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POLITICAL RISK, ASSET SUBSTITUTION AND EXCHANGE RATE DYNAMICS: THE MEXICAN FINANCIAL CRISIS OF 1982

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DOCUMENTO DE TRABAJO

Núm. V - 1983

POLITICAL RISK, ASSET SUBSTITUTION AND EXCHANGE RATE DYNAMICS: THE MEXICAN FINANCIAL CRISIS OF 1982

by

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October, 1984

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Useful comments from Herminio Blanco, Everardo Elizondo, Albert Fishlow, Louis Makowski, Raúl Ramos, Steve Sheffrin, Lance Taylor and Jeffrey Sachs are gratefully acknowledged. Fiorella Tapia provided competent research assistance.

RESUMEN

Los riesgos cambiario y político han sido ambos reconocidos como elementos esenciales para determinar el grado de sustitución entre activos domésticos y externos. Hasta ahora sin embargo, los impactos macroeconómicos del riesgo político habían sido analizados en un contexto puramente estático a donde el riesgo político se introduce como una variable exógena. Este trabajo analiza la sustitución de activos y la dinámica de la tasa de cambio en un modelo en el cual el riesgo político es determinado endógenamente por el salario real. En particular, un choque que produce un deterioro del nivel de vida (por ejemplo, un empeoramiento en los términos de intercambio) producirá un sobredisparo de la tasa de cambio <u>sólo</u> si existe riesgo político. Diferentes tipos de intervención son también analizados. La crisis económica de México de 1982 (que dio lugar a una depreciación real muy grande) inspiró este modelo. El caso Mexicano es particularmente conveniente para analizar la interacción de los riesgos político y cambiario así como la dinámica de la tasa de cambio, debido a la existencia de un mercado de mexdólares hasta agosto de 1982. Las características de este mercado permiten una clara separación de los factores del riesgo considerados en el modelo.

ABSTRACT

Both exchange risk and political risk have been recognized as essential elements that determine the degree of substitution between domestic and foreign assets. So far, the macroeconomic effects of the existence of political risk have been analyzed in a purely static framework, in which the risk factor is introduced exogenously. This paper focuses on asset substitution and exchange rate dynamics in a model in which political risk is determined endogenously by the real wage. In particular, a shock that implies the deterioration of living standards (such as a worsening of the terms of trade) will produce overshooting of the exchange rate only if political risk is present. Different types of intervention are also studied. The Mexican economic crisis of 1982 (which produced a very large real depreciation) inspired this model. The Mexican case is particularly convenient to study the interaction of exchange and politital risk and the dynamics of the exchange rate, due to the existence of a Mexdollar market until August 1982. The characteristics of this market allows for a clear separation of the risk factors considered in the model.

1. Introduction.

The impact of political risk on asset substitution in the context of an open economy is an issue which has received increasing attention in the last decade[1/]. While initially the literature focused on asset substitution exclusively, in a recent contribution, Eaton and Turnovsky (1983) analyze how the economy may react to macro disturbances under varying degrees of capital mobility when both types of risk are present. So far, however, political risk has been associated with the probability of foreign debtors defaulting on their obligations and has been taken as a purely static and exogenous factor.

In this paper, we analyze the issue of political risk from a somewhat different and broader perspective. Domestic wealth holders are concerned here with potential losses in their own national bond holdings for fear that political and social unrest may eventually force government actions which could threaten their wealth position. The degree of political risk is endogenously related to the current macroeconomic situation, and to the real wage in particular, which is assumed to be an important underlying factor behind social unrest. The issue of capital flight and its impact on the exchange rate can thus be explored in a fully integrated dynamic setting and it is shown in particular that a significant degree of political risk will lead to an overshooting of the exchange rate in response to external shocks like a worsening in the terms

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[1/] Initial work was done by Aliber (1973). See also Dooley and Isard (1980).

of trade. Since that may occur even in the absence of explicit rigidities in the adjustment of the good and labor markets, the explanation which is offered here differs substantially from the ones usually given in the literature[2/].

The model is inspired in the recent experience of Mexico, which provides an especially interesting case to study the interactions of both exchange and political risk with the exchange rate, due to the existence of a "mexdollar" market (until August, 1982). Mexdollars were dollar denominated bank deposits available in the banking system which offered returns comparable to those available in the eurodollar market. In theory, these deposits were payable in "real" dollars upon demand, while peso deposits were also fully convertible into foreign exchange before exchange controls were imposed a few weeks after the closing of the mexdollar market[3/]. Given the characteristics of those assets, it is then possible to separate neatly the effects of exchange and political risk. Dollar and mexdollar deposits were very close substitutes, except for the political risk factor, since they were denominated in the same currency and offered similar yields; on the other hand, exchange risk was the only factor affecting the substitutability of pesos and mexdollars.

[2/] See the earlier contributions of Dornbusch (1976), McKinnon (1976) and Kouri (1976) and the more recent work of McKinnon (1981) and Dornbusch (1982, 1983).

[3/] An analysis of the functioning of the mexdollar market and its impact on monetary policy in Mexico can be found in Ize (1981) and Ortiz (1983).

The paper is structured as follows. Section 2 presents a brief summary of recent economic events in relation to the crisis of 1982 in Mexico. This background story is then used to motivate the model which is presented in Section 3. With this model, Section 4 analyzes how exchange and political risks interacted to generate the patterns of dollarization and capital flight which took place until August 1982, and Section 5 explains the collapse of the mexdollar market and its limits as a shock absorber. The following section goes on to analyze the dynamics of the exchange rate, while Section 7 provides a rationale for adopting a two-tier exchange control system. In Section 8 we present a brief synthesis of the main conclusions.

2. The Mexican Financial Crisis of 1982.

Table 1 shows some selected statistics for the Mexican economy over the period 1977-1982. As it can readily be seen, Mexico suffered a severe liquidity crisis in 1982. The flow of external funds in the form of public and private international borrowing declined from a peak of over 21 billion dollars in 1981 to just under 7 billion in 1982, while estimated capital flight reached around 8 or 9 billion dollars in 1981 and 6 billion in 1982[4/]. As a result, Central Bank reserves fell by 3 billion and the economy was forced into brutal stagflation. Following a

[4/] There are no accurate available figures of asset holdings abroad by Mexican residents. Yearly estimates of capital flight are based on the errors and omissions item of the balance of payments -although these figures include smuggling, overinvoicing, etc... Monthly estimates are derived from net sales of foreign currency by the Mexican banking system to the private sector adjusted for the indebtedness of the private sector and import and debt service requirements.

series of devaluations the consumer price index grew at an unprecedented rate of nearly 100 per cent while GDP fell slightly in real terms, the first decrease in five decades.

TABLE 1

Paradoxically, the problems of 1982 stemmed from a balance of payments crisis, after a period in which the country had received external funds in very large amounts, both in the form of oil revenues and foreign borrowing. Revenues from oil exports increased 12 times from 1977 until 1981 due to a combination of larger volumes (which increased at an average of 53 per cent a year) and steep price increases between 1979 and 1980. This resulted in a sharp improvement in the country's terms of trade. However, in an attempt to speed up economic development, government expenditures increased tremendously, at an average annual real growth rate of 10.0 per cent between 1977 and 1981, while current public income lagged behind (increasing at an average annual real growth rate of 6.0 per cent), giving rise eventually to an enormous financial deficit, that reached 14.5 per cent of GDP in 1981. Due to the availability of external funds, there was little financial crowding out during this period and private and public expenditures increased simultaneously[5/].

[5/] See Ortiz (1984) for a detailed account of the events leading to the 1982 crisis.

TABLE 1

ECONOMIC ACTIVITY IN MEXICO
1977-1982

ITEMS AND UNITS	1977	1978	1979	1980	1981	1982
GROSS NATIONAL PRODUCT (GDP)						
Real growth rate per year (%)	3.4	8.2	9.2	8.3	7.9	- [illegible]
Nominal growth rate per year (%)	34.9	26.4	31.2	39.4	37.0	5[illegible]
CONSUMER PRICE INDEX						
Average increase in the year (%)	28.9	17.5	18.2	26.3	28.0	5[illegible]
December-to-December increase (%)	20.7	16.2	20.0	29.8	28.7	9[illegible]
BALANCE OF PAYMENTS (millions of dollars)						
Current Account	- 1 596	- 2 693	- 4 871	- 7 273	- 12 544	- 2 684
Trade Balance	- 1 054	- 1 854	- 3 162	- 3 747	- 4 510	6 584
Exports	4 650	6 063	8 818	15 109	19 420	21 006
Oil Exports 1/	1 263	2 109	3 974	10 422	14 573	16 101
Non-Oil Exports	3 387	3 954	[illegible]4	4 687	4 847	4 905
Imports	5 704	7 917	11 980	18 856	23 930	14 422
Balance of Services	- 542	- 839	- 1 709	- 3 526	- 8 034	- 9 268
Inflows	4 527	5 590	7 446	9 815	11 390	9 712
Outflows	5 069	6 429	9 154	13 341	19 424	18 980
Financial	2 163	2 786	4 066	5 921	8 934	11 405
Other	2 906	3 643	5 088	7 420	10 490	7 575
Capital Account	2 276	3 254	4 533	11 948	21 860	6 079
Errors and Omissions	- 22	127	686	- 3 598	- 8 373	- 6 580
Reserve Variation	657	434	419	1 151	1 012	- 3 185
FINANCIAL DEFICIT OF PUBLIC SECTOR (billions of pesos)	126	156	224	322	853	1 660
SHARES WITH RESPECT TO GDP (Inflation adjusted)						
Financial Deficit of the Public Sector	6.8 (5.1)	6.7 (4.9)	7.3 (4.9)	7.5 (5.2)	14.5 (12.6)	17.[illegible] (15.[illegible]
Deficit in the Current Account of the Balance of Payments	2.0 (0.3)	2.6 (0.8)	3.6 (1.3)	3.9 (1.6)	5.2 (3.4)	1.[illegible] (-0.[illegible]

1/ Includes crude oil, natural gas, oil by-products and petrochemicals.

SOURCE: "Informe Anual 1982" Banco de México, (México, D.F. 1983)

Thus, within a short time, the country attained significantly higher levels of production and employment: from 1977 to 1981 the average annual growth rate was 7.4 per cent. However, due to excessive demand pressures, domestic prices rose at an annual pace of 23 per cent during that period while at the same time the exchange rate was kept practically fixed in an effort to stabilize the price level [6/]; as shown in Figure 1, the real exchange rate appreciated strongly. Altogether, the greater degree of openness of the economy resulting from oil export (the ratio of imports to GDP increased from 10.1 to 15.5 per cent between 1977 and 1981), the overvalued exchange rate and continuously high demand pressures, made the country increasingly vulnerable to external shocks.

F I G U R E 1

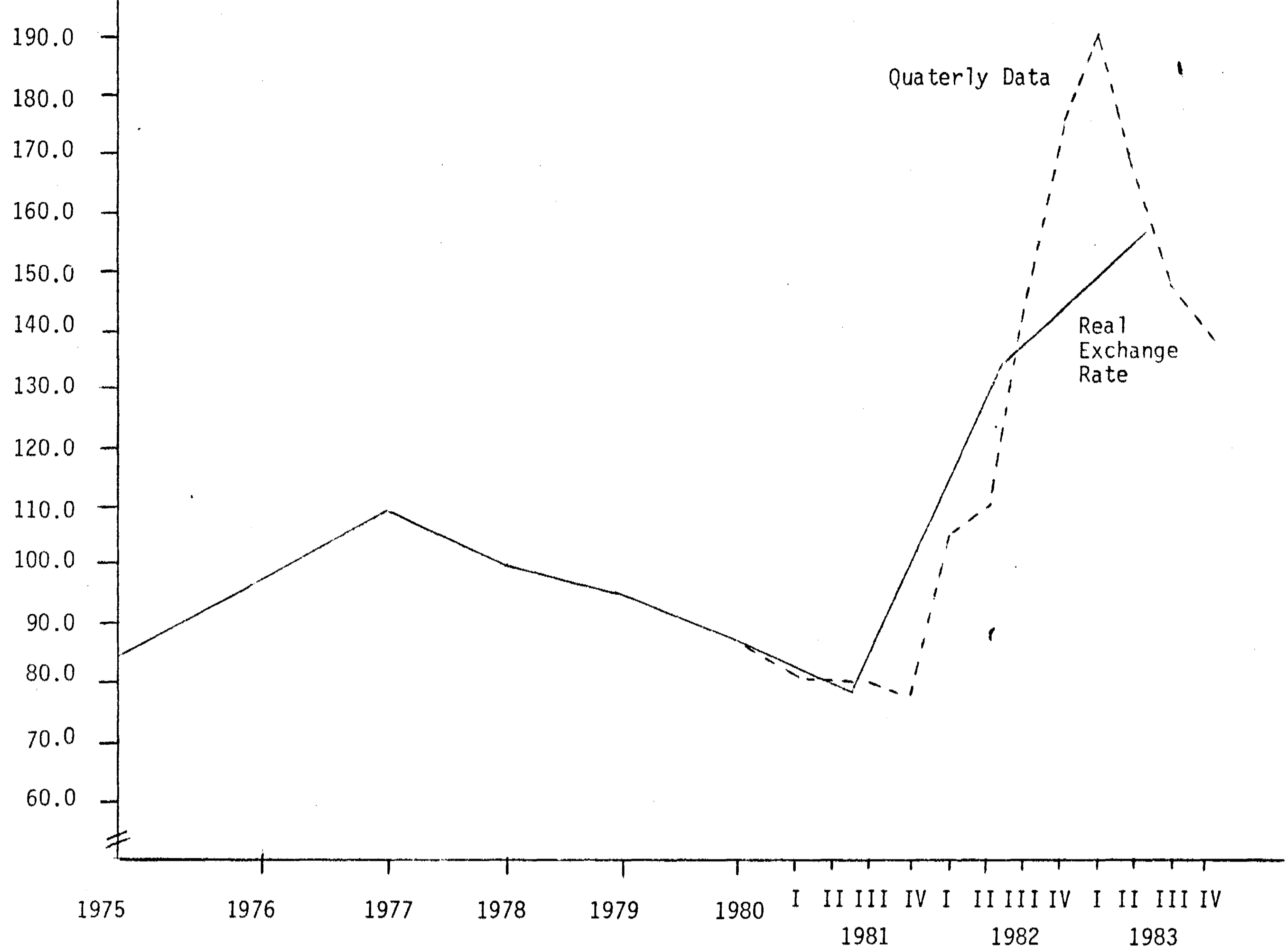
One first such shock was the rise in world interest rates; a second was the fall in oil prices in 1981. Together, they contributed to send the current account deficit soaring to an all times high of 12 billion dollars in 1981 [7/]. In response, an adjustment program was adopted in mid 1981, consisting of a 4 per cent reduction in government expenditures

[6/] Ize and Salas (1984) analyze the dynamics of inflation in Mexico over the last two decades,

[7/] In retrospect, it appears that the fall in oil prices hurt the Mexican economy more because of the government's attitude towards the fall than because of its sheer magnitude, which was relatively modest (2.5 dollars per barrel). Instead of acknowledging a weaker market and simply cutting the price of crude in line with other producers, the authorities refused to lower the price of Mexican oil for several months. The result was a severe decline in the volume of exports which from May to August averaged only 55 per cent of their value during the first four months of the year.

FIGURE 1

BEHAVIOR OF THE REAL EXCHANGE RATE
1978=100



for the second half of the year, greater trade restrictions, a gradual devaluation of the nominal exchange rate and some subsidy cuts. These measures, however, proved to be tardy and insufficient. The expenditure cut was never implemented, and both the domestic and external disequilibria were amplified. In particular, the continuing deterioration of the balance of payments gave way to expectations that the modest crawl of the peso (13.7 per cent on annual terms) would be insufficient to induce a correction of the current account. As a result, a sharp shift from peso into mexdollar deposits occurred from July to September of 1981, as shown in Figure 2. But together with a rising exchange risk, the public was probably also perceiving a rise in political risk, since portfolio preferences were simultaneously shifting from mexdollars into real dollars, as evidenced by the huge capital flight which took place in that year, made possible by massive government intervention financed by short term borrowing[8/]. As shown in Figure 3, capital outflows peaked in June and July of 1981, following the fall in oil prices, rebouncing at the end of the year and in January of 1982, when it became clear that no real adjustment had occurred in the macroeconomic management of the country.

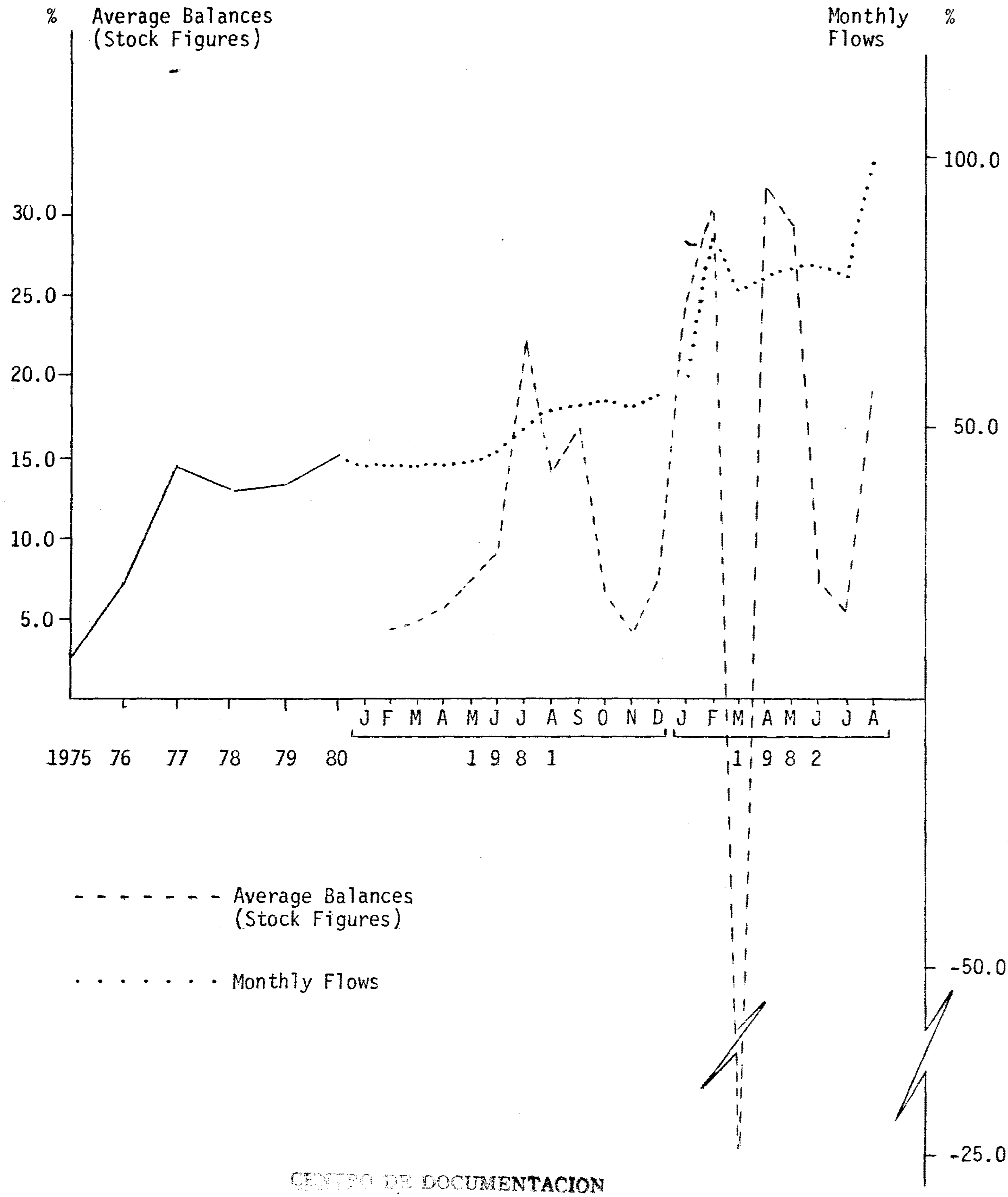
F I G U R E 2

The magnitude of capital flight finally forced the government to devalue the peso by 67 per cent in February of 1982. Following the announcement of a more adequate austerity program immediately after the

8/ More than 10 billion dollars were raised in the second half of 1981 in the international financial system; most of these funds were utilized to sustain the peso in the foreign exchange market.

Figure 2

DOLLAR DEPOSITS/TOTAL DEPOSITS
Mexican Banking System



devaluation, the public may have believed at first that the government had finally taken a more realistic view of the economic situation[9/]. The dollarization coefficient dropped sharply, as evidenced in Figure 2[10/]. In the four or five weeks following the devaluation- more than one billion dollars were transfered from mexdollars into pesos, while capital inflows occurred simultaneously, as evidenced again in Figure 3[11/].

Large wage increases were however granted at the end of March. Together with the wage adjustments already given in January, they canceled most of the potential real impact of the devaluation[12/]. Again, the public realized that no serious attempt of adjusting internal spending could be possible, given the size of the wage increases, and that by further delaying the day of reckoning, the final necessary adjustment would eventually have to be much more severe. Furthermore, confidence in the government's capacity to handle the crisis was severely jeopardized. As a result, the dollarization coefficient jumped again in April and May (see Figure 2)

[9/] The program included strong reductions in government expenditures, price controls and tariff cuts. More flexible interest rate and exchange rate policies were also adopted in an attempt to stop capital flight and avoid a new overvaluation of the peso.

[10/] Notice that the dollarization coefficients of Figure 2 (especially the stock dollarization ratio) show big jumps in February and August of 1982, when large devaluations occurred. This is due to the revaluation effects of the mexdollars in terms of domestic currency. Also, due to the maturity structure of the deposits, the public could not adjust their portfolios instantaneously after the devaluation.

[11/] The monetary authorities had in fact to intervene to prevent appreciation of the peso after the initial devaluation, so as to keep enough margin to absorb ensuing inflationary pressures.

[12/] Minimum wages had been increased by 34 per cent in January 1982, roughly in the line with the rate of inflation observed the year before. The rise granted in March was 30 per cent, making a total of 74 per cent for the first quarter, way above the inflation rate experienced until then.

and again the greater dollarization was accompanied by a renewal of capital outflows (see Figure 3).

F I G U R E 3

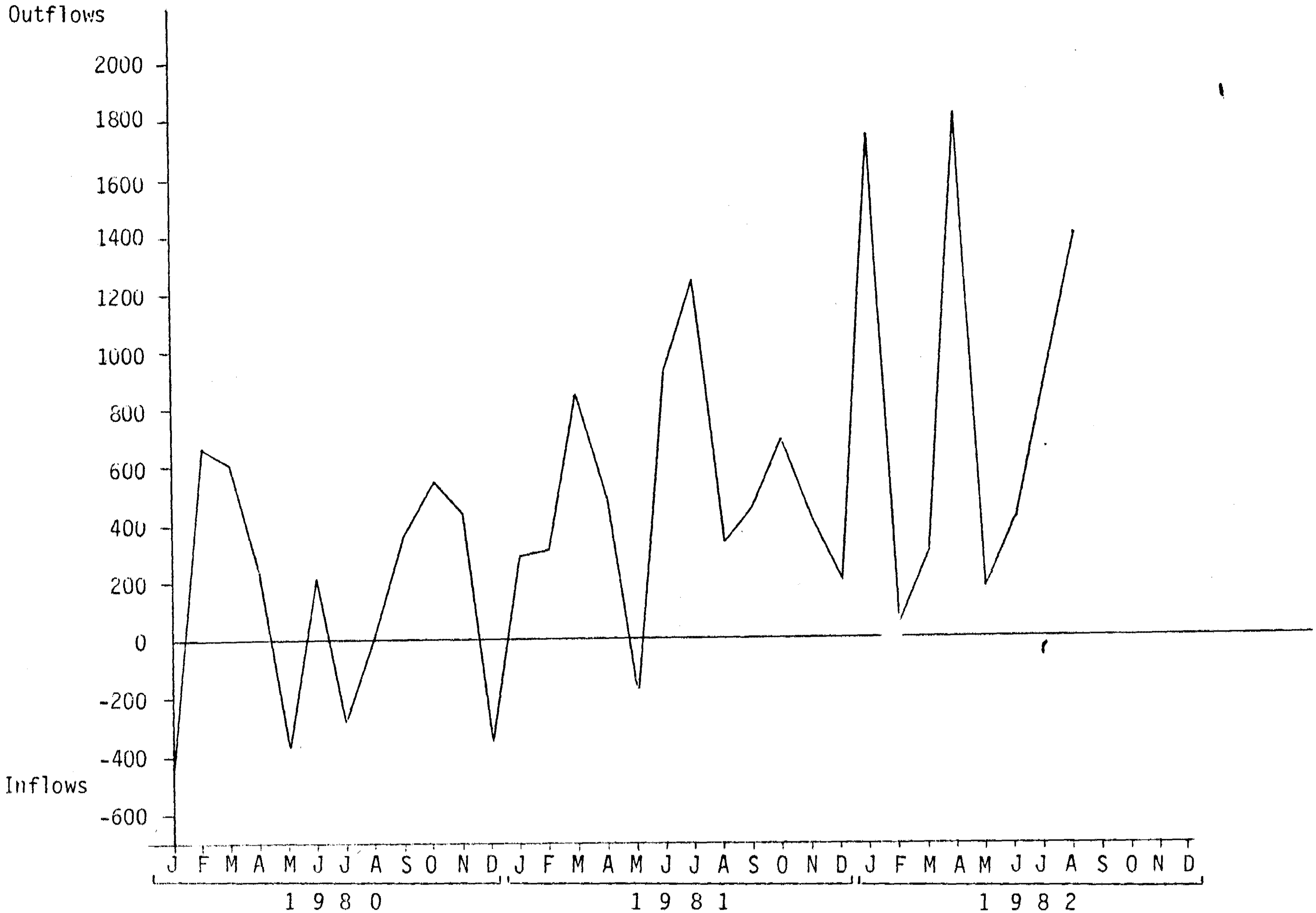
Figure 2 shows that during June and July the dollarization coefficient was reduced[13/]. However, following an announcement by the government of large price increases in basic food staples like corn, capital outflows were triggered again during these two months, as shown in Figure 3. This in contrast to the experience of previous months in which dollarization and capital outflows moved in the same direction. Apparently, the political risk factor was so strong that it dominated over exchange rate considerations. Mexdollars were being massively transfered abroad.

August and September marked the climax of the crisis. Following a brief experience with flexible rates and strong capital outflows in the first weeks of August, the mexdollar market was finally closed and mexdollar deposits were converted into pesos at a fixed rate while a two-tier exchange rate was implemented. The nationalization of the banking system and full exchange controls were finally announced in September 1st. Thereafter, the peso continued drifting downwards, first in the black market and then in the official market, until its value stabilized with the arrival of a new administration and the implementation of an IMF-sponsored stabilization program. By January, however, the peso had depreciated in the controlled

[13/] See in particular the flow coefficient of Figure 2.

Figure 3

ESTIMATED CAPITAL FLOWS*
(Millions of Dollars)



* Derived from the net sales of foreign exchange from the banking system to the private sector corrected for net imports, interest payments and net indebtedness. The August 1982 figure has been extrapolated on a monthly basis, given that the Central Bank ceased to intervene in the foreign exchange market around mid-August.

and free markets 3.5 and 5.6 times respectively, in relation to the parity prevailing on February 17, 1982. A devaluation of this magnitude was unprecedented in the country's history. Considering that prices doubled in 1982, the degree of overshooting of the real exchange rate with respect to any reasonable long run equilibrium level was enormous (see Figure 1).

The Mexican financial crisis of 1982 provides a rich background to analyze the issue of portfolio adjustments and exchange rate dynamics in the presence of both exchange and political risk. There are several aspects of this problem which seem particularly worth exploring. One is the explanation of dollarization and capital flight, which did not always follow symmetrical patterns. Another is the collapse of the mexdollar market and the unwillingness of the monetary authorities to use interest rates as a stabilization device, instead of intervening exclusively in the foreign exchange market. Still other issues are the overshooting of the exchange rate and the rationale for implementing the two-tier exchange rate system which is still now in operation. To this we will now turn, after presenting a model of asset substitution.

3. The Model.

Think of the Mexican economy as having four types of assets: a foreign dollar assets, b_d, and three domestic assets supplied by the government, money (pesos), "peso" bonds, B_p, and "mexdollar" bonds, b_m[14/]. In the presence of exchange risk, peso and mexdollar bonds are not perfect substitutes, as agents tend to hedge and hold both assets, even when

[14/] For simplicity, nationals are assumed to hold no foreign currency.

expected returns differ[15/]. Assuming perfect foresight, the portfolio equilibrium condition between these two assets can be expressed (in logs) as a function of the rates of return differential:

$$B_p - (e+b_m) = \alpha_0(r_p + \dot{p} - r_m - \dot{e}) + \alpha_1 \qquad (1)$$

where e is the nominal exchange rate set by the monetary authorities, p the domestic price level, r_p the real rate on peso bonds, r_m the (equivalent to a real rate, since foreign inflation is assesed to be zero) rate on mexdollar bonds and α_0 is finite in the presence of exchange risk. Rearranging terms, this expression may be rewritten:

$$b_p - b_m = \theta + \alpha_0(r_p - r_m - \dot{\theta}) + \alpha_1 \qquad (2)$$

where $\theta = e - p$ is the real exchange rate and $b_p = B_p - p$ are real peso bond holdings[16/].

Although denominated in the same currency, mexdollar and real dollar bonds are also imperfect substitutes, because of the existence of political risk. One way to conceptualize that risk is to link it with the potential loss of liquidity associated with exchange controls. Indeed, if mexdollars are not fully covered by dollar reserves, a run on mexdollars

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15/ Note that the stochastic source is not explicitely modeled and is considered invariant. This way of modeling risk is somewhat artificial but has been traditionally used, as it allows for a much simple formulation.

16/ As shown in Appendix 1, a reasonably good regression fit can be obtained for that equation during the period 1977-1982.

could precipitate a financial crisis and the possible closure of the exchange market. Since runs are more likely to occur when reserves are low, political risk could then somehow be related to the level of foreign exchange reserves[17/]. There are, however, some compelling reasons to think that this could not possible be the end of the story. Under stable social and political conditions, it is hard to see why a run of the magnitude which Mexico experienced in those years should have taken place. This is so because reserves would have been easily recovered if an adjustment of the real exchange rate could have been achieved painlessly with all the speed and strength required to turn around the current account disequilibrium. It is true that reserves are a stock and as such could not have been replenished instantaneously through the current account only; and it is also true that J-curve type of effects could have temporarily constrained the flow of foreign exchange earnings. But had an adjustment program of this nature been followed, the public could have anticipated that the country would have recovered very rapidly its international credit rating and would have been allowed to borrow against its anticipated foreign exchange earnings, thus improving at once its potential reserve position. In that context then, it seems unlikely that potential reserves could have been reduced to a critical level; the crisis should have remained instead within the purely economic sphere. Devaluation expectations would have probably affected the degree of dollarization, but there was no apparent need for such massive capital flight.

Real exchange rate adjustments however, do require compensating

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[17/] See Blanco and Garber (1983) for a recent contribution to the literature on speculative attacks applied to Mexico.

real wage adjustments and these may not be easily accepted[18/]. To the extent, then, that social and political unrest arises as consequence of a fall in real wages, wealth holders may come to expect a threat to their domestic wealth, due either to a change of political regime or to some redistribution intent to which the government may be forced in order to let the burden of the adjustment be more evenly shared. This "real threat" may now fully justify the possibility of a run and the imposition of exchange controls, thus reinforcing the whole process.

Let us define ω as the expected equilibrium real wage consistent with a sustainable current account target, derived from a realistic path of foreign borrowing. ω will be taken as the main structural factor behind political risk[19/] and the portfolio equilibrium conditions between mexdollar

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18/ There are at least two reasons why this should occur. A first reason, which is the one that will be stressed here, is the usual flow effect on the cost of imports-price of exports. But there is also a slightly more subtle mechanism of income redistribution between wealth holders and wage earners. Following a devaluation, mexdollar bond holders obtain capital gains. If the government actually attempts to honor them, it will either have to reduce its spending, which in the case of a country like Mexico will mean to a large extent a reduction in transfers to low income wage earners; or it will have to raise taxes and that, given again the limitations of the fiscal system, will probably be translated in large part in a regressive increase in indirect taxes. In both cases, however, the government will face rising political opposition as real wage earners income falls, and may thus eventually find it easier either to default or to pay back by issuing money and let the inflation tax erode the real value of financial assets.

19/ To the extent that a significant fall in output also takes place within the stabilization period, unemployment could also become a main determinant of political unrest. For greater simplicity, we are focusing here the analysis on the real wage while considering employment constant. Notice also that there exists a direct link between equilibrium real wage and total available external funds or "potential" reserves; as those reserves shrink, the equilibrium real wage falls. Our formulation based on the real wage is thus deeper, without being too restrictive.

and dollar bonds (b_d) can be expressed as:

$$b_m - b_d = \beta_0(\omega)(r_m - r_d - \beta_1(\omega)) + \beta_2 \qquad (3)$$

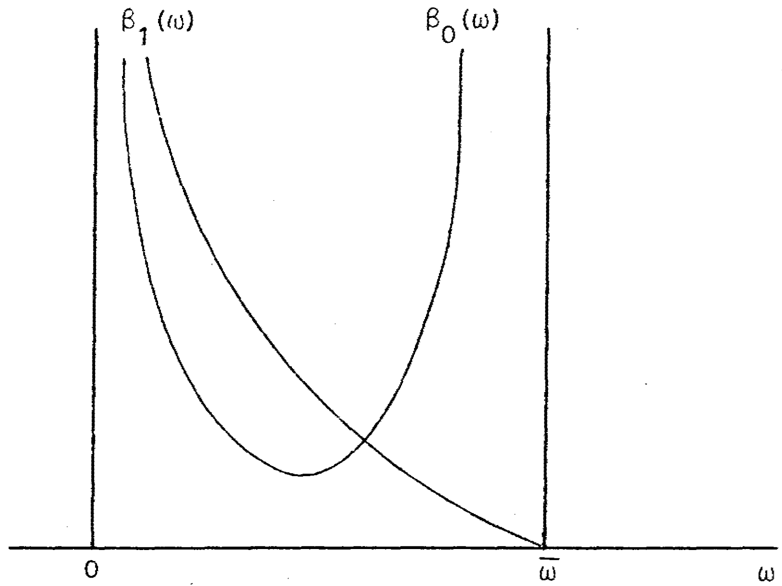
where r_d is the rate of return in dollars, β_0 is proportional to the variance of returns on mexdollar bonds and β_1 to the mean of the distribution. Both β_0 and β_1 are functions of the real wage, as shown in Figure 4. Above a minimum level, $\bar{\omega}$, no political risk is perceived and β_0 tends to infinity, β_1 to zero. As ω falls below $\bar{\omega}$, β_1 begins to rise and β_0 to fall. As ω approaches zero, both β_0 and β_1 tend to infinity, reflecting the fact that the magnitude of the expected loss rises without bounds and with near certainty, as the real wage falls too drastically[20/].

F I G U R E 4

On the supply side, let us suppose that the economy produces one non-competitive good with labor and intermediate goods as variable inputs. Since production takes time, working capital is needed in order to finance the acquisition of inputs. With a Cobb-Douglas production functions, it can easily be shown that the supply equation should have the

[20/] Because the expected availability in the public opinion of additional foreign borrowing is a variable which is difficult to ascertain, the econometric estimation of equation (3) presents problems, as mentioned in Appendix A. However, the sequence of events of 1981-1982 can be satisfactorily interpreted in the light of this equation, as shown in the next section.

FIGURE 4



following form[21/] :

$$y = \gamma_0 - \gamma_1\omega - \gamma_2\theta - \gamma_3 r \tag{4}$$

where y is output and r is taken as a weighted average of the three bond rates; for reasons which will become clear, let us write it as follows:

$$r = \gamma_4 r_p + (1-\gamma_4)[\gamma_5(r_m + \dot{\theta}) + (1-\gamma_5)(r_d+\dot{\theta})] \tag{5}$$

Since firms and wealth holders face symmetric problems, as far as exchange risk is concerned, it is reasonable to assume that the proportion of peso deposits to total dollars follows fairly similar patterns on the asset and liability sides; γ_4 may then be expected to rise with the proportion of peso bond holdings into total holdings[22/]. On the other hand, since political risk cannot be easily defined for firms, the dollar/mexdollar proportion will simply be taken as given and γ_5 assumed to be constant.

Let us then consider the following balance of payments equilibrium condition:

$$\dot{b}_d = \delta_0\theta - \delta_1 \tag{6}$$

[21/] A more rigorous formulation should include lagged real wages and exchange rates, as well. An equation of this type is formally derived and succesfully estimated in Ize and Salas (1984). For greater simplicity we will consider here current money wages and exchange rates only.

[22/] This has been the case in Mexico; the dollarization of the economy has proceeded along very similar paths on both sides of the balance sheet.

Equation (6) expresses that the current account is a function of the real exchange rate and that foreign bonds can be acquired through a current account surplus[23/].

To close the model and keep it simple, let us finally assume that y and b_p are constant[24/].

4. Dollarization and Capital Flight.

As evidenced in Figure 5, the monetary authorities never attempted to manipulate the mexdollar premium as a way to influence portfolio decisions and control capital flight. While the rationale for following that line of policy will be examined in the next section, the invariance of the mexdollar premium implies that changes in the ratio of mexdollar to dollar deposits over that period should be a reflection of a changing perception of political risk. Based on the estimates of capital flight used in Figure 3 and initial balances obtained from deposits held by Mexicans in the US, a rough estimate of the ratio of dollar to mexdollar assets for the period 78-82 can be obtained, as shown in Figure 6[25/]. It clearly indicates that perceived political risk fell steadily in 78 and 79, as a result of favorable expectations associated with a booming economy. However, it started rising

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23/ The flow of foreign borrowing is assumed to be exogenous and included in the constant term.

24/ A constant output is clearly not a very realistic assumption since significant output adjustments, due to wage resistance and J-curve effects, are generally present in any stabilization experience. But the analysis would otherwise become too cumbersome without being more illustrative.

25/ Monthly data on the holdings of deposits on US banks by Mexicans are published in the US Treasury Bulletin.

in 1980 to reach unprecedented levels in mid-1982, just before the collapse of the mexdollar market.

FIGURE 5

FIGURE 6

It is also apparent from Figure 5 that the spreads between peso and dollar interest rates —which begun to increase rapidly in 1980— responded to inflation differentials between Mexico and the U.S. The real peso rate was much more stable up to mid-1982. Movements in the dollarization coefficient should therefore be interpreted as responding mainly to changes in the perception of exchange risk [26/].

Going back to Figure 2, it can then be seen that perceived exchange risk, which had risen strongly in 1981, fell abruptly after the initial February 1982 devaluation, only to increase again in April and May after the wage increases announced at the end of March —as mentioned earlier. Following the graph, exchange risk would seem to have fallen again in June and July. This

[26/] As indicated earlier, sharp shifts in the dollarization coefficient can also be expected following a devaluation, as agents cannot adjust their portfolios immediately, given the term structure of their deposits.

FIGURE 5

INFLATION AND INTEREST RATES

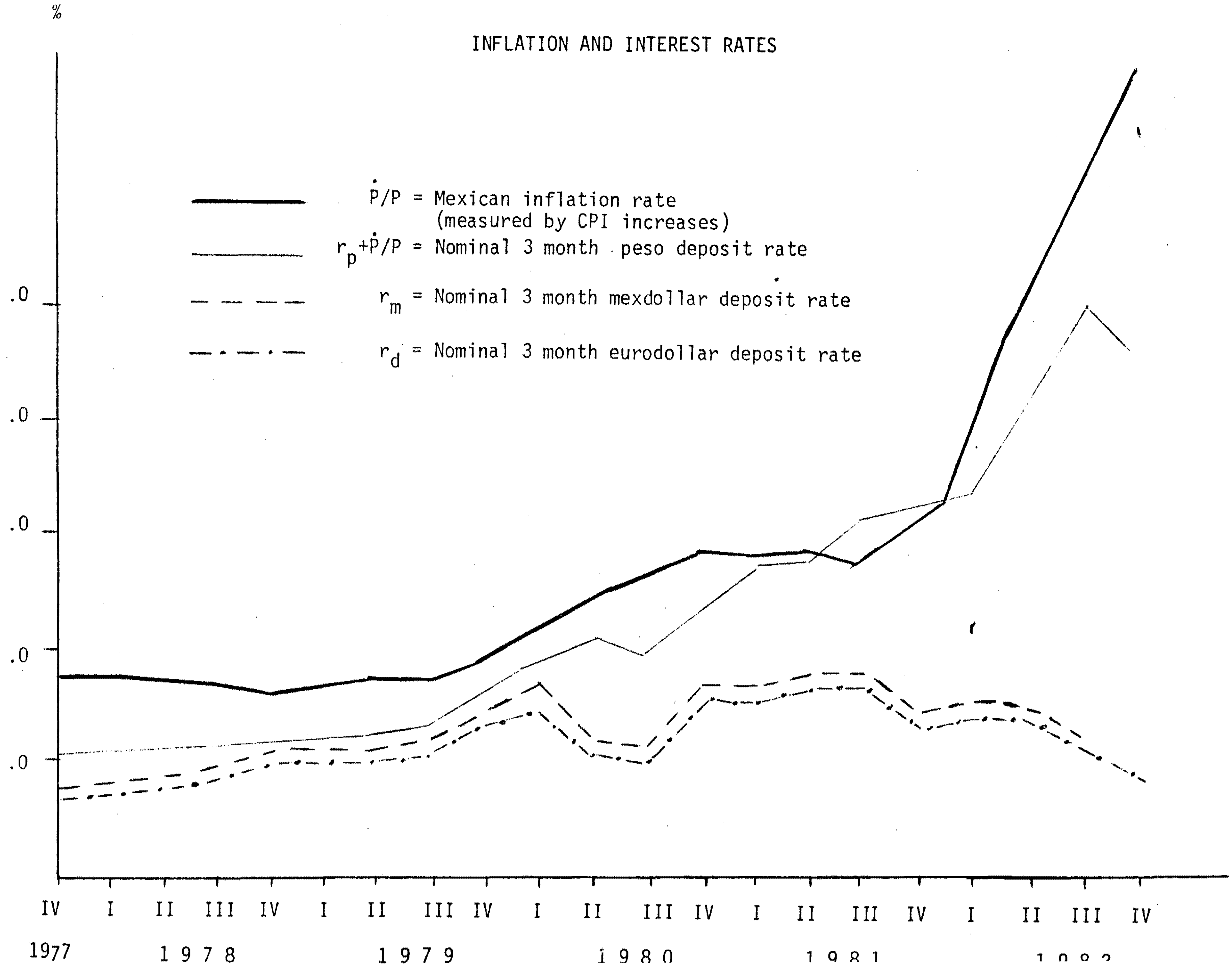
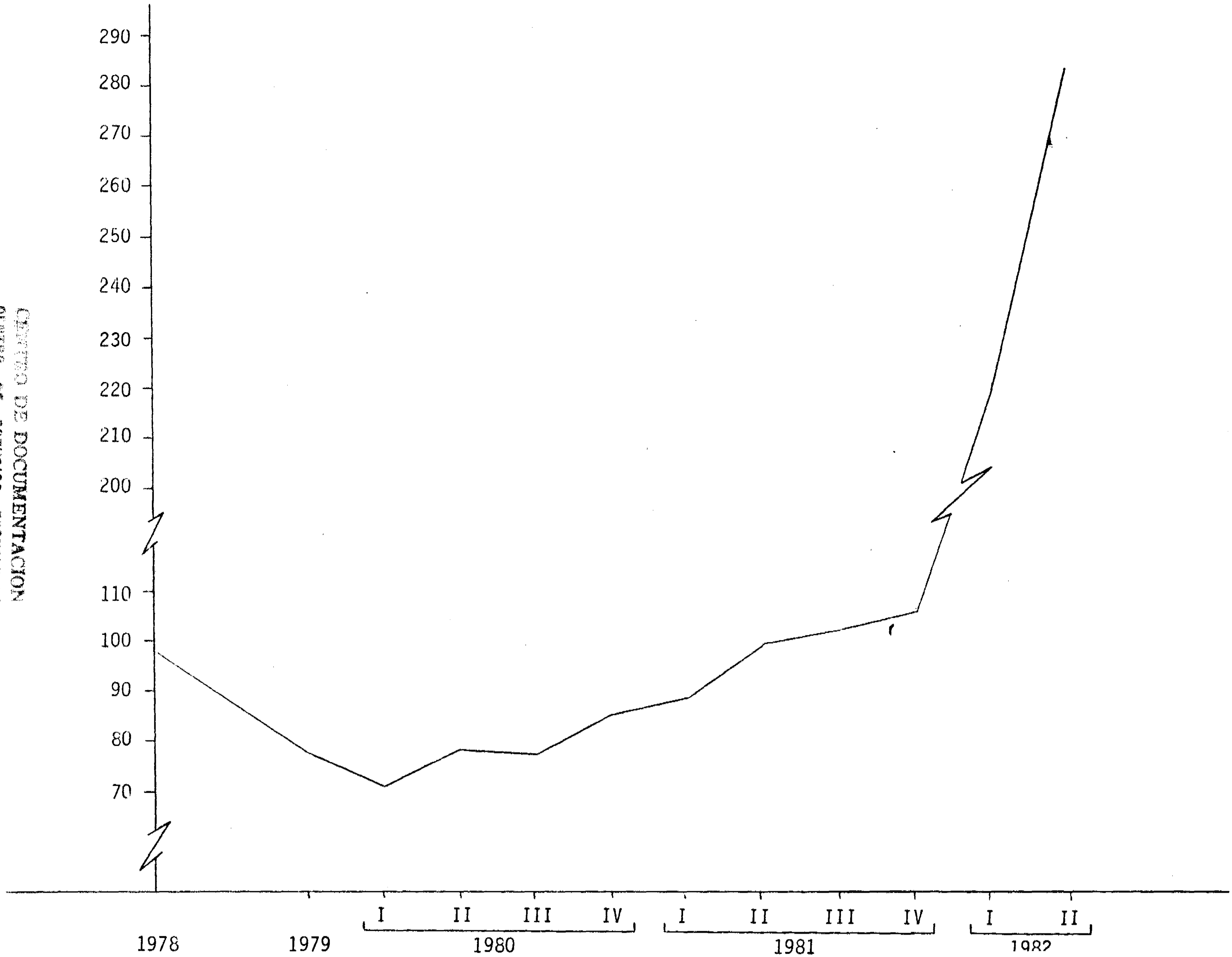


Figure 6

FOREIGN ASSETS/MEXDOLLARS



apparent fall, however, merely reflects the fact that mexdollars ceased to be, in the minds of the public, credible hedging instruments. The public realized that the depletion of foreign exchange reserves and the difficulties faced by the government in obtaining external credit would make it unfeasible to sustain the mexdollar system. That is, that mexdollars could not stand the pressures of the crisis. Thus, both pesos and mexdollars were being massively transfered abroad, leading to the collapse of the mexdollar market in August of that year. In the following section, an attempt is made to explain this collapse utilizing an equilibrium model of rational behavior.

5. The Collapse of the Mexdollar System.

The collapse of the mexdollar system can now be analyzed as follows. Suppose that the central bank, perhaps because it has low foreign exchange reserves, does not want to intervene any more in the foreign exchange market, but can manipulate interest rates in such a way as to maintain the public in a position of complete long run asset equilibrium; b_p, b_m and b_d are thus fixed and (6) implies that the exchange rate must remain at its steady state value:

$$\theta^* = \delta_1 / \delta_0 \tag{7}$$

Substitute then r_p from (2) into (5) and then r from (5) into (4) to obtain the factor price frontier:

$$\gamma_1\omega+(\gamma_2-\gamma_3\gamma_4/\alpha_0)\theta^*+\gamma_3(\gamma_4+\gamma_5(1-\gamma_4))r_m+\gamma_3(1-\gamma_4)(1-\gamma_5)r_d$$

$$+\gamma_3\gamma_4(b_p-b_m)/\alpha_0-\alpha_1\gamma_3\gamma_4/\alpha_0-\gamma_0+y = 0 \qquad (8)$$

The system of equations (3) and (8) is shown graphically in Figure 7. The factor price frontier (FPF) is a downwards sloping curve in the (r_m,ω) space. The dollar/mexdollar portfolio equilibrium condition (DM) has a hyperbolic shape: r_m tends to infinity as ω tends to zero and to r_d as ω tends towards $\bar{\omega}$. In general there could exist two equilibria but only the one with the smaller premium is stable and can thus be expected to prevail. Suppose then that the economy is initially at E; at that poir' the real wage is high enough to discard any probability of a crisis, so that no premium is required on mexdollars. The later can function as perfect substitutes for foreign deposits and the use of a mexdollar system enables the country to save on the acquisition of real dollars which would otherwise be needed in order to satisfy the need of the public to hedge against exchange risk[27/].

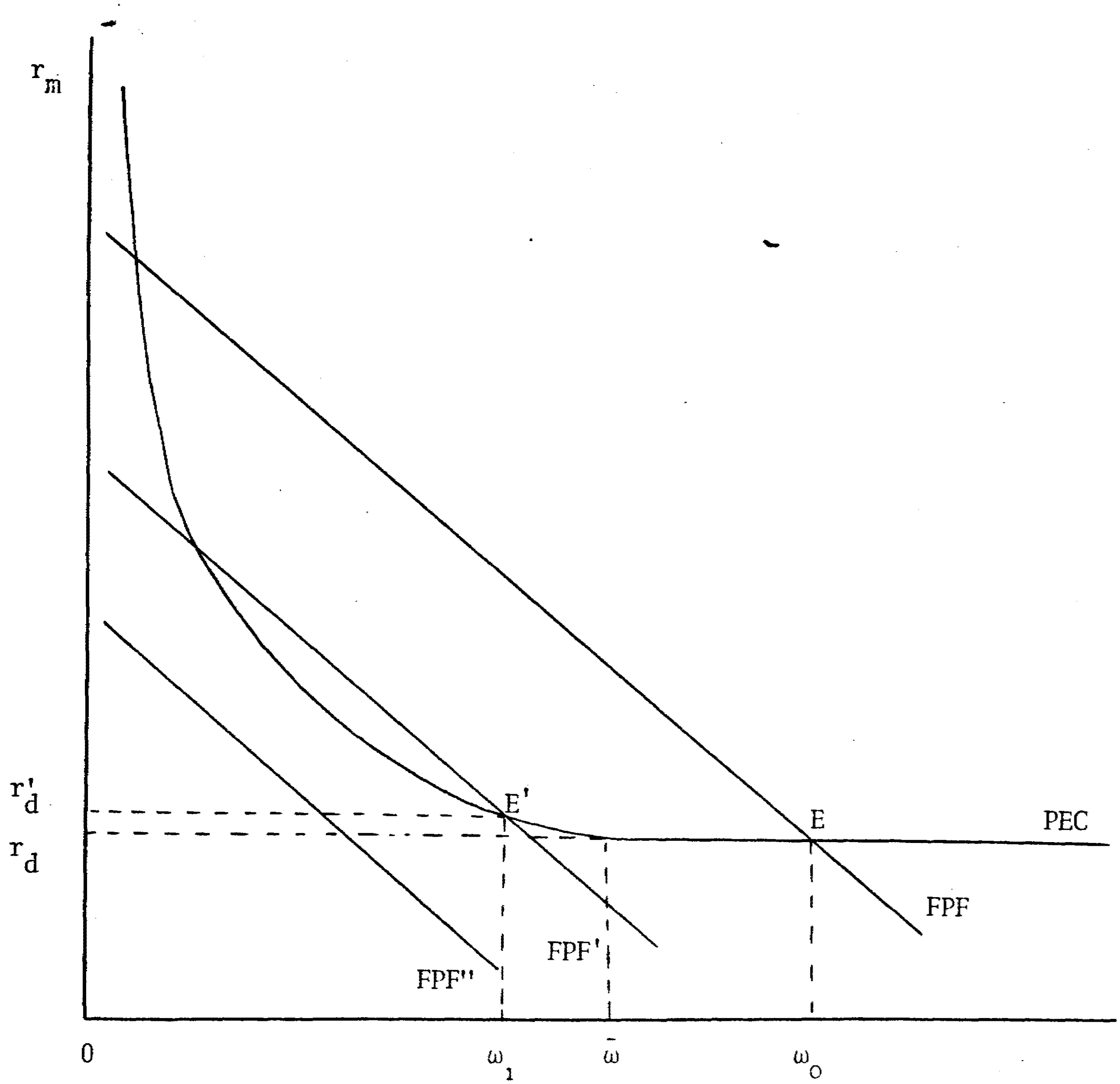
F I G U R E 7

Suppose that an external shock now occurs, such as an adverse shift in the terms of trade, a fall in foreign demand or a reduction in international borrowing availability, causing a rise in the equilibrium exchange rate. The factor price frontier will then shift in a direction which depends on the sign of the expression $\gamma_2-\gamma_3\gamma_4/\alpha_0$ [28/]. If the economy

[27/] Note that net savings for the country as a whole will only occur if the real growth rate of the economy is higher than the real rate of return on foreign bonds, a requirement that is likely to hold in a long run perspective.

[28/] The indeterminancy in the sign of this expression is due to the fact that a rise in θ^* produces a positive valuation effect on dollar holdings, thus increasing the demand for peso bonds relative to dollars. The peso rate might thus fall enough to compensate for the higher mexdollar rate in the overall weighted average.

F I G U R E 7



is financially open (γ_4 is substantially smaller than one) and if peso and dollar bonds are not too distant substitutes (α_0 is large), this expression will be positive and a rise in θ^* will shift the FPF to the left. As shown in the Appendix A, that was the case for Mexico. A new equilibrium is then obtained at E' with a lower real wage and, because of the associated higher political risk, a now positive mexdollar premium. Interest rate intervention enables the central bank to stabilize the situation successfully without having to intervene in the foreign exchange market and deplete its international reserves.

But suppose now that an additional external shock pushed the FPF further to the left (to FPF"), into the region in which the curves no longer intersect. Interest rate intervention is no longer feasible in this position, and a foreign exchange crisis cannot be avoided unless exchange controls are quickly imposed. The reason is that a substantial fall in the real wage can raise the degree of political risk to a point where a run would take place unless a very high premium is paid on mexdollars. But because of their feedback effect on the real wage and hence on political risk, higher interest rates may end up being destabilizing rather than stabilizing.

The mexdollar system is thus effective only as a long as the reserve position of the country is secure or as long as disturbances are of a "moderate magnitude". Too large a shock will eventually exhaust the country's reserves and prevent interest rate intervention, making the imposition of exchange controls unavoidable[29/]. This observation explains why the system was effective in cushioning the 1976 crisis in Mexico, which had the same characteristics but a much smaller magnitude than its 1982 follow-up[30/], but was unable to survive the series of larger recent shocks. It also explains why the monetary authorities did not attempt in the recent crisis to intervene more decisively through interest rate manipulation.

6. Political Risk and Overshooting.

The analysis has been centered so far on the properties and feasibility of a mexdollar system. Let us now focus our attention on the characteristics of the adjustment paths obtained in the presence of political risk when the system is disturbed by an external shock that raises the equilibrium real exchange rate, but no intervention is attempted —as was indeed the case after the collapse of the mexdollar system in August 1982. This implies that the mexdollar rate is kept equal to the

29/ Furthermore, if it seems likely that the economy will face very large shocks, mexdollars should be avoided altogether since they are likely to make the economy even more fragile. As a matter of fact, to the extent that mexdollars and real dollars are imperfect substitutes, the elimination of a mexdollar system is likely to raise the proportion of peso bonds held by domestic residents. As seen before, a higher γ_4 in equation (8) would tend to reduce the magnitude of the leftwards shift of the FPF, hence making the system more stable. The reason behind this result is simply that a rise in the real exchange rate, by depressing the value of peso versus dollar bonds, reduces peso rates relative to mexdollars. If the proportion of wealth held in pesos is larger, the final impact on the cost of working capital will be reduced and real wages will not have to fall by as much as in the previous case.

30/ The dollarization response of the economy to the 1976 crisis can be checked in Figure 2.

dollar rate. The addition of equations (2) and (3) eliminates the mexdollar term and yields the following portfolio equilibrium condition:

$$b_d = b_p - \theta + \alpha_0(\dot{\theta}+r_d-r_p) + \beta_0(\omega)\beta_1(\omega)-\alpha_1-\beta_2 \tag{9}$$

For simplicity, let us assume that the function $\beta_0(\omega)\beta_1(\omega)$ can be approximated linearly, so that (9) may be rewritten:

$$b_d = b_p - \theta + \alpha_0(\dot{\theta}+r_d-r_p) - \alpha_2\omega + \alpha_3 \tag{10}$$

On the supply side, substituting (5) into (4), with $r_m=r_d$, gives:

$$\gamma_1\omega + \gamma_2\theta + \gamma_3\gamma_4 r_p + \gamma_3(1-\gamma_4)(r_d+\dot{\theta}) - y = 0 \tag{11}$$

Substituting now ω from (11) into (10) and rearranging terms we obtain:

$$\begin{aligned} \Delta\dot{\theta} = {} & (\gamma_1-\alpha_2\gamma_2)\theta + \gamma_1(b_d-b_p) + (\alpha_0\gamma_1-\alpha_2\gamma_3\gamma_4)r_p \\ & -(\alpha_0\gamma_1-\alpha_2\gamma_3(1-\gamma_4))r_d + \alpha_2 y \;/\; \gamma_1-\alpha_3 \end{aligned} \tag{12}$$

where $\Delta = \alpha_0\gamma_1 + \alpha_2\gamma_3(1 - \gamma_4)$. Together with the balance of payments equation (6), this system can be easily visualized in Figures 8 and 9.

The long run equilibrium of the balance of payments $(\dot{b}_d = 0)$ is obtained on the BB curve at the equilibrium value of the real exchange rate, θ^*, in Figures 8 and 9. The AA curve represents real exchange rate equilibrium. It will slope downwards (Figure 8) if $\alpha_2 < \gamma_1/\gamma_2$, that is, if the political risk factor is not very important and/or the economy tends to be closed on the real side. Instead, in a fairly open economy with significant political risk, the AA curve will be upwards sloping (Figure 9). It is easy to check that the steady state equilibrium is a saddle point in both cases. Hence, if the economy starts with dollar balances wich are too low, the exchange rate needs to depreciate, so that dollar holdings can rise over time.

F I G U R E S 8 and 9

Suppose now that the economy is initially at the steady state and a foreign shock raises the equilibrium real exchange rate represented by a shift of BB to BB'. It is then easy to see that in the first case (Figure 8), the exchange rate will immediately depreciate to E_0 and then go on depreciating gradually on the saddle path. In the second case, however, there will be overshooting, as shown in Figure 9. The difference arises because in the case of strong political risk, the lower real wage and higher political risk induced by a higher equilibrium exchange rate raises the steady state demand for dollars. In contrast, in the case of low political risk, the valuation effect obtained when dollar holdings are computed in pesos at a higher exchange rate is strong enough to reduce the amount of dollar demanded, relative to pesos.

In the more general case of the strong nonlinearities in political risk that were assumed previously, the varying strength of the risk factor would give rise to an AA curve such as the one in Figure 10.

FIGURE 8

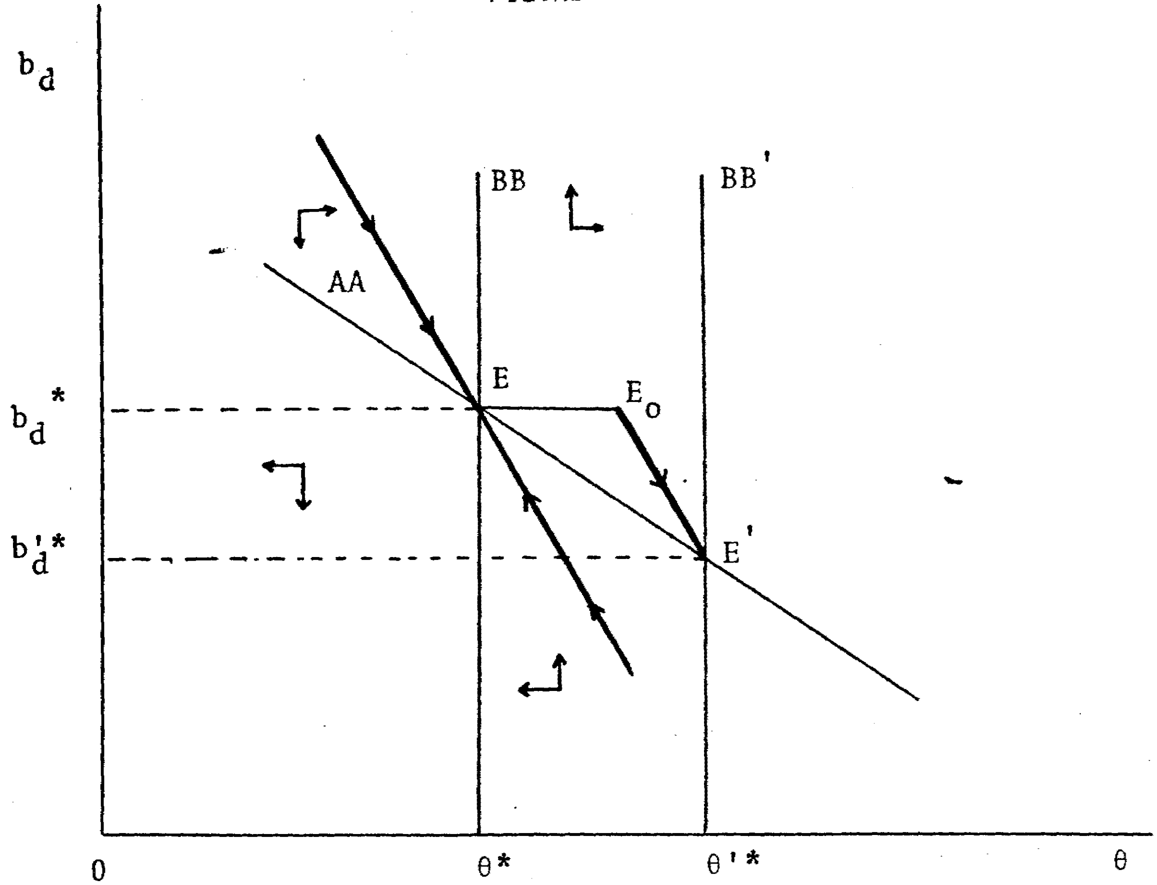
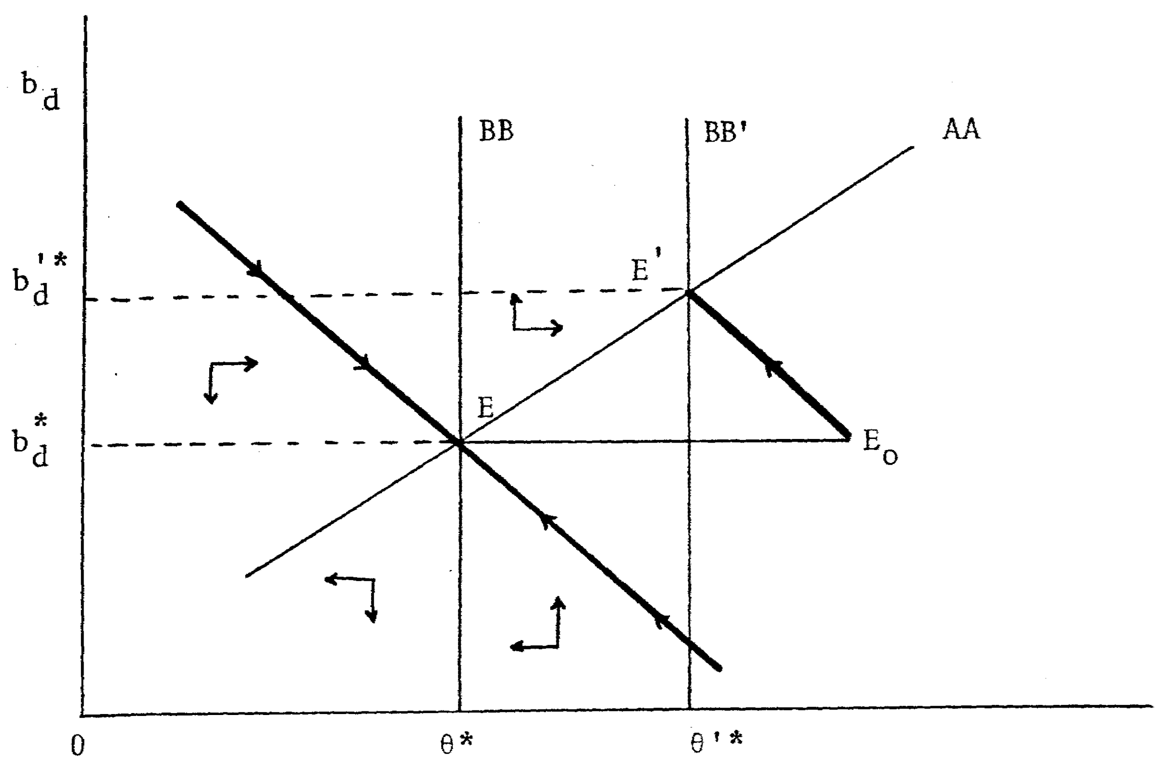


FIGURE 9



It is worth then noticing again that small shocks would not produce any overshooting, while larger shocks would. Hence, substantial overshooting caused by shifts in the equilibrium exchange rate can only be explained if political factors are important, the economy is widely opened and the shock that hits the economy is large, three conditions that seem to have been met in the 1982 crisis.

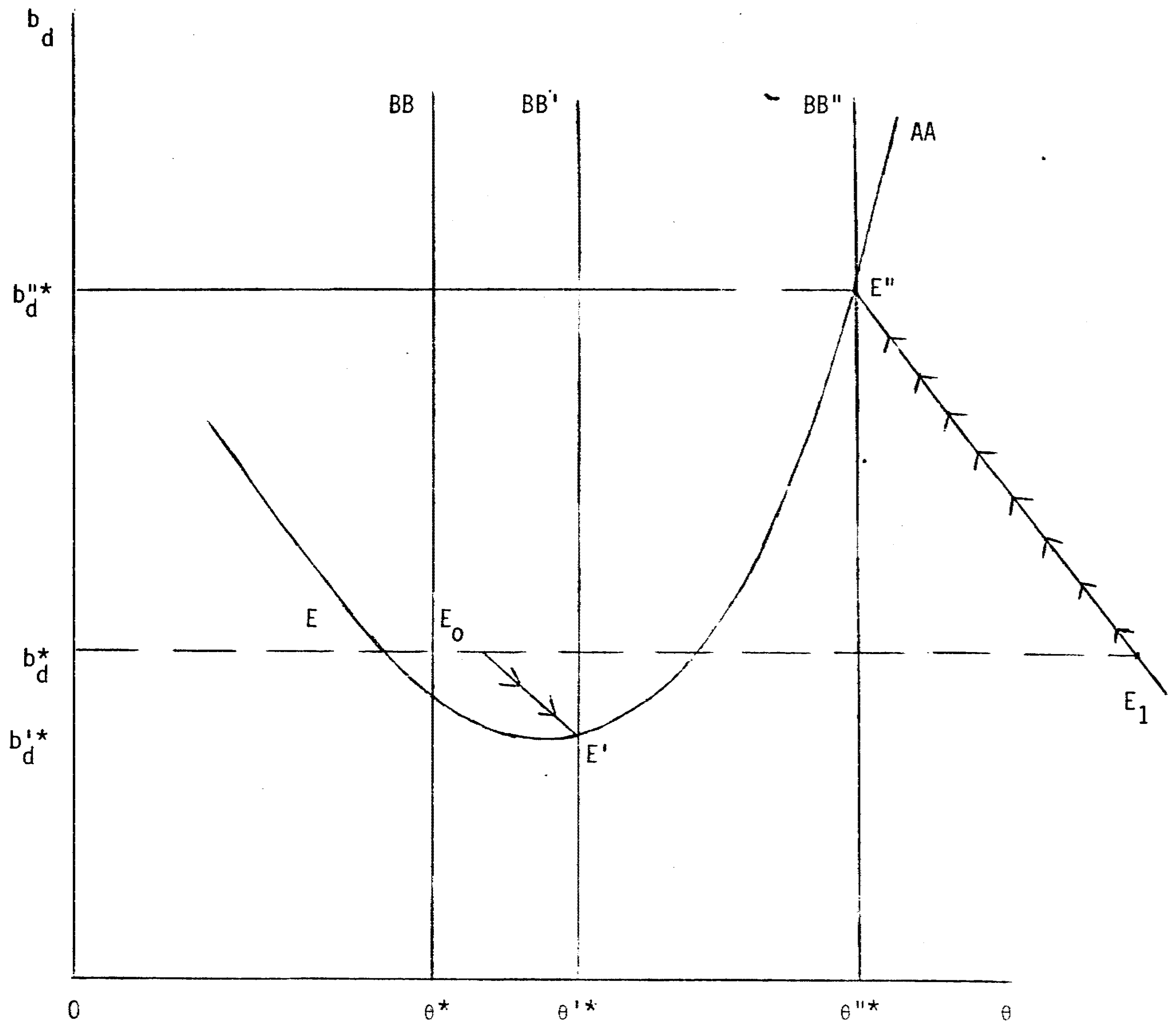
F I G U R E 10

7. Intervention, Exchange Rate Policy and Overshooting.

Large overshootings of the exchange rate are clearly undesirable, as they introduce political uncertainties and may cause wide disruptions on the real side of the economy, based on price signals which are not permanent. Also, to the extent that real wages are rigid and the government is obliged to follow a partly accomodative monetary policy, the fall in real wages induced by the overshooting of the exchange rate might generate a vicious inflationary spiral whose dynamics might be hard to control. Therefore, it is important to implement machanisms that reduce the magnitude of the overshooting.

Interest rates are an instrument that could be used. Changes in the peso interest rates will shift the AA curve (see equation (12)) and a downwards shift would clearly reduce the size of the overshooting. However, the direction of the required adjustment in the interest rate is not clear, as it depends on the sign of the expression $\alpha_0\gamma_1 - \alpha_2\gamma_4\gamma_3$. Hence, in a situation of high political risk (α_2 is high),

FIGURE 10



significant interest rate effects on output (γ_3 is high) and substantial openness of the economy (γ_1 is small), a rise in the level of real interest rates could give a further boost to the overshooting phenomenon by lowering real wages even more and further exacerbating political tensions and risk. If the government does not feel totally confident about the values of those coefficients, it might be very risky to venture into an abrupt intervention program in the middle of a crisis.

If interest rate intervention is thought to be too risky, a two-tier exchange rate system can provide a more reliable and safer way to reduce overshooting. To see this, assume that the government can force transactions in the current account to be realized at a controlled exchange rate $\bar{e}$, and then resells at the free market rate e the foreign exchange derived from a current account surplus. Suppose, also, that the controlled rate is adjusted progressively to close the gap over time between the two rates, and eventually converge to the steady state rate. If $\bar{\theta}$ is the real controlled exchange rate, then $\bar{\theta}$ follows the adjustment path:

$$\bar{\theta} = (1 - \nu)\theta + \nu\theta'^{*} \quad , \qquad \nu \in [0,1] \tag{13}$$

where θ'^{*} is the new equilibrium exchange rate (after the shock) and ν equals zero when no exchange controls at all are imposed, ν equals one when a maximum spread is imposed between the two rates and the real controlled rate is fixed once and for all. Note that, on the real side, $\bar{\theta}$ replaces now θ in the factor price frontier and in the balance of payments equations while, on the financial side, the uncontrolled θ is left unchanged in the portfolio balance equation. After using the adjustment rule (13), the two modified equations may now be rewritten:

$$\gamma_1\omega + \gamma_2(1-\nu)\theta + \gamma_3\gamma_4 r_p + \gamma_3(1-\gamma_4)(r_d+\dot{\theta})+\gamma_2\nu\theta'^{*}-y = 0 \quad (14)$$

$$\dot{b}_d = \delta_0(1-\nu)(\theta - \theta'^{*}) \quad (15)$$

After substituting, as before, ω from (14) into (10), an equation of the following type is obtained:

$$\Delta\dot{\theta} = \left[\gamma_1-\alpha_2\gamma_2(1-\nu)\right]\theta + \gamma_1(b_d-b_p)-\alpha_2\gamma_2\nu\theta'^{*}+A \quad (16)$$

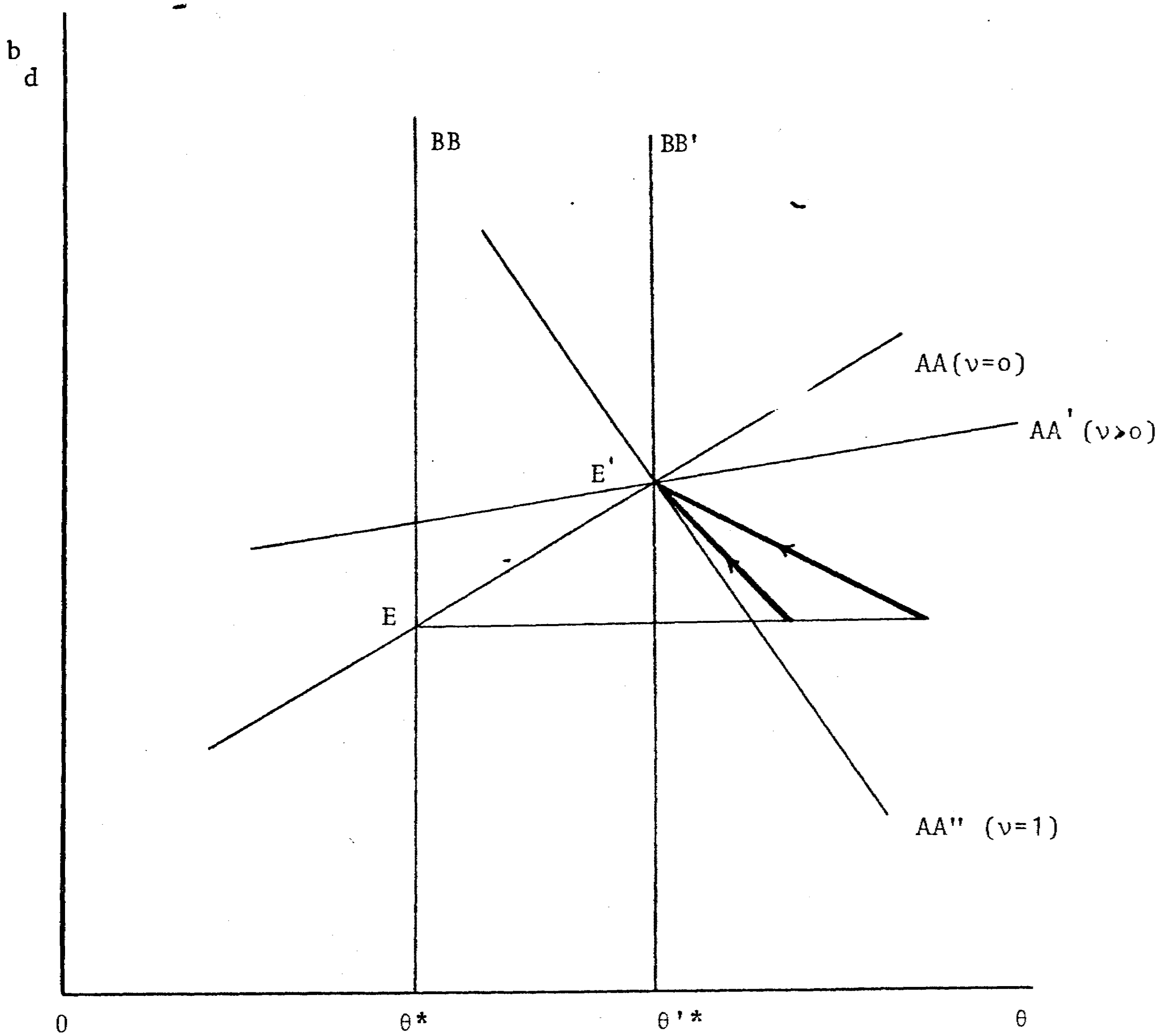
where A is a constant term identical to the ones in equation (12). It is easy to check in Figure 11 that as ν rises, this AA curve rotates clockwise around the steady state equilibrium. Hence, tighter exchange controls would seem to imply smaller overshootings. This intuition can easily be checked mathematically[31/].

F I G U R E 1 1

Thus, it appears that two-tier systems can reduce overshooting. The dilema which the government has to face however in choosing a degree of exchange controls is the size of the overshooting versus the length of the adjustment path. As a matter of fact, since a lower controlled rate means a smaller current account surplus, it will clearly take longer for the public to adjust its portfolio to the amount of dollar bonds

31/ See Appendix C.

FIGURE 11



required in the steady state. In the limiting case of extreme exchange controls ($\nu = 1$), a repressed demand for dollars will in fact always remain, and the gap between the free and controlled exchange rates will never close[32/].

8. Conclusions.

In this paper, the Mexican financial crisis of 1982 was utilized to illustrate the impact of exchange rate and political risk on real and financial variables in an open economy. Since political risk was associated with movements in the real wage, a feedback loop linking financial variables —such as asset demands— with real variables could be systematically explored.

It was found that the above mentioned relationship could render monetary policy ineffective. By raising interest rates, instead of providing an incentive to retain domestic savings, the authorities could provoke capital outflows through the lowering of real wages and the increased perceived political risk. That mechanism was used to explain the collapse of the mexdollar market in Mexico and the introduction of exchange controls. On the other hand, when monetary authorities chose not to intervene, political risk was shown to produce an overshooting of the exchange rate when a shock induced a steady state demand for foreign assets

32/ In particular, if smuggling is significant (and it usually is when multiple exchange rate systems are imposed) then this problem would not disappear.

too high to be satisfied through the wealth effect of a devaluation. The channel of transmission was again a fall in the real wage and a rise in political risk. It was shown, finally, that a two-tier exchange control system, by cutting one of the channels of that feedback loop, could effectively shrink the magnitude of the overshooting and was therefore a valuable alternative to reduce the real negative impact of excessive exchange rate fluctuations.

APPENDIX

A. Estimations.

The simultaneous estimation of the structural equations of the model is not possible, due to the problems presented by equation (3), the equilibrium condition between mexdollar and dollar deposits. Since ω is the expected equilibrium real wage, this variable depends on the public's expectation of the additional borrowing capacity of the country, a difficult notion to model for empirical purposes. Another problem faced in estimating equation (3) is the lack of appropriate information[1/]. Therefore, only the structural equations (2) and (4) were estimated utilizing quarterly data from 1977(IV) to 1982(III). The estimating period begins with the liberalization of the mexdollar interest rates and ends with the collapse of the mexdollar market. The interest rate differential term of equation (2) was modified to include the expected depreciation of the exchange rate -as measured by the forward market. The estimated resulting equation was

$$b_p - b_m - \theta = \alpha_0 \left[1 + r_p - \frac{e_{t+1}}{e_t} (1 + r_m) \right] + \alpha_1 \qquad (2')$$

where e_{t+1} is the 3 month forward rate and e_t is the spot exchange rate. The values of γ_4 and γ_5 (of equation 5) were computed directly from the data in order to construct the weighted interest rate, r, of equation 4. The values for γ_4 and γ_5 obtained were .731 and .663, respectively. The regression results

---

[1/] The available data on the holdings of dollar balances in the U.S. by Mexican nationals, published monthly in the U.S. Treasury Bulletin is incomplete, since it does not include information of deposits in non-banking financial intermediaries. Also, it is impossible to distinguish between asset movements due to changes in Banco de México's international reserves, PEMEX's deposits or modifications in the private sector's dollar holdings.

are reported in Table A-1.

Table A-1

REGRESSION RESULTS OF STRUCTURAL EQUATIONS (2) AND (4)

Dependent Variable	$\left[1+r_p-\frac{e_{t+1}}{e_t}(1+r_m)\right]$			α_1	R^2	D-W	SER
$b_p - b_m - \theta$ (equation 2')	2.707 (7.22)			(- 7.23) (-74.09)	.8434	1.674	.08753
y (equation 4)	ω	θ	r	c			
	-1.197 (-8.368)	- .127 (-1.830)	- .095 (-1.501)	7.946 (9.052)	.910	2.24	.0522

Note: Figures in parenthesis correspond to t-statistics.

The results of the estimation are satisfactorily, since all the coefficients have the expected signs and are significantly different from zero. From the values of the relevant elasticities, it is easy to compute the expression $\gamma_2 - \gamma_3 \gamma_4 / \alpha_0$ which determines the direction of the shift of the factor price frontier. The nominal value for this expression is positive, which indicates that the factor price frontier would have shifted leftwards in response to a higher perceived degree of political risk associated with a rise in θ^*, as mentioned in the text.

B. Data Sources.

Gross Industrial Product (Quarterly Data)	Cuadernos de Actividad Industrial 1975-1982, Banco de México.
Consumer Price Index (1978 = 100)	Indice de Precios, Cuadernos Mensuales, Banco de México.
U.S. Wholesale Price Index (1978 = 100)	International Financial Statistics, IMF.
Nominal, Future and Spot Exchange Rates	Indicadores Económicos. Subdirección de Investigación Económica, Banco de México.
Peso Denominated Bank Deposits in the Mexican Banking System (b_p)	Indicadores de Moneda y Banca, Cuadernos Mensuales, Banco de México.
Dollar Denominated Bank Deposits in the Mexican Banking System (mexdollars).	Indicadores de Moneda y Banca, Cuadernos Mensuales, Banco de México.
Mexican Short-Term Deposits in the U.S. Banking System.	Treasury Bulletin. Department of Treasury.
Three Month Interest Rate on Peso Deposits (r_p) in the Mexican Banking System.	Indicadores de Moneda y Banca, Cuadernos Mensuales, Banco de México.
Three Month Interest Rate on Mexdollar Deposits (r_m)	"Evolución de las Tasas de Interés Pasivas...". Banco de México, 1983.
Three Month Interest Rate on Dollar Deposits in the U.S. Banking System (r_d)	Indicadores de Moneda y Banca, Cuadernos Mensuales, Banco de México.

C. Overshooting as a Function of the Degree of Exchange Controls.

Let us write the dynamic system (17) and (18) in the following simplified form:

$$\dot{\theta} = a_0 \theta + a_1 b_d + a_2 \tag{C-1}$$

$$\dot{b}_d = a_3\,\theta + a_1\,b_d + a_2 \qquad \text{(C-2)}$$

Differentiating (C-1) and substituting (C-2) gives the following second order differential equation:

$$\ddot{\theta} - a_0\,\dot{\theta} - a_1\,a_3\,\theta + a_1\,a_4 = 0 \qquad \text{(C-3)}$$

The negative root of this equation (the one leading to the saddle point equilibrium) is:

$$u = \frac{a_0 - \sqrt{a_0^2 + 4a_1\,a_3}}{2} \qquad \text{(C-4)}$$

On the saddle path, θ must follow the equation:

$$\theta = \theta'^{*} + (\theta(0) - \theta^{*})\,e^{ut} \qquad \text{(C-5)}$$

Differentiating (C-5) and substituting into (C-1) leads to:

$$\theta(0) = \frac{u\theta'^{*} + a_1\,b_d(0) + a_2}{u - a_0} \qquad \text{(C-6)}$$

On the other hand, it is clear from (C-1) that the initial steady value of θ (before the shock) satisfies:

$$a_0\,\theta^{*} + a_1\,b_d(0) + a_2 = 0 \qquad \text{(C-7)}$$

Using (C-6) and (C-7), the degree of overshooting, ε, can be found as:

$$\varepsilon = \frac{\theta(0) - \theta'^*}{\theta'^* - \theta^*} = \frac{a_0}{u - a_0} \tag{C-8}$$

Using (C-4), this can be expressed as:

$$\varepsilon = \frac{-2}{1 + \sqrt{1 + 4a_1\, a_3 / a_0}} \tag{C-9}$$

Hence, ε is monotonically and positively related to the expression $a_1 a_3 / a_0^2$. Going back to equation (17) and (18), it is then easy to check that ε falls when ν rises.

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