{\left(\frac{P_N}{P_T}\right)} \tag{2}$$

$$N^D = N^D \left(\frac{P_N}{P_T}, E\right) \tag{3}$$

$$(-) \quad (+)$$

$$T^D = T^D \left(\frac{P_N}{P_T}, E\right) \tag{4}$$

$$(+) \quad (+)$$

$$y = T^S + \frac{P_N}{P_T} N^S \tag{5}$$

$$E = y + Z = T^D + \frac{P_N}{P_T} N^D \tag{6}$$

$$P_T = eP_T^* \tag{7}$$

where the signs in parentheses refer to the assumed sign of the respective partial derivative, and

N^S, T^S: Quantity supplied of nontradables and tradables, respectively.

N^D, T^D: Quantity demanded of nontradables and tradables.

P_N, P_T: Nominal prices of nontradables and tradables, respectively.

y : Real income measured in terms of the tradable good.

E : Real expenditure measured in terms of the tradable good.

Z : Flow of international capital (current account deficit).

e : Exchange Rate.

P_T^* : International price of tradable goods.

Equations (1) and (2) are the supply functions of nontradable and tradable goods, respectively. It is assumed that they depend only on relative prices. Equations (3) and (4) are the demand functions for nontradable and tradable goods, and it is assumed that they depend on relative prices and

total expenditure. Equation (5) is the definition of real income in terms of tradable goods, while equation (6) is real expenditure, also in terms of tradables. It is assumed that expenditure exceeds output by the amount of the (exogenous) capital inflow Z. This capital inflow, in turn, will be equal to the current account deficit if there are no changes in international reserves (i.e., if the balance of payments is equal to zero). Finally, equation (7) is the law of one price and states that the domestic price of tradable goods is equal to the international price (P_T^*) times the exchange rate.

Short run equilibrium requires: (a) that the nontradable goods market clears, and (b) that expenditure exceeds income by the amount of the exogenous capital inflow.

$$N^S\left(\frac{P_N}{P_T}\right) = N^D\left(\frac{P_N}{P_T}, E\right) \tag{8}$$

$$E - y = Z$$

In the long run, on the other hand, the level of capital inflow (Z) will be equal to the exogenously given long run equilibrium level $\bar{Z}$:

$$Z = \bar{Z} \tag{9}$$

Equilibrium in this economy is summarized in Figure 1.[1] Schedule NN captures the combinations of P_N/P_T and E that are compatible with equilibrium in the nontradable goods sector. It has a positive slope since a higher level of E generates an excess demand for nontradables that can be eliminated by a higher relative price of nontradables. Schedule yy, on the other hand, presents the relationship between P_N/P_T and y that is compatible with total income being equal to $T^S + \frac{P_N}{P_T} N^S$. It has a positive slope since higher levels of P_N/P_T increase the <u>real</u> value of output

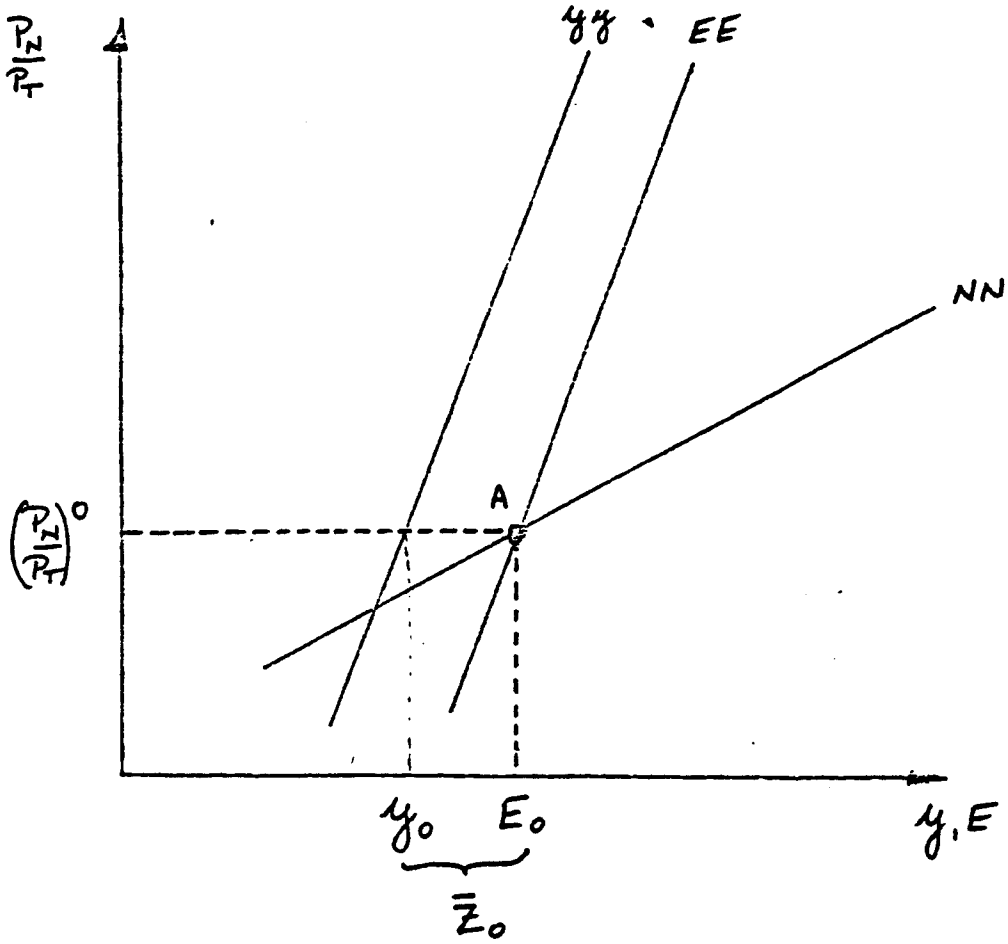

FIGURE 1

expressed in terms of tradable goods. Finally, schedule EE is derived from equation (6) and is parallel to yy. The distance between both schedules is equal to the exogenously given level of capital inflows ($\bar{Z}_o$). The relationship between the slopes of schedules E and NN is dictated by stability requirements. In Figure 1, initial equilibrium is attained at point A, where the nontradable goods market clears, and expenditure equals income plus capital inflows (Z_o).

2.2. Long Run Effects of an Increase in the Flow of Foreign Capital

Assume now that a capital account liberalization process takes place, and that foreigners are willing to increase the long run flow of capital to the domestic country to $\bar{Z}_1 > \bar{Z}_o$. This will be reflected in Figure 1 by a parallel shift of the EE curve by the amount $\Delta Z = \bar{Z}_1 - \bar{Z}_o$. The final equilibrium situation is depicted in Figure 2, where the new expenditure equilibrium schedule is given by E'E'. New equilibrium is achieved at B, with a higher level of expenditure (E_1), a higher level of real income (y_1), and a higher relative price of nontradables to tradables $[(P_N/P_T)_1 > (P_N/P_T)_o]$. This is an important result that shows that an increase in foreign capital flows will result in a higher equilibrium relative price of nontradables. This implies that a financial liberalization will result in a decline of the equilibrium real exchange rate, defined as $s = \frac{eP_T}{P_N}$. The magnitude of this equilibrium real appreciation of the exchange rate will depend on the magnitude of the exogenous increase of the equilibrium capital inflow and on the slope of the NN curve. The steeper is this curve, the higher will be the real appreciation of the domestic currency. This appreciation of rea exchange rate has indeed been observed in Chile during period 1979-1981 (see Edwards, 1982a).

2.3. Short Run Effects

The discussion presented in Figure 2 deals with the long run effects of a financial liberalization process. Assume, however, that immediately following the relaxation of controls, the short run (Z_s) capital inflow exceeds its new long run equilibrium level ($\bar{Z}_1$). (This seems to have been the case of Chile during 1981, where the deficit in the current account reached 14% of GNP, a figure that clearly cannot be maintained in the long run.)[2] In this case, short run real expenditure (E_s) will exceed the new long run equilibrium level of expenditure (E_1) by $Z_s - \bar{Z}_1$. The new short run equilibrium is depicted in Figure 3, where E^sE^s captures short run equilibrium in the expenditure sector consistent with a higher short run level of capital inflow (Z^s). It may be seen that in order to equilibriate the nontradable goods market, the relative price of nontradables will increase in the short run to $(P_N/P_T)_s$, overshooting its final equilibrium level $(P_N/P_T)_1$. In the short run, then, equilibrium will be attained at C, with a level of real expenditure equal to E_s.

As time passes, however, there will be a tendency for the level of capital inflows to return to their new (i.e., post-liberalization) equilibrium level Z_1. This will be obtained, in principle, by a movement along the NN curve from C to B. The new long run relative price of nontradables is, as in Figure 2, $(P_N/P_T)_1$. In this case, then, there will be an overshooting of P_N/P_T: its short run level $(P_N/P_T)_s$ will exceed the new (higher) long run equilibrium level $(P_N/P_T)_1$. The possibly dynamic paths of this relative price (which under fixed rates is the inverse of the real exchange rate) are summarized in Figure 4. Depending on whether the movement from A to C in Figure 3 is instantaneous, or whether it takes some time, P_N/P_T will follow either paths A or B in Figure 4. What is clear, however, is that if as a

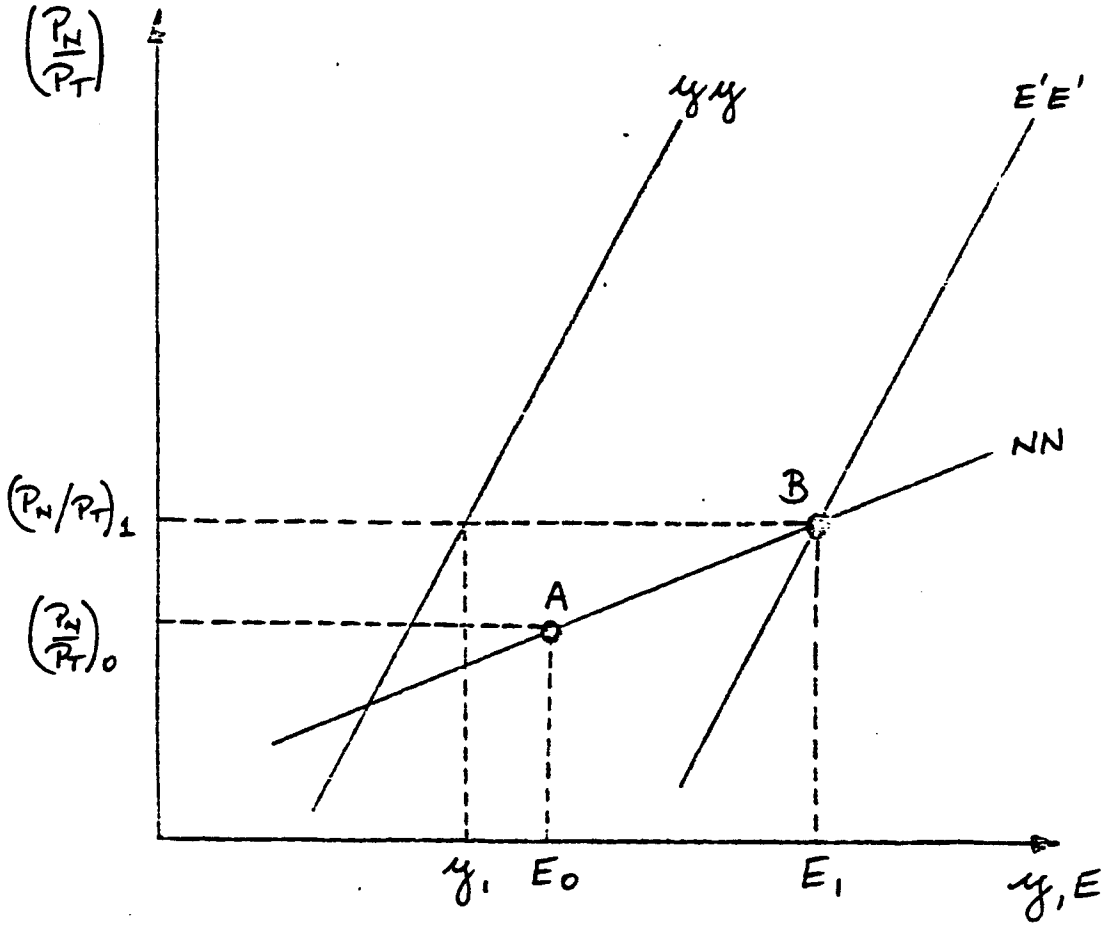
$\left(\frac{P_N}{P_T}\right)$
yy
E'E'
NN
B
$(P_N/P_T)_1$
A
$\left(\frac{P_N}{P_T}\right)_0$
y_1
E_0
E_1
y, E

FIGURE 2

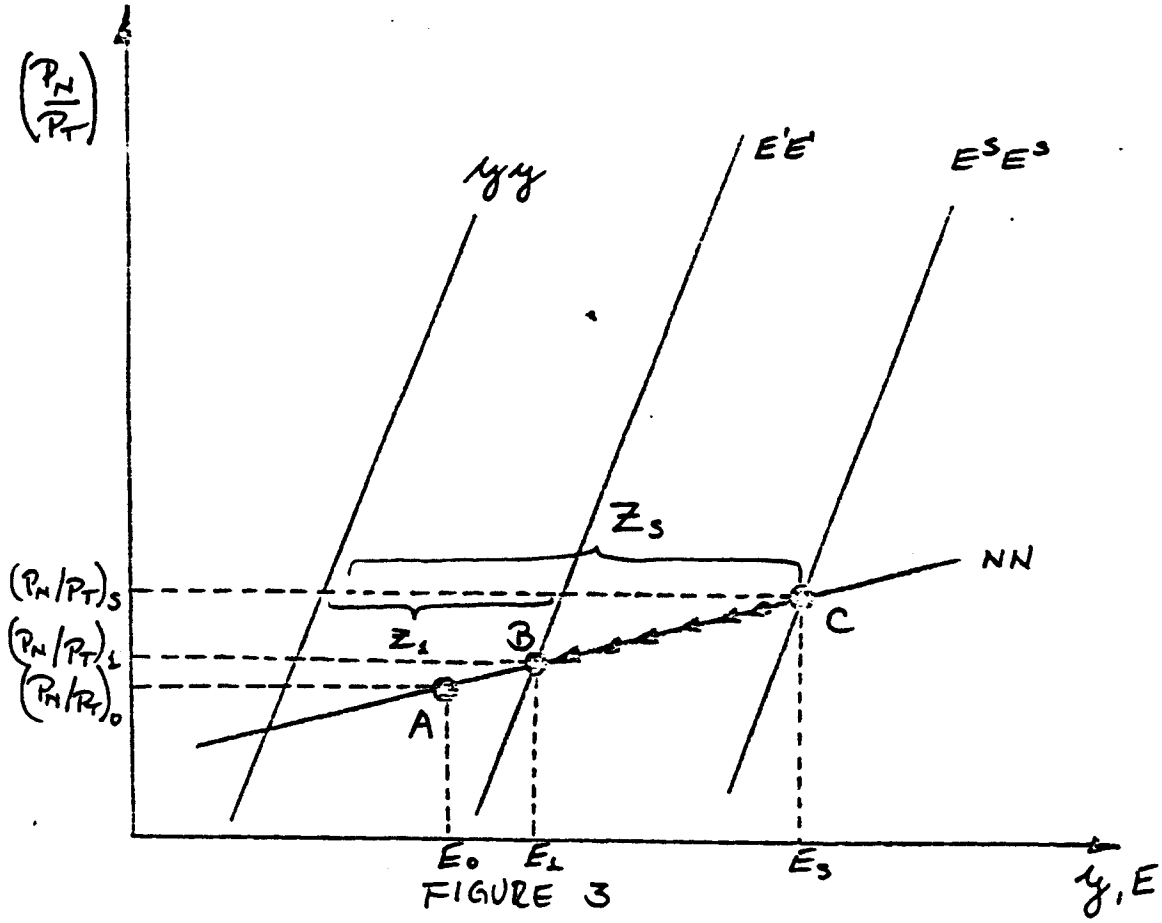

FIGURE 3

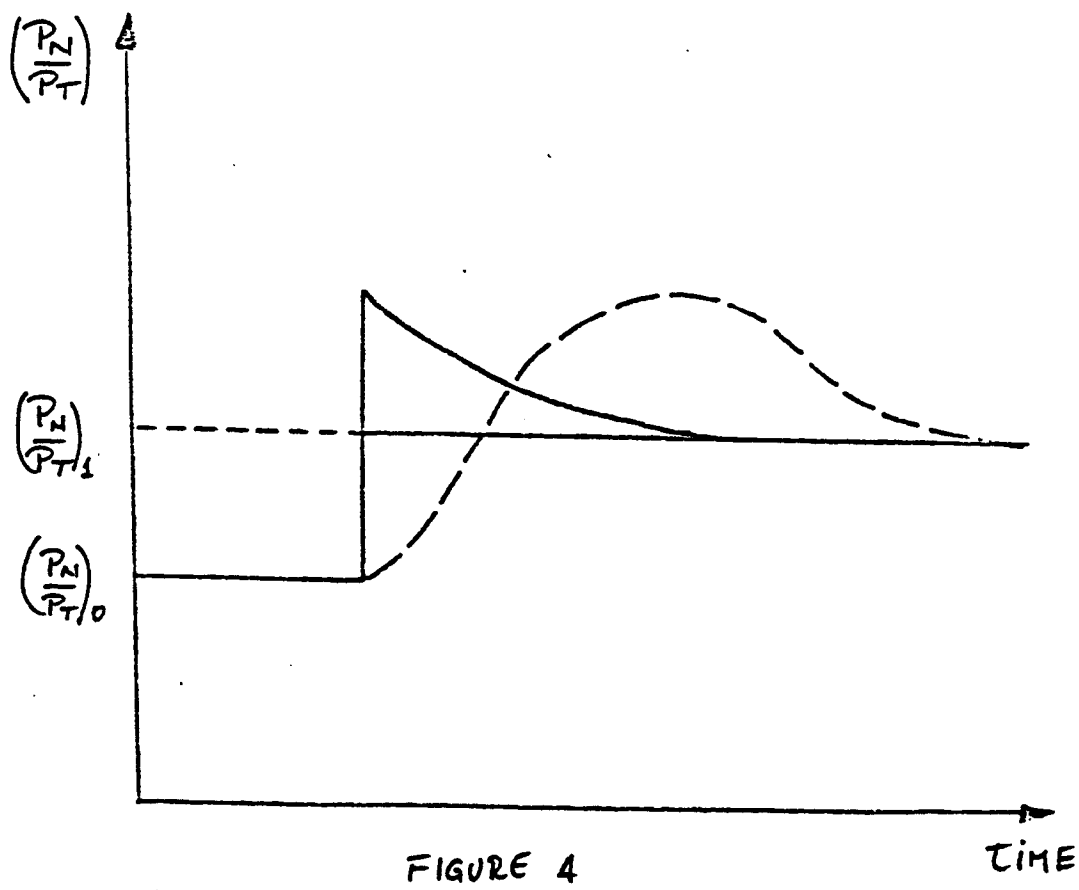

FIGURE 4

consequence of a financial liberalization, in the short run the flow of foreign capital overshoots its new (higher) level, the relative price of nontradables will also overshoot its new long run equilibrium level. In terms of the real exchange rate, this means that as a result of the financial liberalization, there will be a short run undershooting of $s = \frac{eP_T}{P_N}$.

2.4. Adjustment, Rigid Prices and Devaluation

As the preceding analysis has emphasized, a possible effect of a financial liberalization is the overshooting of the relative price of nontradables (P_N/P_T), which is equivalent to an undershooting of the real exchange rate. Following this overshooting, the relative price of nontradables (P_N/P_T) will decline to its long run equilibrium level. In a small economy with fixed rates, and a world with no inflation, this adjustment of relative prices will have to take place through a reduction of the nominal price of nontradables P_N.

If, however, prices of nontradables are rigid downward, the adjustment towards long run equilibrium will result in unemployment. The reason for this is that the reduction in expenditure from E_s to E_1 will generate an excess supply of nontradable goods, which under rigid P_N/P_T will be eliminated by a reduction in the level of real activity in this sector.

If, however, the rate of world inflation (i.e., $d \ln P_T^*$) is positive, the required reduction of (P_N/P_T) to restore long run equilibrium can be obtained through a rate of domestic inflation lower than world inflation: $d \ln P_N < d \ln P_T^*$. In general, however, this inflation differential will tend to reduce the unemployment cost of the adjustment, but not eliminate it. Specifically, the huge increase in unemployment between 1981 and the first quarter of 1982 tends to indicate that for Chile this cost has been extremely

high. Under these circumstances the adjustment costs could be greatly reduced by altering relative prices through a devaluation. The degree of success of a devaluation, will depend on the behavior of real wages. If these are rigid downward, as in the case of Chile, a substantial devaluation might be required to bring about the desired relative price changes (see Corbo and Edwards, 1981). However, there should be little doubt that in a case with open unemployment around 20% (Chile, first quarter 1982), a devaluation will have a positive effect by reducing the adjustment costs.

3. Capital Account Liberalization and the Interest Rate

This section analyzes the effect of a capital account liberalization on interest rates and the real exchange rate in a small country with fixed exchange rates. This is done by adapting and extending the model presented in the preceding section.

The model assumes that two goods are produced — tradables and nontradables — and focuses on the equilibrium of the money and nontradable goods markets. Equilibrium in the nontradable goods market is obtained when the excess demand for these goods is equal to zero. This condition is presented in equation (10):

$$N = N^D - N^S = N(P_n, r; Z, P_T^*, e) = 0 \qquad (10)$$
$$(-)\ (-)(+)(+)\ (+)$$

This equation indicates that the excess demand for nontradable goods (N) depends negatively on the price of nontradables (P_N), negatively on the (real) interest rate (r), positively on the world price of tradables (P_T^*), the exchange rate (e), and capital inflows (Z). A higher level of capital inflows allows real expenditure to increase; and to the extent that a

proportion of this additional expenditure falls on nontradables, there will be an excess demand for this type of good (i.e., $\partial N/\partial Z > 0$).

Equilibrium in the monetary market is attained when the excess demand for money is equal to zero. This condition is given by equation (11); where M is the nominal quantity of money:

$$M = M^D - M^S = M(\underset{(+)}{P_N}, \underset{(-)}{i}; \underset{(-)}{Z}, \underset{(+)}{P_T^*}, \underset{(+)}{e}) = 0 \tag{11}$$

An increase in P_N, e, or P_T^* will result in an excess demand for money, since a higher value of any of these variables will result in a higher domestic price level, and in a decrease in the real stock of money. A rise in the nominal interest rate (i), on the other hand, will result in an excess supply of money. Finally, an increase in the level of capital inflows will be translated into an excess supply of money. Real income and expenditure are defined as in equations (5) and (6) in the preceding section.

It is assumed that capital inflows depend on the long term interest rate differential (d), corrected by expectations of devaluation and political risk, and on the degree of quantitative restrictions on the capital account (T):

$$Z = Z(\underset{(+)}{d}, \underset{(-)}{T}) \tag{12}$$

where d is the interest rate differential defined as

$$d = i + D^e + R - i^* \tag{13}$$

where D^e is the expected rate of devaluation, R is a term that captures the political or country risk premium, and i^* is "the" world interest rate.

It is assumed that previous to the liberalization process, the interest rate differential (d) is positive, and that quantitative restrictions (T) impede foreign capital from flowing in the amount required to close the gap

between interest rates.[3] This means that T in equation (12) is binding, and that a change in the restrictions will result in a change in the volume of capital flows.

In order to close the model, it is postulated that the nominal interest rate is equal to the real rate plus expected inflation.

$$i = r + \pi^e \tag{14}$$

In order to simplify the exposition, this version of the model assumes static (exogenous) expectations. However, the analysis can be easily extended to other assumptions with respect to expectations formation (i.e., perfect foresight, rational expectations) without affecting the main results.

Using (14) in (11), the excess demand for money equation can be rewritten in the following way:

$$M = M^D - M^S = M(\underset{(+)}{P_N}, \underset{(-)}{r}; \underset{(-)}{Z}, \underset{(+)}{P_T^*}, \underset{(+)}{e}, \underset{(-)}{\pi^e}) \tag{11'}$$

The equilibrium situation in this economy can be represented in Figure 5, where schedule NN depicts the combinations of P_N and r that are consistent with equilibrium in the nontradable goods market. This schedule is negatively sloped, since a higher P_N will generate an excess supply of nontradables, which can be offset by a reduction in the real interest rate. To the right of the NN there is an excess supply of nontradables, and to its left there is an excess demand.

Schedule MM, on the other hand, depicts the combination of P_N and r, consistent with monetary equilibrium. The slope of this curve is positive since an increase in P_N will result in an excess demand for money, which will be corrected by an increase in r.

It is assumed that previous to the liberalization process the domestic (nominal) interest rate, adjusted by country and political risk, exceeds the

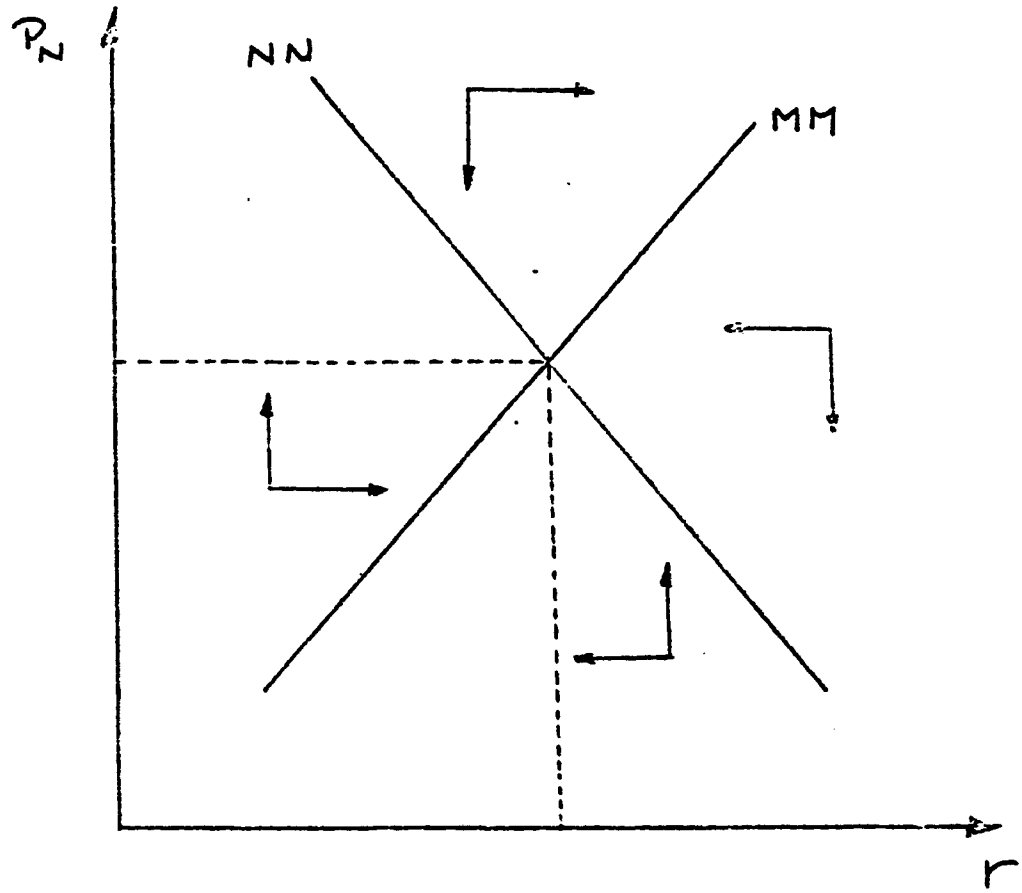

FIGURE 5

world interest rate, and that quantitative restrictions impede the flow of funds that would generate an equilibrium relationship between both interest rates (i and i^*).[4]

Assume now that a financial liberalization reduces the level of quantitative restrictions T, inducing an increase in the flow of foreign capital Z [equation (12)]. In terms of our model, the increase in Z will result in an upward shift in both the NN and the MM schedules. The final equilibrium will depend on which schedule shifts by more. If the MM schedule shifts by more than the NN schedule, the new interest rate will be lower. However, if the contrary is true (i.e., $dP_N\big|_{MM} < dP_N\big|_{NN}$), the new equilibrium will be characterized by a higher interest rate. In both cases, however, the new equilibrium will imply a higher P_N, and thus for given P_T^* and e, a <u>lower</u> real exchange rate $s = \frac{eP_T^*}{P_N}$.

It seems reasonable, however, to assume that as a consequence of an increase in the flow of foreign capital, the MM schedule will shift by more than the NN schedule. The reason for this is that the increase in Z will have a direct one-to-one <u>impact</u> on high-powered money, while its effect on the nontraded goods market will depend on the expenditure elasticity of demand for nontraded goods. The case where the increase in foreign capital flows has a greater effect on the money market is presented in Figure 6, where A is the initial equilibrium situation and B is the final equilibrium characterized by a <u>higher nominal</u> price of nontradables (and a lower real exchange rate) and a <u>lower</u> real interest rate. It is important to keep in mind, however, that changes in the other relevant variables, like D^e, R and π^e, for example, will result in additional effects on the real interest rate and real exchange rate.[5]

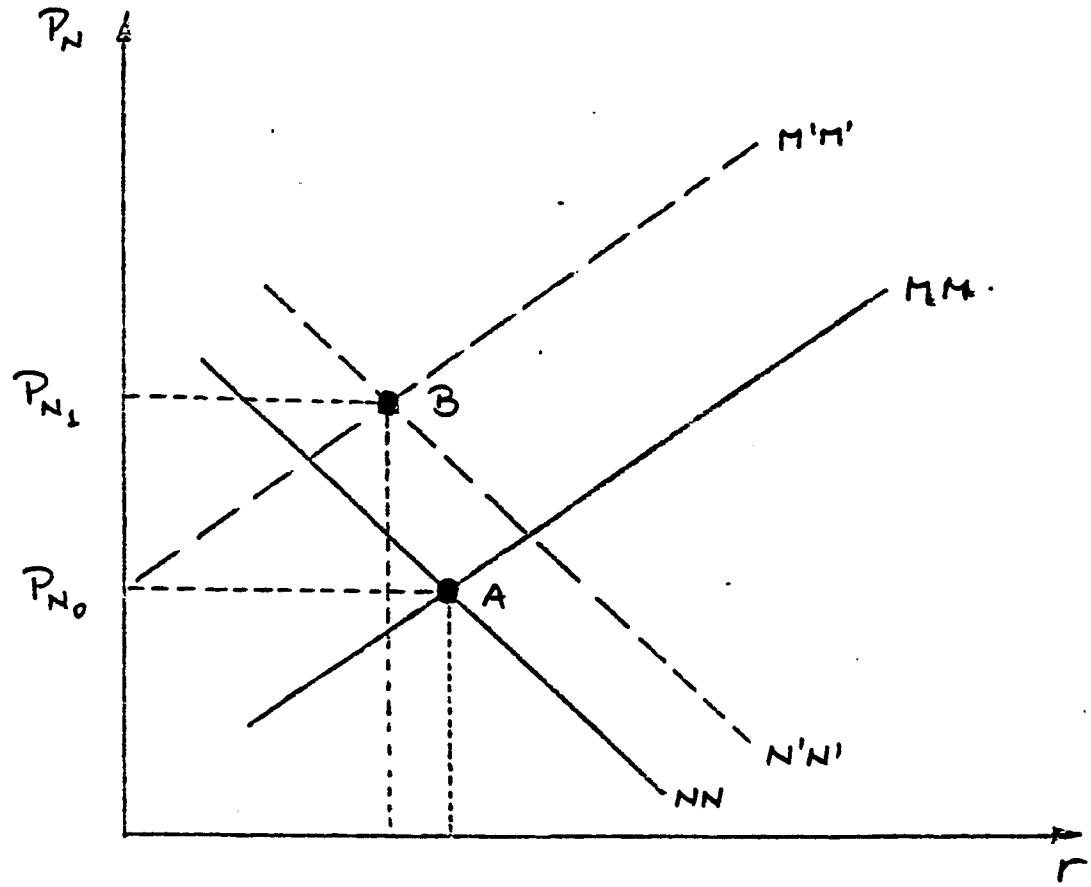

FIGURE 6

3.2. Dynamics

In the previous section it was shown that under feasible assumptions, a financial liberalization would result in a long run lower real exchange rate, and a lower real interest rate. In this section the possible dynamic paths of these variables are investigated.

The dynamic analysis depends critically on the assumptions made with respect to price flexibility and market clearing conditions. If, for example, it is assumed that prices are fully flexible, and that both markets clear instantaneously, the dynamic process will be characterized by a jump of equilibrium from A to B in Figure 5. However, if it is assumed that prices adjust slowly and at least one of the two markets clears slowly, different dynamic paths are obtained. In the rest of this section three alternative dynamic paths are briefly discussed.

Case 1:

Assume that the nontradable goods market clears permanently and that P_N moves slowly; r, however, is allowed to jump. In this case, the dynamics are given in Figure 7.a. In order to maintain equilibrium in the nontradables market, the interest rate will jump from A to C immediately following the liberalization measures. At C the nontradable goods market will be in equilibrium, and there will be an excess supply of money, which will be slowly eliminated by a movement on the NN curve from C to B.

Case B:

Assume now that P_N adjusts slowly, that r can jump, and that the money market equilibrates permanently while in the nontradables goods market excess demand or excess supply situations are solved by decumulating or accumulating inventories. This case is presented in Figure 7.b, where it may be seen that a liberalization will generate an instantaneous reduction of the

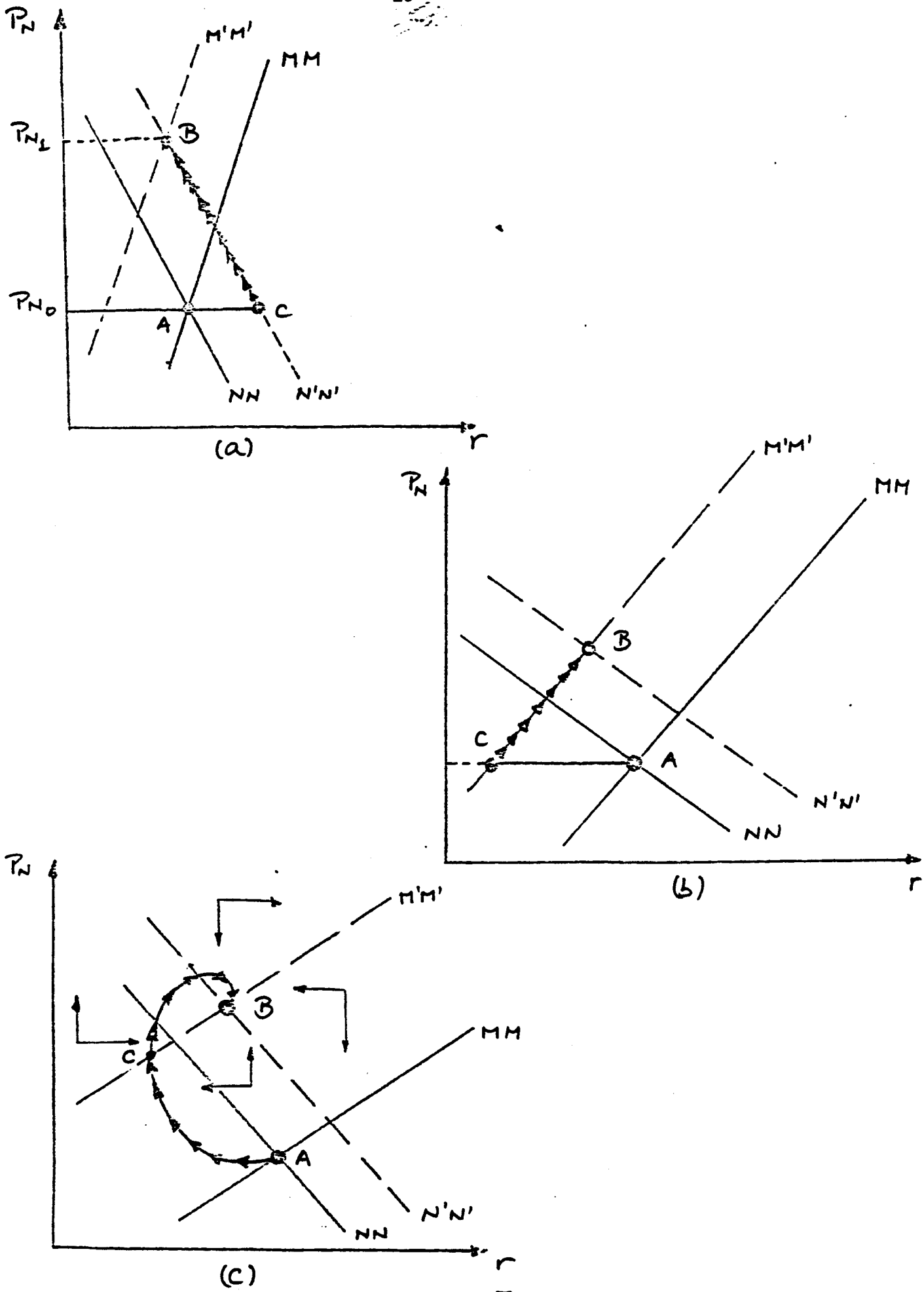
P_N
M'M'
MM
P_{N_1}
B
P_{N_0}
A
C
NN
N'N'
r
(a)
P_N
M'M'
MM
B
C
A
N'N'
NN
r
(b)
P_N
M'M'
B
MM
C
A
N'N'
NN
r
(c)

FIGURE 7

interest rate to C. This decline of r will be followed by a slow adjustment on the MM curve with an increase in r and P_N, until the final equilibrium is reached at B.

Case C:

Finally, assume that both r and P_N move slowly and that in the short run, both the money and the nontraded goods market can be in disequilibrium. In this case, r and P_N will follow the arrowed path in Figure 7c, with an undershooting of r below its new equilibrium level and (maybe) an overshooting of P_N above its new equilibrium level.

This path corresponds to the more general case and tracks fairly closely what has happened in Chile during the 1979-1981 period: real rates fall as the relative price of nontradables increases. However, at a certain point C the real rate begins to increase while the relative price of nontradables continues to increase. It is even possible that P_N overshoots its final equilibrium and that towards the end of the adjustment process, r increases while P_N decreases. The final long run equilibrium situation, however, is given by B with a lower real interest rate and higher relative price of nontradables (see Edwards 1982a).

3.3. The Effects of an Overshooting of Capital Inflows

Assume now, as in the previous section, that following the current account liberalization process, there is a short run inflow of foreign capital that exceeds the new equilibrium level of Z. This case is characterized in Figure 8, where NN and MM are the initial (pre-liberalization) schedules; M^1M^1 and N^1N^1 are the new short run schedules; and M^2M^2, N^2N^2 are the final post-liberalization long run equilibrium schedules.

In this case, the new short run equilibrium will be given by B, while the final long run equilibrium is given by C. Additionally, if the dynamic

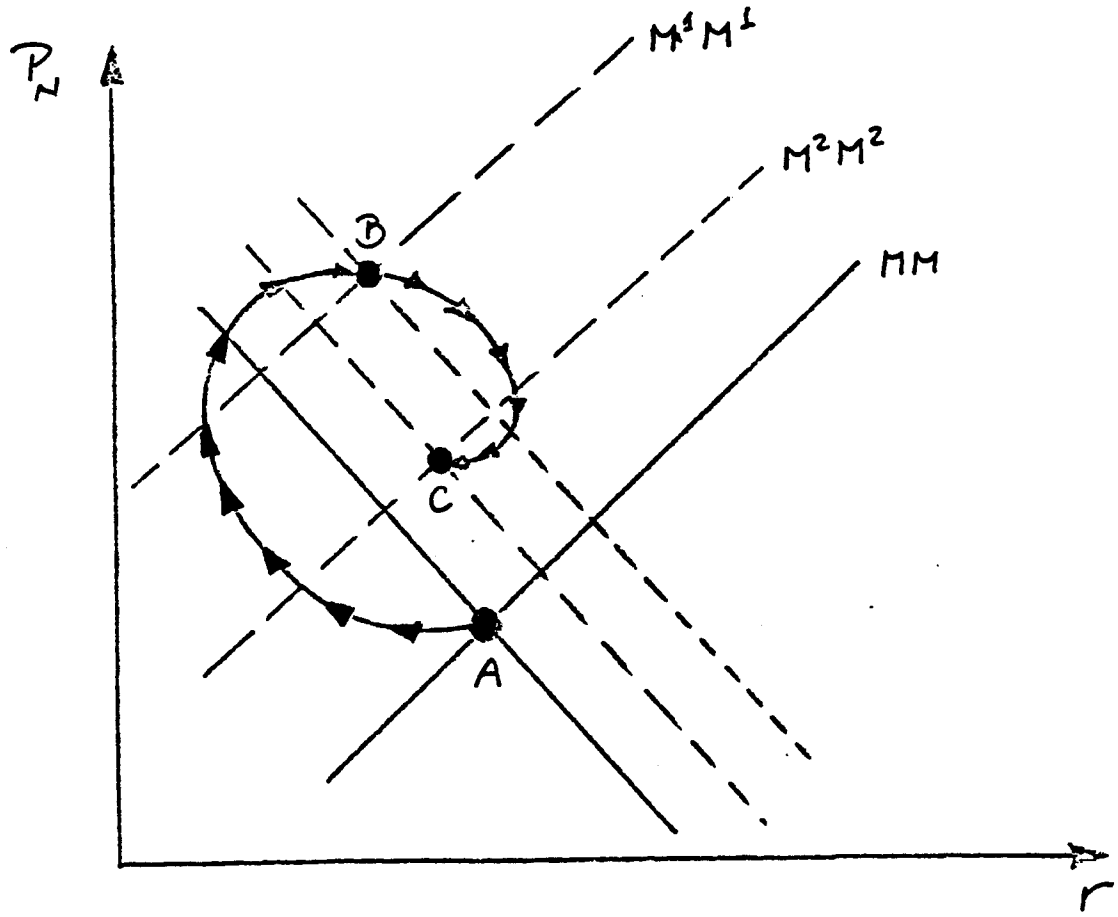

FIGURE 8

process is characterized by Case C in the preceding section, the adjustment path will be given by the arrowed lines path. This path of the real interest rate and the real exchange rate, following a capital account liberalization also describe in a fairly accurate fashion the way these variables have recently behaved in Chile.

It is important to notice that, as mentioned in the previous section, under the assumption of a short run overshooting of capital inflow, following the capital account liberalization, at some point the relative price of nontradables (P_N/P_T) will have to fall in order for equilibrium to be maintained at the same level of employment. If, however, the nominal price of nontradables is rigid downward (and prices of tradables do not increase) the adjustment process will result in unemployment. As mentioned, a possible way out of this problem will be to accomplish the required relative price adjustment through a devaluation. This alternative, however, seems to have been ruled out by the Chilean economic authorities, due to "ideological" reasons.[6]

4. Concluding Remarks

This paper has investigated the effects of a capital account liberalization on the real exchange rate in a small open economy with fixed exchange rates. It is shown that as a consequence of a capital account liberalization the long run equilibrium real exchange rate will fall (i.e., there will be an appreciation of the real value of the domestic currency). It was also shown that to the extent that immediately following the capital account liberalization the flow of foreign funds overshoots its new long run level, the real exchange rate will undershoot its new (lower) long run equilibrium level. This process -- which seems to have occurred in Chile

during 1980-1981 -- implies that, with a fixed exchange rate, at some point the nominal price of nontradable goods will have to fall in order for the real exchange rate to obtain its new long run equilibrium. However, if wages are inflexible downwards (as is the case of Chile due to legal reasons), the price of nontradables will not fall and unemployment will result. It is then argued that under these circumstances the adjustment will be greatly facilitated by a devaluation. It is important to realize, however, that in order for the devaluation to be successful, in terms of altering the relative price of tradable to nontradable goods, real wages should have some flexibility, and the labor market should have an initial disequilibrium (i.e., unemployment).

The paper also investigates the behavior of real interest rates as a consequence of a capital account liberalization. It is shown that, to the extent that the quantitative restrictions that are removed during the liberalization process were initially binding, the new long run equilibrium interest rate will be lower than the pre-liberalization rate. It is shown, however, that the dynamic path of the real interest rate can be characterized by an initial decline, and a subsequent increase, before the new (lower) long run level is achieved. Specifically, the dynamic analysis suggests that one of the possible paths is characterized at one point by a simultaneous increase of the real interest rate and an appreciation of the real exchange rate (Figure 8). This dynamic behavior of real interest rates and the real exchange rate captures the behavior these variables had during 1980-1981 in Chile.

FOOTNOTES

[1]Dornbusch (1980) presents a similar model.

[2]There are several reasons why once the capital account is opened, capital inflows could initially overshoot their new (higher) equilibrium level. For example, it may be postulated that prior to the capital account liberalization there was an important stock disequilibrium, which is solved by the capital account opening. In the following periods, however, capital inflow will respond to new flow demand for credit. For an analysis of capital inflows in 1981 in Chile, see Edwards (1982b).

[3]Alternatively, we can assume that bonds denominated in domestic currency and bonds denominated in foreign currency are imperfect substitutes. Under these assumptions most of the results presented in this paper will still hold.

[4]This indeed was the case in Chile prior to the opening of the capital account in mid-1980. See Edwards (1982a).

[5]In the case of Chile, the direction in which these variables changed suggests that the result depicted in Figure 6 will be reinforced. See Edwards (1982a).

[6]After this paper was written, however, the peso was devalued by 18%. However, it might have been "too little, too late", to avoid the huge unemployment adjustment costs.

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