ESSAYS ON THE MACROECONOMIC EFFECTS OF MONETARY REFORMS, PRICE CONTROLS AND FINANCIAL REPRESSION.

BY

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Alejandro Reynoso-del-Valle

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ABSTRACT

This thesis examines the impact on stabilization and growth of policies of institutional and structural change. It has been divided in five parts in which the topics of monetary reforms, financial repression and price-wage control stabilization schemes are discussed.

Part one, "Monetary Reforms and Exchange Rate Dynamics", examines the role of uncertainty in the determination of the exchange rate in economies in transition from an inconvertible money standard to a fixed exchange rate regime. Using as a framework a simple monetary model , the essay reviews experiences of several monetary reforms occurred in Europe and the Americas between 1850 and 1930. It was found that between the moment when people realize that a move to convertibility is possible and the actual introduction of the reform, the connection between monetary aggregates and the exchange rate breaks down and is replaced by an expectations-driven process.

Part two, "Foreign Debt Problems, Budget Correction and Inertial Inflation: The Case of Mexico" highlights some of the crucial factors that determine the feasibility of stabilization schemes based on prices, exchange rate and wage controls.

This chapter illustrates the importance of complementing the basic criterion of feasibility of a shock program which only looks a the inflation corrected budget deficit, with questions about the consistency of a fast reduction in the inflation tax with balance of payments and domestic capacity constraints. The simulations help to show how, in spite of the deep fiscal corrections Mexico had made at the time, the success of a program of this kind would be extremely sensitive to external shocks.

Part three, "Financial Repression, Financial Liberalization and the Interest Rate Elasticity of Savings in Developing Countries", analyses the old question of financial repression and savings. While the literature offers no definite answers, this paper starts from the fact that a careful review shows that the signs and sizes of the interest rate elasticities in different countries are very sensitive to the sample periods, and consequently to the degree of financial repression in a particular country at a particular time.

This essay estimates the savings functions for 26 countries distinguishing periods of high and low average real interest rates. Using the

results of these regression it is found evidence of a Laffer-curve shaped savings function, with positive elasticity at very low real rates, zero elasticity when real interest rates are around zero and negative elasticity for high real returns. An income distribution argument is used to provide an explanation for this type of response.

Part four focuses on the role of financial repression on capital flight with a special reference to the Mexican economy. It has two sections. The first one, "Capital Flight and Incomplete Financial Markets: Two Mexican Stories", is a note which describes some of the basic characteristics of the Mexican financial system and the effects of the recent reforms. By comparing the 1981 and 1986 experiences, it is suggested that the dynamics of capital flight, as well as the connection between capital flight and private external borrowing in Mexico, can be explained to a large extent by the specific regulations existing on the financial system.

The second section, "Dollarization and Capital Flight. The Role of Financial Repression in the Mexican Experience (1981-1982)" examines in detail capital flight from the perspective of the financial markets.

This paper takes advantage of some features of the Mexican institutional framework such as strong market segmentation and interest rate regulation to exploit credit market information to generate, with the help of some econometric techniques of markets in disequilibrium, capital flight data. Another outcome of this exercise is a balance sheet which shows, on the one side capital flight decomposed in terms of the users of foreign exchange (firms, individuals and banks) and on the other side shows the sources of capital flight financing (external borrowing of banks, private firms, public external borrowing and reserve losses). The information generated in this section helps to understand the impact of financial regulation on the size, dynamics and composition of the most serious episode of capital flight in Mexico.

Finally, part five, "Domestic Stability and External Shocks. A review of the Causes of the Mexican Stabilizing Development (1955-1971)", tries to answer to what degree institutional and policy changes are responsible for the fifteen years of price stability and rapid growth of the 'desarrollo estabilizador', and how much can be explained by changes in external conditions.

Using a methodology based on an optimal control exercise it is shown that almost 90% of the stabilization of the fifties and sixties was due to less variability in external and exogenous conditions, while less than 10% was due to better policy management. This exercise helps answer questions by Mexican policy makers who look back at the institutions of the sixties wonder what should be copied and what is right for today's Mexico. The answer is very little.

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Part I

MONETARY REFORMS AND EXCHANGE RATE DYNAMICS

MONETARY REFORMS AND EXCHANGE RATE DYNAMICS.

Introduction.

This paper tries to assess the importance of people's perception of future policy actions as a determinant of the exchange rate, by looking at some episodes of monetary reforms in the Americas and Europe between 1860 and 1930.

The motivation of this empirical exercise comes from the literature of collapsing currencies, such as Dornbusch (1986), Flood and Garber (1984) and Lizondo (1983). These papers address the question of what happens to the interest rate or to the price of the currency in the futures market when the stochastic nature of moretary shocks affects the conjectures agents have of the time of collapse of a fixed exchange rate regime.

Here we will look at how uncertainty influences the exchange rate in the opposite case of a collapse, that is, during the transition from an inconvertible money standard to a fixed parity.

This paper has two sections. Section 1 shows a simple monetary model of exchange rate determination which includes some of the elements of uncertainty usually present in economies in transition to a fully convertible currency.

Section 2 uses this framework to review the role of people's expectations of a return to a fixed parity as it was recorded in the cases of the United States (1862-1865), Argentina (1876-1894), Brazil (1870-1899), Spain (1870-1899), England (1922-1925), France (1926-1929), Puerto Rico (1898-1900) and Mexico (1903-1905).

1. A model.

Before getting in the details of a model it would be convenient to have in mind the sequence of events during the transition to a fixed exchange rate regime.

We start with a country which for some exogenous reason such as a war, decides to abandon a convertible money standard and rely on domestic credit creation to finance the extraordinary events imposed by the external shock. This stage is characterized by inflation and the corresponding depreciation of the inconvertible paper with respect to gold.

Some time after the cause to leave a fixed exchange rate regime disappears, the government decides to begin a stabilization program which will end with the return to convertible money standard. In many instances the first sign is a significant reduction in the rate of money printing. This first move coincides with some institutional changes such as the creation of a special commission to study the advantages of the return to full convertibility or the appointment of a new economic cabinet.

Between the moment when authorities decide to start the conversion process (announcement) and the time when they finally intervene, there is a period during which people do not know for sure the exact time when the exchange rate is to be pegged or about the final parity.

Thus, uncertainty takes place in two dimensions. First, people would not be sure if the government will try to stabilize at par (at the pre-collapse price) inducing a deflation, or if it will resume convertibility at a price consistent with the current stock of inconvertible money (or something in between). A second dimension has to do with the fact that is a matter of discretion for the central bank to decide the

right time to start the intervention in the currency market.

Now, lets see what we can expect to happen to the exchange rate during this transition.

Begin with a very simple monetary model. Equation (1) is a portfolio equilibrium condition where the relative demand of local currency (pesos) to the standard currency (gold, dollars, etc.) depends on their expected relative rates of return.

$$\frac{M_t}{e_t D_t} = \gamma - \beta \, \underset{t}{E} \left(\frac{e_{t+1} - e_t}{e_t} \right) \tag{1}$$

Coefficient β has to do with the degree of risk aversion of the representative individual. The larger β the more risk averse is the agent. M(t) is the quantity demanded of home currency and $D^d(t)$ is the demand for foreign currency at time t. E(t) is the expectation operator conditional to information available at time t. In equilibrium both, domestic and foreign currency demand have to be equal to the exogenously determined supplies of both currencies.

To solve for the equilibrium exchange rate it will be useful to rewrite equation (1) as

$$e_t = k_0(t) + k_1 \, \underset{t}{E} \, e_t + 1 \; ;$$

$$k_0(t) = \frac{(M/D)_t}{\gamma + \beta} \qquad k_1 = \frac{\beta}{\gamma + \beta} \quad ; \quad k_0 > 0 \; k_1 E(0,1) \tag{2}$$

Take as a benchmark case the solution when agents have perfect foresight, meaning that they know at any time the sequence of future relative money supply (M/D). Here, the equilibrium exchange is given by the solution of the certainty equivalent of difference equation (2).

$$e_t = \sum_{i=0}^{\infty} k_1^i \; k_0(t + i) \tag{3}$$

In what follows expression (3) will be referred as the "fundamental" or "no-reform" exchange rate.

The reason for these names has to do with the way in which we model a monetary reform. Think of the government as being able to choose one among many possible sequences of money supply. People know all the alternatives and can distinguish at any point in time which one the government is using. If the government is not planning a reform then the equilibrium is the same as in the perfect foresight case because the authorities have the intention to keep moving the money supply along the current and already identified path.

On the other hand, when the government makes a reform it moves money from the current path to a different one. It is precisely how people think this change will occur what we want to capture.

Assume initially that during the transition to a new standard people have a conjecture on what the final price of the currency will be but do not have an exact idea of when the reform will take place. Instead, they see the decision making of the government as a Markov process in which the transition probability to a fixed parity from time t to time t+1 is $\alpha(t)$.

To obtain the equilibrium exchange rate for any time we proceed in two steps. First, one starts from an arbitrary period T+1 when the market clearing exchange rate (if the reform has not occurred by then) is assumed to be known and equal to $\tilde{e}$, and from there solve (2) backwards. Second, to get the final solution we will need to make T arbitrarily large.

At time T people perceive two possible values of the exchange rate at time T+1: the market solution $\tilde{e}$ or the new parity e. Then, at time T the

market equilibrium is given by

$$e_t = k_0(T) + k_1\left[\alpha(T)e + \left(1 - \alpha(T)\right)\bar{e}\right]$$

at time T-1, the expected price of foreign currency at time T is:

$$E_{T-1}e_T = \alpha(T-1)\ e + \left(1 - \alpha(T)\right)\left[k_0(T) + k_1\left[\alpha(T)e + \left(1 - \alpha(T)\right)\bar{e}\right]\right]$$

and

$$e_{T-1} = k_0(T-1) + k_1\alpha(T-1)e + k_1\left(1-\alpha(T-1)\right)\left[k_0(T) + k_1\left[\alpha(T)e + \left(1-\alpha(T)\right)\bar{e}\right]\right]$$

which implies that

$$E_{T-2}e_{t-1} = \alpha(T-2)e + \left(1 - \alpha(T-2)\right)\left[k_0(T-1) + k_1\left(1 - \alpha(T-1)\right)\left[k_0(T) + k_1\left[\alpha(T)e + \left(1 - \alpha(T)\right)\bar{e}\right]\right]\right]$$

Repeating the same process until time t gives us an exchange rate equation of the form

$$e_t = k_0 + k_1\alpha(T)e + k_1\left(1 - \alpha(T)\right)\left[k_0(T+1) + k_1\alpha(t+1)e\right] +$$

$$k_1^2\left(1 - \alpha(T)\right)\left(1 - \alpha(T+2)\right)\left[k_1(T+2) + k_1\alpha(t+2)e\right] + \ldots +$$

$$k_1^T\left(1 - \alpha(T)\right)\ \ldots\ \left(1 - \alpha(T-1)\right)\left[k_0(T) + k_1\left[\alpha(T)e + \left(1 - \alpha(T)\right)\bar{e}\right]\right]$$

As T is made to go arbitrarily far into the future, the dynamics of the exchange rate can be represented by

$$e_t = \sum_{i=0}^{\infty}\theta_i(t)\left[k_0(t+i) + k_1\alpha(t+i)e\right] \qquad \theta_i = \begin{cases} 1 & i=0 \\ k_1^i \prod_{j=1}^{i-1}\left(1 - \alpha(t+j)\right) & i>0 \end{cases} \tag{4}$$

Which can also be rewritten as

$$e_t = \sum_{i=0}^{\infty} \theta_i(t) k_0(t+i) + \sum_{i=0}^{\infty} \theta_i(t) k_1 \alpha(t+i) e \qquad (4a)$$

Expression (4a) helps to think of the exchange rate dynamics as having two components: one which depends on the nature of the current path of money supplies and other which has to do with expectations about the post reform parity. The relative weight of each component depends on the profile of one-step transition probabilities, by the degree of risk aversion and by the anticipated final parity e.

Some examples can help getting a better sense of how these factors interact.

Take the simplest case of a flat money supply (M/D) path and a constant one-step probability profile.

Here, the market "fundamental" (no-reform exchange rate) is given by

$$\bar{e} = \frac{k_0}{1 - k_1} \qquad (5)$$

whereas the exchange rate in the case of an anticipated monetary reform, obtained from substituting constant values of k_0, k_1 and in equation (4) is

$$e_t = \frac{k_0 + k_1 \alpha e}{1 - k_1(1-\alpha)} \qquad (6)$$

Equation (6) can be rearranged in a very insightful way.

$$e_t = \frac{k_0 + k_1 \alpha \bar{e} + k_1 \alpha (e - \bar{e})}{1 - k_1(1-\alpha)}$$

$$= \frac{k_0 + k_1 \alpha \frac{k_0}{1-k_1}}{1 - k_1(1-\alpha)} + \frac{k_1 \alpha (e-\bar{e})}{1 - k_1(1-\alpha)}$$

$$e_t = \bar{e} + \frac{k_1 \alpha (e-\bar{e})}{1 - k_1(1-\alpha)} \qquad (7)$$

Equation (7) defines the equilibrium exchange rate equal to the "no-reform fundamental" plus a term given by the difference between the fundamental and the final parity.

From this simple expression we can more easily distinguish some of the determinants of the exchange rate dynamics during the transition to a fixed parity.

For instance, if agents are risk neutral meaning $k_0 = 0$ and $k_1 = 1$, the exchange rate will immediately jump to the level people anticipate for the final parity, independently of the transition probability and the current monetary conditions.

Also, take the situation in which, after a period of money supply increases the authority decides to stop printing. This is understood as a signal to the public of the intention of the government to fix the exchange rate some time in the future. Now, if they think that the government will fix the parity at the level consistent with the current money supply, that is $e=\bar{e}$, then the exchange rate will immediately jump to its fundamental. If people interpret the change in the money supply path as an announcement of a future movement to a fixed parity e, the equilibrium exchange rate will over or undershoot the market fundamental if their conjecture about the final parity is above or below it respectively, and remain constant at this new level.

It is interesting to see what happens if we relax the assumption of a constant one-step transition probability, keeping k_0 and k_1 fixed.

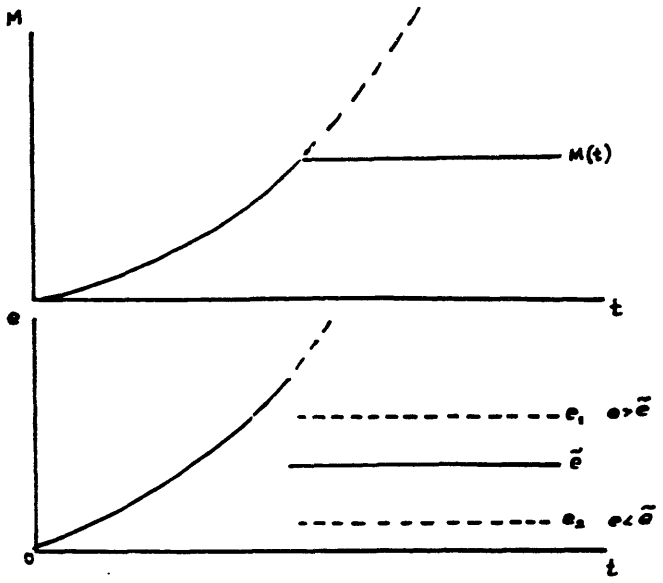


Figure 1.

Once again we start from equation (4) which can be rewritten as

$$e_t = \sum_{i=0}^{\infty}\theta_i(t)[k_0 + k_1(t+i)\tilde{e}] + k_1\sum_{i=0}^{\infty}\theta_i(t)\alpha(t+i)(e-\tilde{e}) \qquad (8)$$

looking in more detail at the first term of equation (8)

$$\sum_{i=0}^{\infty}\theta_i(t)[k_0 + k_1(t+i)\tilde{e}] = \sum_{i=0}^{\infty}\theta_i(t)[k_0 + k_1\alpha(t+i)\frac{k_0}{1-k_1}] =$$

$$= \frac{k_0}{1-k_1}\sum_{i=0}^{\infty}\theta_i(t)[1 + k_1(1-\alpha(T+i))]$$

but

$$-\sum_{i=0}^{\infty}\theta_i(t)[1 + k_1(1-\alpha(t+i)) = 1 + k_1(1-\alpha(t)) +$$

$$k_1(1-\alpha(t))[1 + k_1(1-\alpha(t+1)) +$$

$$k_1^2(1-\alpha(t))(1-\alpha(t+1))[1 + k_1(1-\alpha(t+2))]+\ldots$$

$$= 1 + k_1(1-\alpha(t)) - k_1(1-\alpha(t)) + k_1^2(1-\alpha(t))(1-\alpha(t+1)) - k_1^2(1-\alpha(t))$$

$$(1-\alpha(t+1)) +\ldots+ k^{n+1}(1-\alpha(t))\ldots(1-\alpha(t+N)) +\ldots+ = 1$$

$$e_t = \tilde{e} + k_1(e-\tilde{e})\sum_{i=0}^{\infty}\theta_i(t)\alpha(t+i)$$

It is interesting to notice that:

$$\sum_{i=0}^{\infty}\theta_i(t)\alpha(t+i) = \sum_{i=0}^{\infty}k_1^i p(t+i)$$

where p(t+i) is the probability, evaluated at time t of a reform taking place precisely at time t+i, which in terms of the reliability theory is the law of failure of the system. The fact that $\sum_{i=0}^{\infty} p(t+i)=1$ gives again the property that with risk neutral agents the exchange rate will jump immediately to the expected final parity regardless of the time profile.

To get a sense of how the shape of the transition probability profile affects the exchange rate dynamics we could try an example in which the transition probability grows linearly, say with $\alpha = t/T$ for $t \leq T$ and $\alpha = 1$ $T > t$ and t. The implied exchange rate equation is:

$$e_t = k_0 + k_1 \frac{t}{T} e + \frac{k_1}{T}(T-t)(k_0 + k_1\frac{t+1}{T} e) + \ldots +$$

$$\frac{k_1^{T-t}}{T^{T-t}} (T-t)\left(T - (t+1)\right) \ldots (1)(k_0 + k_1 e) \qquad t \leq T$$

$$e_t = k_0 + k_1 e \qquad t \geq T$$

Figure 2 shows the case where e = 10 and T = 10. Other time increasing transition probability profiles give basically the same result. Figure 2 also compares the linear case with one in which $\alpha(t) = 1-\exp(-gt)$ with e = 10.

It can be seen how the size of the initial undershooting depends on the entire probability profile: when the subjective probability profile rises faster the initial exchange rate jump will go farther below fundamentals.

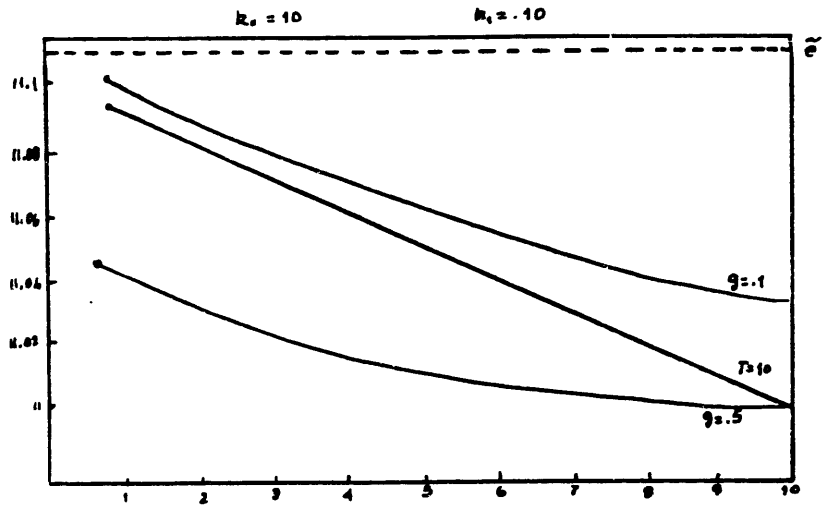


Figure 2.

In the beginning of this discussion it was mentioned that monetary reforms convey two kinds of uncertainty: one with respect to the time of reform and the other relative to the value of the final parity. So far, we have said nothing about the case when the representative agent has more than one conjecture about the final parity.

To see how this works imagine the situation where the representative agent thinks of two possible final prices, giving a probability $\alpha(t)$ to the event of no reform, $\alpha(t)\delta(t)$ to a return to convertibility at parity $\bar{e}$ and $\alpha(1-\delta)$ to parity e. The exchange rate equation is given by:

$$e_t = \sum_{i=0}^{\infty} \theta_i(t) \left[k_0 + k_1\, a(t+i) \left[\delta(t+i)e + \left(1-\delta(t+i)\right)\bar{e}\right]\right] \tag{13}$$

$$\theta_0 = 1 \qquad \theta_i = k_1^{\,i} \prod_{j=1}^{i-1} \left(1-\alpha(t+j)\right) \qquad i > 0$$

substituting on it the result of (5) one gets:

$$e_t = \tilde{e} + k_1 \sum_{i=0}^{\infty} \theta_i(t)\alpha(t+i)\delta(t+i)(e-\tilde{e}) \tag{14}$$

$$+ k_1 \sum_{i=0}^{\infty} \theta_i(t)\alpha(t+i)\left(1-\delta(t+i)\right)(\bar{e}-\tilde{e})$$

Expression (14) carries again the same idea of a difference between the observed exchange rate and its fundamental, explained by a function of the expected final parity, which will be larger the steeper the probabili-

ty profile, the less risk averse the representative agent and the less likely are people's conjectures about an stabilization at the "current price".

A natural extension to what has been said would be to introduce more than one agent. One reason for this is that in times preceding a movement by the authorities one can expect people disagreeing about the time and terms of the correction.

It is possible to imagine several ways in which these differences of opinion can have an impact on the exchange rate dynamics before the reform.

For example, if agents have strong (and different) beliefs with respect to the conditions of the policy switch, small changes in money supply can produce large exchange rate fluctuations in a range bounded by the conjectures of individuals about the final exchange rate. This would make reasonable to expect that after the "announcement" of the intention to return to a fixed rate, the exchange rate will be very volatile to the extent that people do not coincide in their points of view. Following the same idea, we could see this variability reduced with time if we think that differences in opinion are less spread as time passes.

Another closely related aspect has to do with the fact that to determine the market equilibrium it is important not only what people think about the actions of the government but what each individual agent knows about the others. This opens the issue of learning to consideration. The details of the role of heterogeneity among agents are treated in more detail in the appendix.

The view of the exchange rate determination process that we get from this section is of a process which results from the combination of currently observed monetary policy and a second part which depends on people's conjectures about the terminal conditions, degree of risk aversion, unanimity in their opinions and the profile of transition probabilities.

The idea of the next section is to see how the explicit inclusion of an expectation component in a monetary model of the exchange rate helps to better explain the experience recorded in the sample of reforms chosen.

2. Empirical Analysis.

The intention of this section is to review some monetary reforms happened in Europe and the Americas between 1850 and 1930, from the perspective of the results obtained in the first part of the essay.

Figure 3 in the end of the essay shows a series of note circulation and premium of gold (or convertible currency) during the process of monetary reform in the United States, Argentina, Spain, Brazil, England and France.

In the first four cases, the beginning of the transition is characterized by a sudden stop in note printing. In the last three there is in fact, a reduction in the stock of inconvertible money. The first response in all cases is a sharp appreciation caused by the change in the profile of money supply: the very fact of a reduction in anticipated inflation increases money demand. Using the ideas of section 1, we have a change in the "no-reform" fundamental $\bar{e}$ which is reflected in a jump of the market exchange rate.

The second part of the dynamics is given by the probability people assigned to the event of a "final move" by the government to sustain an even more appreciated exchange rate.

The experiences of the United States, Argentina, Spain, Brazil and England show how the market exchange rate can deviate consistently from its fundamental in anticipation of further appreciation.

The example of the United States follows very closely the model where we have a country anticipating a return to par with gradually increasing probability between periods where it remains constant. This is what can be interpreted from the plateaus in the exchange rate path between 1866 and 1868 and between 1870 and 1877. A similar situation seems to have occurred in Spain from 1900 to 1905.

From an econometric standpoint, an exchange rate determination regression in an inconvertible money standard (flexible exchange rate regime) will look different when no reform is anticipated compared to times when people perceive a return to a fixed parity regime in the near future.

A correct specification for an exchange rate equation in a pure flexible regime is given by equation (3). Under the "no-reform" assumption its counterpart for estimation purposes is

$$e_t = \delta + \sum_{i=0}^{n} \mu_i \, M_{t-i} + \epsilon_t \qquad (15)$$

In contrast, when a reform is anticipated, we have to include a component which takes into account the role of expectations and the declining importance of the "no-reform" fundamental as the people feel the "final move" of the authorities becomes more likely

$$e_t = \delta + \sum_{i=0}^{n} \mu_i M_{t-i} + \sum_{i=0}^{n} \beta_i M_{t-i} + \gamma t + \epsilon_t \qquad (16)$$

With this idea in mind, we can take a look at our sample of currency reforms to see if there is any evidence of a structural change after the 'announcement time'.

Here we will look at six stabilizations. For the first four, listed in table 1, we have relatively few degrees of freedom which limits the range of conclusions we can get from them, but are enough to test for the presence of an expectations-driven exchange rate. We will be able to get a better look at the French and British experiences.

Table 1 looks for evidence of a structural change in the coefficients of money supply between pre and post-announcement periods and to check if some time dependent component (reflecting a changing probability profile (t) or a learning process) appears in the post-announcement time.

In all equations a measure of exchange rate (United States, Argentina and Spain: premium of gold in terms of inconvertible currency (percent); Brazil: pence per reis) is regressed on total inconvertible note circulation (United States: millions of greenback dollars; Spain: millions of pesetas; Argentina: millions of pesos and Brazil: millions of reis), current and lagged one and two periods.

The basic regression equation is given by expression (17)

$$e(t) = B_0 + B_1 \text{ MONEY} + B_2 \text{ MONEY}(-1) + B_3 \text{ MONEY*DUMMY} + B_4 \text{ MONEY}(-1)\text{*DUMMY} + B_5 \text{ TIME} + B_6 \text{ TIME*DUMMY} + u(t) \qquad (17)$$

where the dummy variable takes a value of one whenever the reform is anticipated. Column (1) shows the starting date in the sample, and column (2) the announcement date. The second lag in note circulation as was

Table 1.

C	MONEY	MONEY(-1)	TIME	TIMED	MONEYD(-1)	R^2	DW
United States.		Announcement: 1862		Enactment: 1865		N = 17	
-106.8	.392	.0019				.72	2.46
(1.62)	(2.38)	(0.61)					
-98.69	.388	.0025		-2.32		.79	2.28
(1.48)	(2.15)	(0.52)		(2.56)			
-95.61	.375	.0020	.0108	-2.27		.80	2.28
(1.18)	(2.49)	(0.47)	(.474)	(3.31)			
Argentina		Announcement: 1876		Enactment: 1894		N = 25	
63.72	-.311	1.314				.79	1.69
(2.78)	(0.24)	(2.57)					
52.09	-.201	1.176		-18.44	.0211	.92	1.88
(2.40)	(0.11)	(2.63)		(4.41)	(2.18)		
54.41	-.188	1.199	-1.568	-15.36	.0204	.92	1.89
(2.35)	(0.10)	(2.45)	(0.102)	(3.58)	(2.19)		
Brazil		Announcement: 1870		Enactment: 1899		N = 40	
47.62	.0716	-.0442				.85	1.71
(8.61)	(1.85)	(1.62)					
37.57	.0481	-.0352		-1.632		.91	1.92
(3.22)	(1.75)	(1.48)		(2.17)			
2.53	.0623	-.0514	2.038	-4.045		.92	1.93
(2.91)	(2.12)	(1.57)	(1.66)	(2.31)			
Spain		Announcement: 1870		Enactment: 1899		N = 40	
-18.8	.0806	-.0481				.83	1.63
(4.5)	(3.87)	(2.40)					
-19.7	.0752	-.0513	-.0212	.1052		.83	1.64
(4.3)	(2.76)	(1.51)	(.009)	(.412)			
					DUMMY		
-18.1	.0885	-.0577			5.588	.85	1.79
(4.4)	(4.12)	(2.78)			(1.26)		

rejected to be different from zero at a 10% significance in all four cases. The coefficient of money*Dummy current and lagged is reported only when it is significantly different from zero at a 5% significance level.

There will be evidence of structural change when the coefficients of Money*Dummy (MONEYD) and/or Time*Dummy (TIMED) are significantly different from zero.

With respect to the United States we have a significant trend component although there is no evidence of a change in the coefficients of money supply after the "announcement" dated in 1862. The coefficient of TIMED is clearly significantly different from zero at a 5% percent significance level, while the coefficient of TIME cannot be rejected to be equal to zero.

The Argentine regression shows clearly a significant trend component after the Baring crisis of 1894 which marks the beginning of the return to a gold-exchange standard and the same happened in Brazil after 1899 when the law for the building of a 'Caixa de Conversao' was passed.

In Spain the reform starts with the passing of the 'Law of 1899' promoted by minister Villaverde. Figure 3d. shows how there is a sudden stop in note printing and an immediate appreciation of the peseta. After the first decline in premium it rises a little and remains fluctuating above the final parity for a couple of years. This is reflected by the significantly different from zero (at a 10% significance) coefficient of the dummy variable. This behavior is consistent with a period where there is uncertainty between a return to a final parity at a more appreciated value and a remonetization of the economy with a constant probability profile. This sounds plausible in a period when Banco de Espana and the

Ministerio de Hacienda had strong differences of opinion about increasing note circulation again or to continue the deflation. In 1909, both Banco and Hacienda agreed on keeping the monetary aggregates at the current level and complete the stabilization 'at current prices'. This process is completed 'de jure' in 1912.

We will be able to tell more about the French and British stabilizations of the 1920's as more and information becomes available. Tables 2 and 3 summarize the results.

The British return to par starts after the inflation of 1920. The beginning of the deflation can be dated in 1921 when the Bank of England starts the liquidation of assets through extensive open market operations. As a result, by the first months of 1922 wholesale prices had returned to the level prevailing before the inflation and a decision had to be made about stabilizing at the current price or to continue the return to par. In the meanwhile the United States continued an inflationary process. The period between July 1922 and October 1924 is known as the "British waiting policy" (Brown, 1940. vol 1, pp.301). In the second semester of 1922 wholesale prices in both sides of the Atlantic put the British pound in a position to make a final movement to the pre-war par with the United States dollar. This happens in April 1925 by means of the Gold Standard Act.

Table 2 shows the exchange rate dynamics in England between January 1920 and April 1925. Regressions are run breaking the sample in two halves trying as announcement date July 1922 (when par was consistent with the price levels in the United States and England according to Brown) and July 1921 when the deflation starts.

Table 2. England

C	EXRATE(-1)	MONEY(-1)	MONEY(-2)	TIME	R^2	Rho
Sample 1920.01 - 1925.04						
130.03	.54319	-.18191	.00600		.965	.678
(3.06)	(3.41)	(-3.03)	(0.625)			(4.0)
122.93	.52251	-.16457	.00765	.0548	.965	.698
(2.87)	(2.56)	(-2.66)	(0.756)	(.434)		(3.3)
Sample 1920.01 - 1922.07						
103.17	.5328	-.13797	.0164	.0087	.927	.550
(2.11)	(1.89)	(-2.11)	(0.651)	(.613)		(1.8)
142.55	.5171	-.20483	.0074		.926	.608
(2.13)	(1.87)	(-2.18)	(0.532)			(1.9)
Sample 1922.07 - 1925.04						
34.90	.8765	-.06561	.0186		.864	.120
(0.50)	(5.48)	(-.554)	(0.168)			(0.5)
-41.33	.9310	-.01388	.0124	.077	.875	.120
(-.80)	(9.96)	(-.116)	(1.154)	(1.93)		(0.5)
Sample 1920.01 - 1921.07						
115.9	.553	-.14803		.0484	.580	.578
(2.66)	(3.16)	(-1.88)		(.208)		(1.2)
Sample 1921.08 - 1925.04						
-39.9	.9421	-.0911		.0591	.864	.123
(-1.16)	(9.77)	(-1.52)		(-1.747)		(0.5)

Dependent variable: dollars per pound . Index 1922.01=100.0.
Money: Total Note Circulation in million pounds.
Source: Brown (1940)

It is interesting to notice that the first half of the sample can be adjusted very well with a regression of the form :

$$e_t = \beta_0 + \beta_1 e_{t-1} + \beta_2 M_{t-1} + \beta_3 M_{t-2} + \epsilon_t$$

which is equivalent to

$$e_t = \gamma_0 + \sum_{i=0}^{\infty} (1-\beta_1)^i (\beta_2 M_{t-1-i} + \beta_3 M_{t-2-i}) + \xi_t \quad \xi_t = \frac{1}{1-\beta_1 L} \epsilon_t \quad \gamma_0 = \frac{\beta_0}{1-\beta_1}$$

But, in the second half, the exchange rate behaves basically as a random walk with a positively sloped trend. (The dependent variable is dollars per pound). Applying the Chow test for parameter stability on :

$$EXRATE = C + B_1\ EXRATE(-1) + B_2\ MONEY(-1) + B_3\ TIME + w(t) \qquad (18)$$

the result is $F_{5,51} = 4.32$ when the announcement time is 1922.07. On the other hand if the sample is cut at the beginning of the deflation we obtain that F5,51=1.89. The critical $F_{5,51}$ is 2.37 (for a 5% significance), 3.51 (1%) and 1.95 (10%). Consequently one cannot reject the null hypothesis of structural change and the role of expectations in the final phase of the stabilization.

The French experiment, also known as the Poincare stabilization, took only a couple of months to be completed, but even in such a brief period the exchange rate showed some of the distinctive characteristics of monetary reforms. The first part of the adjustment takes place during the last week of July 1926 when R. Poincare takes office as prime minister, with the idea of imposing strict monetary and fiscal discipline. As expectations of further depreciation disappear, the exchange rate fundamental jumps appreciating substantially. In the following months the appreciation process continues gradually and it accelerates as the event of widespread intervention of monetary authorities in the foreign currency

market becomes more likely. This is particularly evident during the last weeks of 1926.

Table 3 shows the regression equations for France using weekly data of exchange rates on total note circulation. The lag structure is specified as an exponential distributed lag to save degrees of freedom.

Once again there is strong evidence model of structural change between the pre-announcement and post-announcement periods. The Chow test statistic run for regression equation specified as (18) is $F_{5,105} = 4.59$ where the critical value at the 1% significance level is 3.17 which allows us to reject the null hypothesis of stable parameters in both subsamples.

After July 1926 the process looks, the same as in the case of England, as a random walk with a drift component, whereas the monetary component (fundamental) helps explaining the exchange rate movements mostly in the months previous to the stabilization.

All six examples, but specially the English and French help to make a point on the way we should think about the exchange rate determination process. Essentially one could say that in normal times the exchange rate can safely thought in terms of the monetary approach determination: the relative price of two currencies which respective demands have a very stable velocity and consequently any appreciation or depreciation depends on the relative growth of both monetary aggregates. But when agents are forward looking and there are good chances for some important event in the forseable but uncertain future, the exchange rate will respond, some times in such a way that it moves driven almost exclusively by people's interpretation of future events.

Table 3. France

C	EXRATE(-1)	MONEY(-1)	MONEY(-2)	TIME	R^2	DW
Sample 1924.11 - 1927.01		N = 115		Method : OLS		
	.9564	0.024			.925	1.76
	(33.3)	(1.56)				
1.182	.9640	0.022		-.001	.966	1.77
(0.76)	(25.1)	(1.51)		(-.30)		
-6.363	.932	0.016	.0035	-.0236	.967	1.77
(-1.31)	(19.7)	(1.68)	(0.23)	(-1.19)		
Sample 1924.11 - 1926.07		N = 89		Method : OLS		
	.9405	0.039			.976	1.94
	(31.1)	(2.03)				
1.214	.9105	0.051		0.0161	.977	1.94
(1.45)	(17.1)	(1.58)		(1.16)		
0.916	.8980	0.054	-.007	0.0123	.978	1.94
(1.12)	(16.3)	(1.50)	(-.27)	(1.13)		
Sample 1926.07 - 1927.01		N = 26		Method : WLS		
	.987	0.028			.822	1.79
	(11.2)	(1.11)				
5.435	.803	0.019		-.1001	.847	1.79
(0.33)	(6.30)	(0.80)		(-2.03)		
19.05	.778	0.381	-.360	-.1949	.853	1.81
(1.55)	(4.61)	(0.62)	(-.658)	(-2.65)		

Periodicity: weekly
Dependent Variable: francs per dollar. Money: Note circulation in millions of francs
Source: Dulles (1926)

Concluding Remarks.

One of the distinctive characteristics of the exchange rate dynamics before the return to a convertible money standard is that, even if monetary aggregates are held constant it keeps moving towards some expected final parity.

It was found that once people realize the possibility of a reform, historically measured relations between money supply and exchange rate break and are substituted by an expectations-driven process.

This separation between "fundamentals" and observed exchange rate is attributed to people's the anticipation of a future open market operation which will sustain a further appreciated value of the home currency. It was suggested that the shape of the path and the variability of the price of the currency depends on the degree of risk aversion, the profile of transition probabilities as well as on the differences among agents and the way they learn about each other in a market where conditions are changing fast.

The data sources used in the commentaries of section 2 and in the appendix are: Mexico and Puerto Rico, Kemmerer (1907); United States, Mitchell (1903); France, Dulles (1929); England, Brown (1940); Argentina and Brazil, Subercaseaux (1912) and Spain, Sarda (1986).



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Appendix. The model in an economy with several agents

1) Case of two risk averse agents.

Consider an economy with two agents, a and a*. Each one has a portfolio equilibrium equation

$$\frac{M_t}{e_t\ D_t} = c - b\ \underset{t}{E}\left(\frac{e_{t+1} - e_t}{e_t}\right) \qquad \frac{M^*_t}{e\ D^*_t}\ c^* - b^*\ \underset{t}{E^*}\left(\frac{e_{t+1} - e_t}{e_t}\right)$$

$$D + D^* = \bar{D} \qquad M + M^* = \bar{M}$$

their own probability distribution of the moment when the government will peg the exchange rate and their own perception of what the final parity will be e and e*.

Assume for the moment that they have rational expectations, in the sense that everybody knows how the other agent think and formulates his expectations of future exchange rates calculating the market clearing price, for those instances when the authorities do not intervene in the currency market.

The equilibrium condition is given by

$$\frac{\bar{M}}{e\ \bar{D}} = \frac{D_t}{\bar{D}_t}\ \frac{M_t}{e_t\ D_t} + \frac{D^*}{\bar{D}_t}\ \frac{M^*_t}{e_t\ D^*_t} \tag{A1}$$

$$= \rho c + (1-\rho)c^* - \rho b \underset{t}{E}\left(\frac{e_{t+1} - e_t}{e_t}\right) - (1-\rho)\ b^*\ \underset{t}{E^*}\left(\frac{e_{t+1} - e_t}{e_t}\right)$$

$$\frac{\bar{M}_t}{e\ \bar{D}_t} = \gamma - \beta\ \underset{t}{E}\left(\frac{e_{t+1} - e_t}{e_t}\right) - \beta^*\ \underset{t}{E^*}\left(\frac{e_{t+1} - e_t}{e_t}\right) \tag{A2}$$

$$\rho = D_t/D^*_t \qquad \gamma = \rho c + (1-\rho)c^* \qquad \beta = \rho b \qquad \beta^* = (1-\rho)b^*$$

reordering terms in condition (A2)

$$e_t = k_0 + k_1 \underset{t}{E} e_{t+1} + k^*_1 \underset{t}{E^*} e_{t+1} \qquad \text{(A3)}$$

$$k_1 = \frac{\beta}{\gamma+\beta+\beta^*} \qquad k^*_1 = \frac{\beta^*}{\gamma+\beta+\beta^*} \qquad k_0 = \frac{\bar{M}/\bar{D}}{\gamma+\beta+\beta^*}$$

To solve the model we proceed in exactly the same way as in the case of a single individual. Let us start at an arbitrary time T.

$$\underset{T}{E} e_{T+1} = \alpha(T)e + (1-\alpha(T))\tilde{e}$$

$$\underset{T}{E^*} e_{T+1} = \alpha^*(T)e + (1-\alpha^*(T))\tilde{e}$$

Consequently the market clearing condition at time T is

$$e_T = k_0 + k_1 [\alpha(T)e + (1-\alpha(T))\tilde{e}] + k^*_1 [\alpha^*(T)e + (1-\alpha^*(T))\tilde{e}]$$

at time T-1

$$\underset{T-1}{E} e_T = \alpha(T-1)e + (1-\alpha(T-1))[k_0+k_1[\alpha(T)e + (1-\alpha(T))\tilde{e}]] + k^*_1 [\alpha(T)e^* + (1-\alpha^*(T))\tilde{e}]$$

$$\underset{T-1}{E^*} e_T = \alpha^*(T-1)e^* + (1-\alpha(T-1))[k_0+k_1[\alpha(T)e + (1-\alpha(T))\tilde{e}]] + k^*_1 [\alpha^*(T)e^* + (1-\alpha^*(T))\tilde{e}]$$

$$e_{T-1} = k_0+k_1\Big[\alpha(T-1)e + (1-\alpha(T-1))[k_0+k_1[\alpha(T)e + (1-\alpha(T))\tilde{e}] + k_1^*[\alpha^*(T)e^* + (1-\alpha(T))\tilde{e}] + k_1^*[\alpha^*(T-1)e + (1-\alpha^*(T-1))[k_0+k_1[\alpha(T)e + (1-\alpha(T))\tilde{e}] + k_1^*[\alpha^*(T)e^* + (1-\alpha^*(T))\tilde{e}]$$

repeating the same procedure down to time t, and making T arbitrarily large the resulting exchange rate equation is:

$$e_t = \sum_{i=0}^{\infty} \theta_i(t) \left[k_0 + k_1^* \alpha^*(t+i)e^* + k_1 \alpha(t+i)e\right] \qquad (A4)$$

$$\theta_0 = 1$$

$$\theta_i(t) = \prod_{j=0}^{i-1} \left[k_1\left(1-\alpha(t+j)\right) + k_1^*\left(1-\alpha^*(t+j)\right)\right] \quad i > 0$$

If we substitute in (A4) the value of the "fundamental" now given by:

$$\bar{e} = \frac{k_0}{1-k_1-k_1^*}$$

the resulting expression is

$$e_t = \bar{e} + k_1(e-\bar{e}) \sum_{i=0}^{\infty} \theta_i(t)\alpha(t+i) + k_1^*(e^*-\bar{e}) \sum_{i=0}^{\infty} \theta_i(t)\alpha^*(t+i) \qquad (A5)$$

Equation (A5) looks by now very familiar, with an over(under)shooting component defined by a weighted average of people beliefs about the final parity. These weights depend on their degree of risk aversion and the particular shape of their probability distribution. In that sense, the distance between the fundamental and the market exchange rate will be biased towards the expected final parity of those agents who are less risk averse and assign large probability to a reform taking place in the close future. Now, the assumption of everybody knowing what the other knows, may be not a very accurate description of what really happens. Instead, we could imagine people trying to infer other's expectation from market clearing prices observed in the past. It can be seen that the particular specification of the learning process opens some room for oscillation in the exchange rate path.

The first case is when each agent looks at the market equilibrium in the near past and solves (A5) for the parameter corresponding to the other agent. The implied result is:

$$e_t = \frac{k_0 + k_1 \alpha e + k_1^* \alpha^* e^*}{1 - \left(k_1(1-\alpha) + k_1^*(1-\alpha^*)\right)} \tag{A6}$$

$$\hat{\alpha}^* = \frac{k_0 + k_1 \alpha (e_{t-1} - e) + e_{t-1}(1-k_1-k_1^*)}{k_1^*(e_{t-1} - e^*)} \tag{A7}$$

$$\hat{\alpha} = \frac{k_0 + k_1^* \alpha^* (e_{t-1} - e^*) + e_{t-1}(1-k_1-k_1^*)}{k_1(e_{t-1} - e^*)} \tag{A8}$$

As a result the exchange rate equation will look like

$$e_t = k_0 + k_1 \alpha e + k_1^* \alpha^* e^* + k_1(1-\alpha)e_{t-1} + k_1^*(1-\alpha^*)e_{t-1} \tag{A9}$$

This means that, even if all members of this economy have constant probability profiles, the exchange rate will approach smoothly the solution value (A6) as agents learn about current conditions. The magnitude of the undershooting (with respect to fundamentals) will depend on the initial conjectures each agent has about each other's probability, and consequently the exchange rate could approach the solution (A6) from above or bellow.

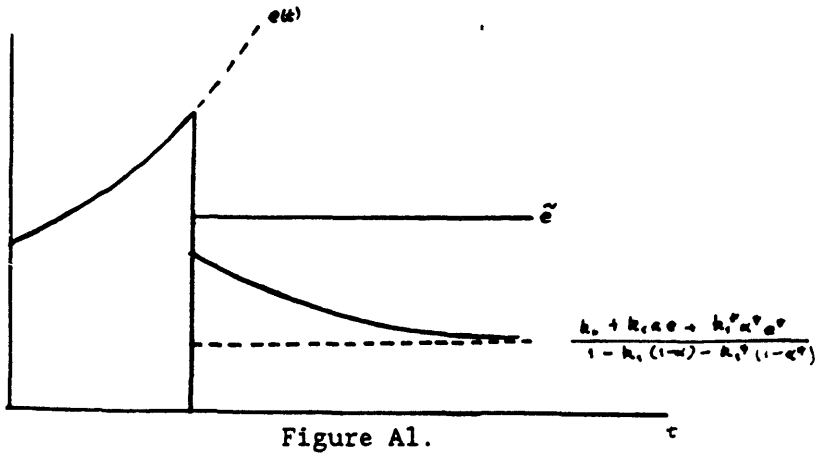


Figure A1.

Another, slightly more complete story on how learning takes place could affect the exchange rate dynamics in a very interesting way.

Take the situation where agents, knowing the market equilibrium, their own previous conjectures and the parameters k(0) k(1) and k(1)* compute at time t+1, the right hand side of expression (A10) (here shown only for the case of agent 'a')

$$e_t - k_0 - k_1 \underset{t}{E} e_{t+1} = k_1^* \left[\hat{\alpha}^* e + (1-\hat{\alpha}^*) \frac{k_0 + k_1 \alpha e + k_1^* \hat{\alpha}^* e^*}{1-k_1^*(1-\hat{\alpha}^*)-k_1(1-\alpha)}\right] \quad \text{(A10)}$$

Then solves (A10) for $\hat{\alpha}$. Implicitly we have assumed each agent presuming that the other agent really knows the parameters determining the market equilibrium. It happens that the left hand side of (A10) depends on the true parameters and past conjectures that agent 'a*' had on 'a''s probability profile. As a result one arrives to a solution of the form $\hat{\alpha}=\hat{\alpha}(\hat{\alpha}^*_{-1})$, $\hat{\alpha}^* = \hat{\alpha}^*(\hat{\alpha}_{-1})$. In other words the solution of $\hat{\alpha}^*$ is in equation (A11a) and for α in (A11b).

$$\alpha^* e^* + (1-\alpha^*) \frac{k_0+k_1\hat{\alpha}_{-1}e+K_1^*\alpha^* e}{1-k_1^*(1-\alpha^*)-k_1(1-\hat{\alpha}-1)} = \hat{\alpha}^* e^* + \frac{(1-\hat{\alpha}^*)(k_0+k_1\alpha e+k_1^*\hat{\alpha}^* e^*)}{1-k_1^*(1-\hat{\alpha}^*)-k_1(1-\alpha)} \quad \text{(A11a)}$$

$$\alpha e + (1-\alpha) \frac{k_0+k_1^*\hat{\alpha}^*_{-1}e^*+K_1\alpha e}{1-k_1^*(1-\hat{\alpha}^*_{-1})-k_1(1-\alpha)} = \hat{\alpha}e+(1-\hat{\alpha}) \frac{k_0+k_1\hat{\alpha}e+k_1^*\hat{\alpha}^* e}{1-k_1(1-\alpha^*)-(1-\hat{\alpha})} \quad \text{(A11b)}$$

Assuming e=e*=0 the conjecture formation equations are:

$$\hat{\alpha}^* = 1 - \frac{(1-\alpha^*)\left(1-k_1(1-\alpha)\right)}{1-k_1(1-\hat{\alpha}_{-1})} \quad \text{(A12a)}$$

$$\hat{\alpha} = 1 - \frac{(1-\alpha)\left(1-k_1^*(1-\alpha^*)\right)}{1-k_1^*(1-\hat{\alpha}_{-1})} \quad \text{(A12b)}$$

It is interesting to see that equations (A12a) and (A12b) imply exchange rate fluctuations. First, we could see that with the help of figure A2.

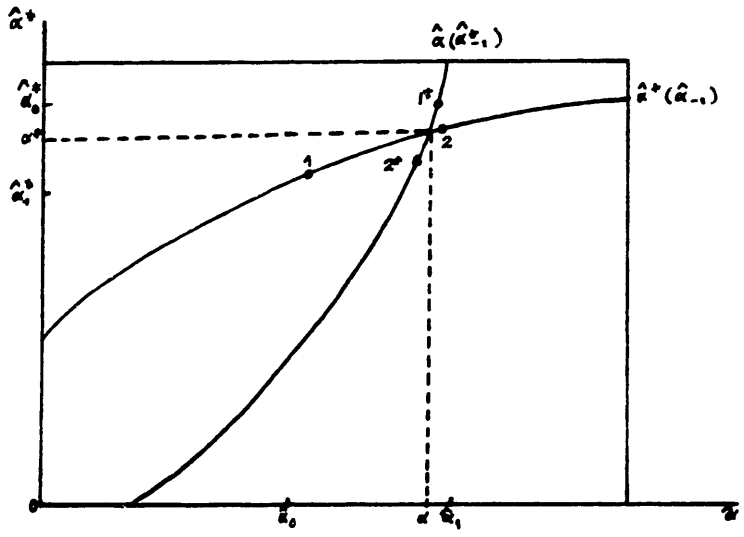


Figure A2.

The $\hat{\alpha}(\hat{\alpha}^*_{-1})$ schedule represents the dynamics of agent 'a*' conjecture about agent 'a' probability distribution function. The converse is true for $\hat{\alpha}^*(\hat{\alpha}_{-1})$. Solving simultaneously (A12a) and (A12b) it can be proved that both schedules cross at the true values of α and α^*. This is also a unique solution. Consequently, as long as the system of difference equations is stable, the exchange rate path in this learning exercise will coincide with the perfect foresight solution. To prove stability and get the paths of α and α^* we start from some initial value for each one which is determined by the prior beliefs of each agent $\hat{\alpha}_0$ and $\hat{\alpha}^*_0$. After one period agent 'a' conjecture moves to $\hat{\alpha}^*_1$ which is precisely $\hat{\alpha}^*(\hat{\alpha})$ evaluated at $\hat{\alpha}_0$ (point 1* in schedule). Agent 'a*' conjecture corresponds to point 1 in $\hat{\alpha}(\hat{\alpha}^*_{-1})$ schedule. For the following periods we repeat the operation to complete the sequence of probability paramenter conjectures. It does not matter which is the initial point we choose in fig. A2, one will always converge to the equilibrium (α,α^*).

The problem has two nice properties. On the one hand all conjectures

converge to the actual paramenter values, which means that market information can be enough to reveal the characteristics of all agents. On the other hand, the solution shows alternating over and under-shootings with respect to the rational expectations solution. These oscillations will make the exchange rate fluctuate in a way consistent with the experience of several monetary reforms, where the first months after the beginning of the transition are characterized by large, but decreasing exchange rate variability.

An exercise can help to make the point clearer and to perceive the sensibility of these fluctuations to the specification of the money demand equation. Imagine the situation where $\alpha = \alpha = .50$, $\hat{\alpha}_0^* = .25$, $\hat{\alpha}_0 = .75$. Table Ala contains the sequences for the cases where $k(1) = k(1)^* = .25$ and $k(1) = k(1)^* = .10$. Table 1a.

Table Ala.

	k(1)=.25		k(1)=.10	
Time	$\hat{\alpha}^*$	$\hat{\alpha}$	$\hat{\alpha}^*$	$\hat{\alpha}$
0	.25	.75	.25	.75
1	.533	.4615	.512	.486
2	.4944	.5046	.4992	.5006
3	.5057	.4999	.50	.50
4	.4999	.5008	.50	.50
5	.50	.50	.50	.50

When k(0)=1 the perfect foresight equilibrium exchange rate is 1.333 for k(1)=.25 and 1.111 when k(1)=1.111. The market exchange rate in this simulation exercise is given in table 1b.

Table A1b.

Time	k(1)=.25	k(1)=.10
0	1.415	1.1119
1	1.332	1.1113
2	1.3337	1.1112
3	1.3331	1.1111
4	1.3333	1.1111

It can be seen that the more risk averse the agents the faster conjectures will converge to their actual values, and consequently, the faster the convergence of the exchange rate to its rational expectations solution.

2) Case of an economy with several risk neutral agents.

When dealing with several agents we have considered only the case where all are risk averse to some extent. When we allow people to be risk neutral and hold strong beliefs about post-reform conditions and the time of reform, the first periods after the announcement will be characterized by sharp portfolio adjustments as they move to corner solutions.

The purpose of this section is to try to asses the implications of including risk averse together with risk neutral agents in our model.

Consider first the example of two agents who are risk neutral or that , because of their strong beliefs of a reform happening in the immediate future behave as if they were maximizing the expected value of their portfolios.

Their initial endowments can be described by the Edgeworth box in figure A3. These initial allocations could correspond to the pre-announcement interior solution of a risk averse agent facing no subjective uncertainty.

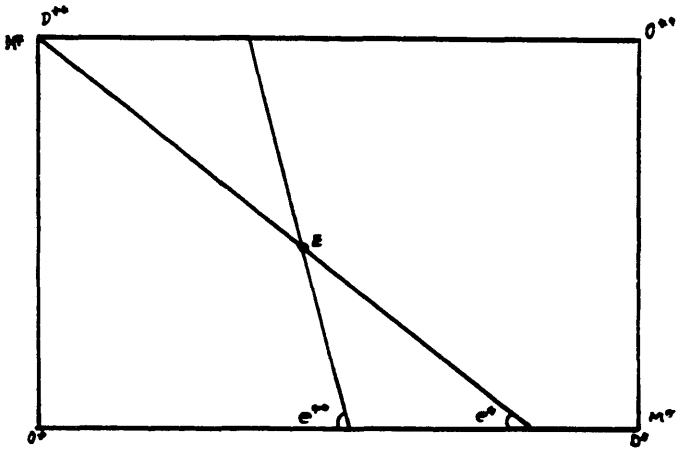


Figure A3.

After the announcement, agent a* will demand all his wealth in dollars whenever the exchange rate is bellow e* and agent a** will have all his wealth in pesos whenever the exchange rate is above e**. The equilibrium of this economy happens at the exchange rate e* where both agents will move to a corner solution, here represented by point A. Agent a* will have all his wealth in dollars and agent a** everything in pesos.

An interesting property of this result is that small open market operations could imply huge changes in the equilibrium exchange rate, being this variability determined by the extent to which agents disagree about post-reform conditions.

For instance, assume that we start at a corner like A. At that point the equilibrium price of the exchange rate is e*. Imagine that the government wants to increase the money supply through buying some dollars, and assume that this increase is arbitrarily small. This operation can only be completed at the exchange rate e** or higher. For we have assumes that the operation is small the final price would be e**. Agent a** will move to a point A' and agent a* will stay at his corner A. Consequently

in an economy where agent behave as if they were risk neutral it could be possible to see huge responses to small changes in the relative abundances of dollars and pesos, and the amplitude of this variability will be bounded by the extent to which agents disagree.

We could imagine that as these differences of opinion would tend to disappear as agents gather information and update their conjectures on post reform conditions and a tentative enactment time. As unanimity is achieved one can expect to see less exchange rate variability.

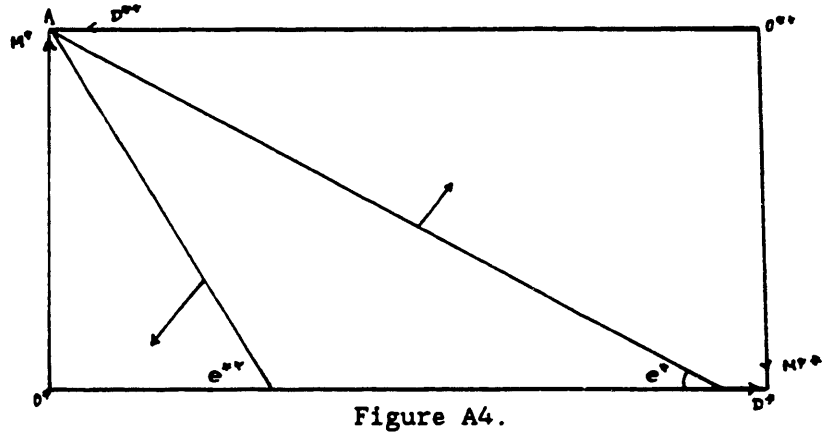


Figure A4.

It is not very realistic to assume that all agents are risk neutral. One extension of the problem is to explore what happens when we combine risk averse and risk neutral people. A simple example will suggest the conclusion that after a period , when everybody adjusts his portfolio and risk neutral agents have moved to their corners, the model can be solved exactly in the same way as in the case where the exchange rate dynamics is determined by a single risk averse agent.

Take for example a three agent economy. Agent 'a' is a risk averse person with a portfolio equilibrium equation

$$\frac{M_t}{e_t\ D_t} = \gamma - \beta\ E\ \left(\frac{e_{t+1} - e_t}{e_t}\right) \qquad \text{(A13)}$$

Again agents 'a*' and 'a**' will be risk neutral. 'a*' will put all his wealth in dollars whenever the exchange rate is less than e* and 'a**' will do the

same when e is less than e**. Lets assume that $e^{**} > \frac{k_0+k_1 \alpha e}{1-k_1(1-\alpha)} > e^{*}$.

Use one more time figure A4 to describe the initial endowments of the neutral agents.

Finally, assume that agent 'a' is small enough so as to allow the market equilibrium happen between e* and e**.

Some inspection of the problem reveals two kinds of mutually exclusive equilibria.

The first one occurs when the equilibrium exchange rate is e*. Here it has to be true that

$$\frac{\alpha e + (1-\alpha)k_0}{1-k_1(1-\alpha)} = \frac{k_0 - e^*}{k_1} \qquad \text{(A14)}$$

Agents 'a*' and 'a**' trade at time t=1 moving to a corner solution . The risk averse agent keeps his initial money and dollar holdings. The exchange rate will remain at e* as long as agent 'a' holds a constant probability profile. Otherwise , if the solution remains between e* and e** agents 'a' and 'a*' will not engage in further trading and the problem will look, after t=1 the same as in the one risk averse agent economy.

A second kind of solution is when the equilibrium is between e* and e** (e** included). Once again agents a* and a** will move to a corner solution. The difference with the case above is that 'a' also participates in trade in the first period. For the case of constant probability the solution will be identical to the case of one risk averse agent where we allow some correction to the initial endowments of this agent.

$$e_t' = \frac{k_0' + k_1 \alpha e}{1-k_1(1-\alpha)} - \frac{k_0 + k_1 \alpha e}{1-k_1(1-\alpha)} \qquad \text{(A15)}$$

Once again, exchange rate variability becomes an issue: at this level the relative sizes of agents begin to matter as long as the exchange rate stays between e* and e** agents a* and a** will not be trading, and all portfolio adjustments has to be carried on by the risk averse agent. This means that an open market operation of, say .1% increase in total money supply means a 10% increase of total money holdings of the risk averse agent if he happens to hold only 1% of total money balances of society. As long as the exchange rate remains between e* and e** these small changes in the money supply path will affect his fundamental largely.

Consequently, the exchange rate will move a lot, not because non-strict convexities in the preferences of the trading agent , but because agents with flat indifference schedule preferences , stay out of the market for a wide range of exchange rate values making a small number of risk averse agents to absorb all money supply changes.

As a matter of fact, the coincidence of monetary discipline and increased exchange rate variability after the "announcement" of a return to a fixed exchange rate regimes seems to be a common place in the historical descriptions of monetary reforms (Williams, 1971; Subercaseaux, 1912; Dulles, 1929;
Kemmerer, 1907).

An explanation for this could be found in heterogeneous beliefs, specially when people have little information about the precise intentions of the authorities. It is also reasonable to think that volatility could decrease as time passes as result of convergence of opinions as people

know more about the government plans and /or as agents learn more about each other perception sand, consequently about the market. Next, we could review a couple of cases to see to what extent this impression can be supported by the evidence.

Table A2 shows the regressions of a measure of exchange rate variability for countries for which there was information available on maximum, minimum and average exchange rates at least on a monthly basis. Defining v as the difference between the maximum and minimum exchange rate in a given period of time, one runs a regression of v^2 on time, a dummy variable and an interaction term between time and the dummy

$$v^2 = c_0 + c_1 D + c_2 t + c_3 Dt + \eta t$$

D = 1 after the announcement

Table A2.

Country	Periodicity	Announcement	N	c(0)	c(1)	c(2)	c(3)	R
France	Weekly	26/07/1926	46	7.33	71.23	.19	-2.56	.78
	t-statistic			1.62	4.997	0.99	-4.44	
U.S.A.	Daily	01/09/1864	227	1.12	37.75	.108	-.215	.29
	t-statistic			.92	4.54	1.23	-2.03	
Mexico	Monthly	01/1903	60	0.11	8.995	0.03	-.121	.40
	t-statistic			1.27	2.45	0.00	-2.05	
Puerto Rico	Monthly	01/1898	53	2.95	5.282	.071	-.240	.52
	t-statistic			2.02	5.98	1.76	1.86	

It is apparent that in all cases the exchange rate has become more volatile and that this variability declines with time.

The question to answer now is to what extent these fluctuations obey to increased variability in note circulation.

In the case of France it is possible to give a concrete answer as we have information on note circulation on weekly basis. The idea is to try a heteoskedasticity test on the residuals of a regression of exchange rate on note circulation and time for the second subsample.

$$\hat{\epsilon}_t = \text{EXRATE-C-}B_1\text{EXRATE(-1)-}B_2\text{MONEY(-1)-}B_3\text{TIME}$$

where B_1, B_2 and B_3 are computed by OLS. The results of the regression of the absolute value of these residuals on time (which is in fact the Park-Glesjer heteroskedasticity test) are:

$$|\hat{\epsilon}_t| = 4.74 - 0.0360 \text{ TIME}$$

t-ratio (1.72) (1.82) d.f.=24

The fact that the null hypothesis of homoskedasticity is rejected the 10% significance level means that, even having taken into account the money supply variability there is additional exchange rate volatility which is negatively correlated with time.

In the other three cases it is difficult to use conventional heteroskedasticity tests, as there are not available series of note circulation in of at least monthly periodicity. Then we will have to rely on some less formal evidence at least to get an idea of the problem.

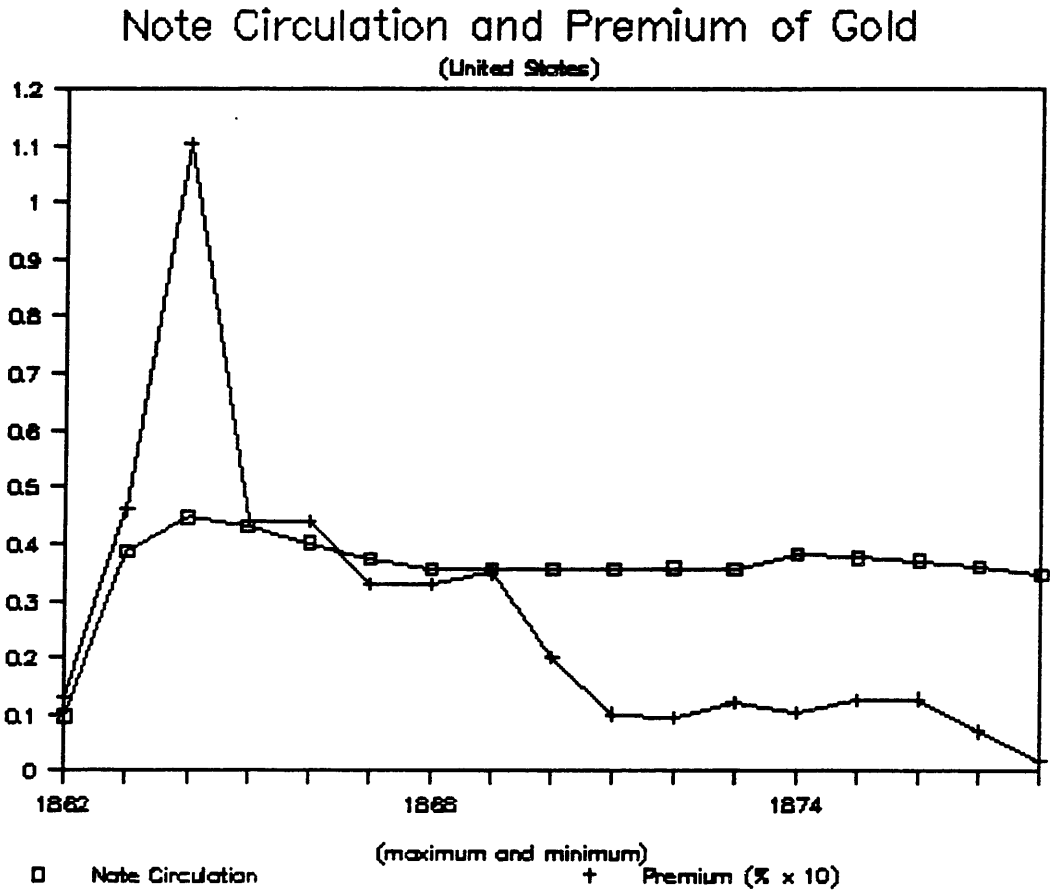
Mitchell (1903) gives some insight for the case of the United States. On the one hand he mentions that if anything, the second half of 1864 and the first half of 1865 were characterized by a careful process of contention of further greenback printing and the start of a very gradual process of reduction in note circulation beginning the second semester of 1865

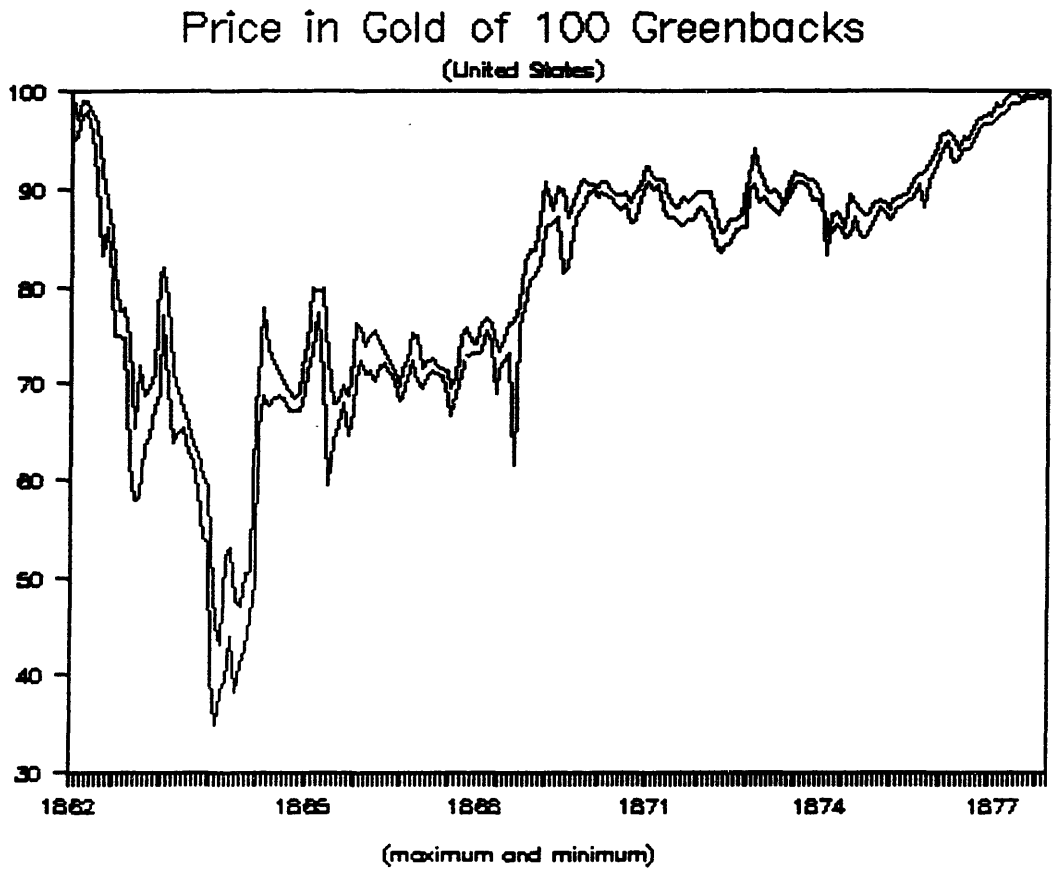
which accelerated in 1866. Curiously, at this time is when the premium has sharper short term fluctuations. He stresses the point saying that "... Statistical attempts to demonstrate or disprove the validity of the quantity theory of money must always be inconclusive so long as there is no accurate data... A rigorous comparison between the quantity of gold and the value of the currency is therefore out of the question. But at least this can be said with confidence: the fluctuations of the gold premium cannot be accounted for by actual issues and redemptions of government notes..." (pp.208).

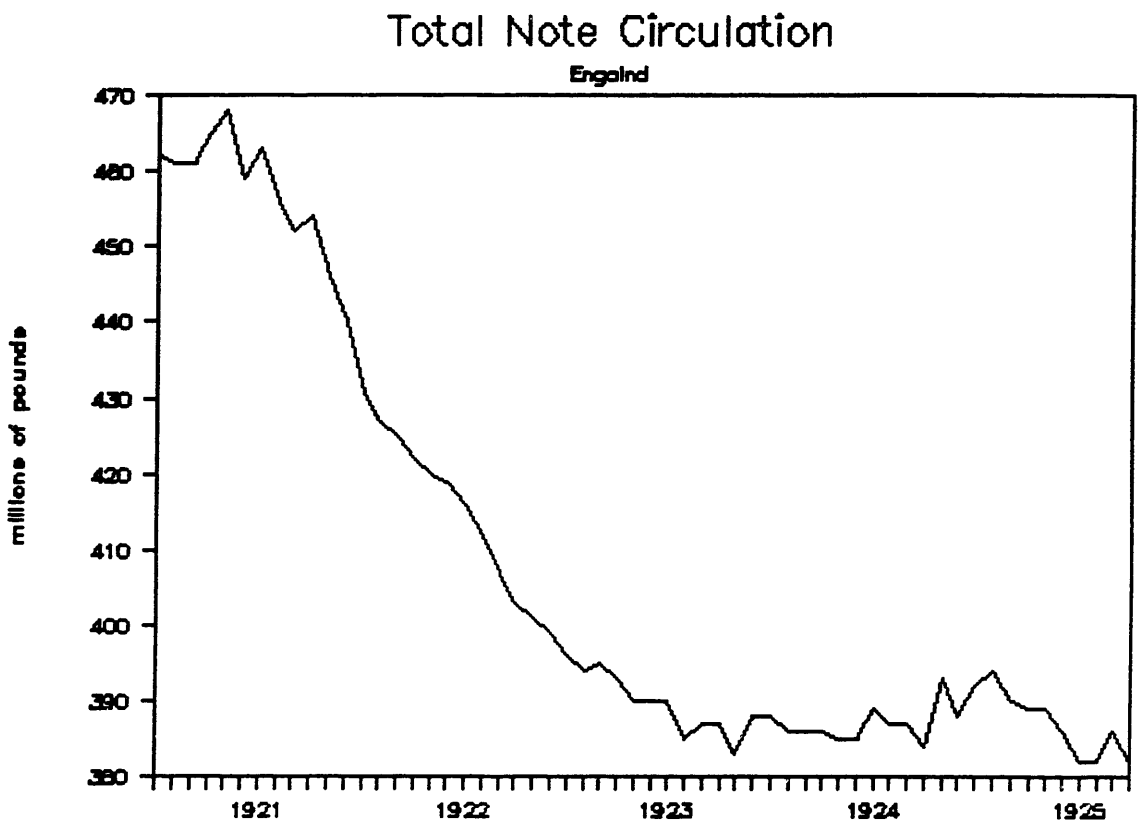
With respect to Mexico it is useful to remember that the kind of reform undertaken was a switch from a silver standard to a gold standard. Consequently the relevant concept of money base for the effects of the determination of the premium is given by the amount of notes convertible in silver and silver coins. According to Estadisticas Historicas de Mexico (SPP, 1985) during 1903 and 1904 the total of notes and coins in circulation changed much less than in previous years . Using values at the end of the year total notes and coins in circulation increased only 1% in 1904 compared to the 7.5% average increase in the interval 1897-1902. In 1905 growth resumes but very slowly (2.5%). From 1906 until the beginning of the Revolution the average growth stayed around 4% a year. Once again, the information available so far suggests that the period of larger exchange rate variability coincides precisely with times where the stock of inconvertible currency showed more stability.

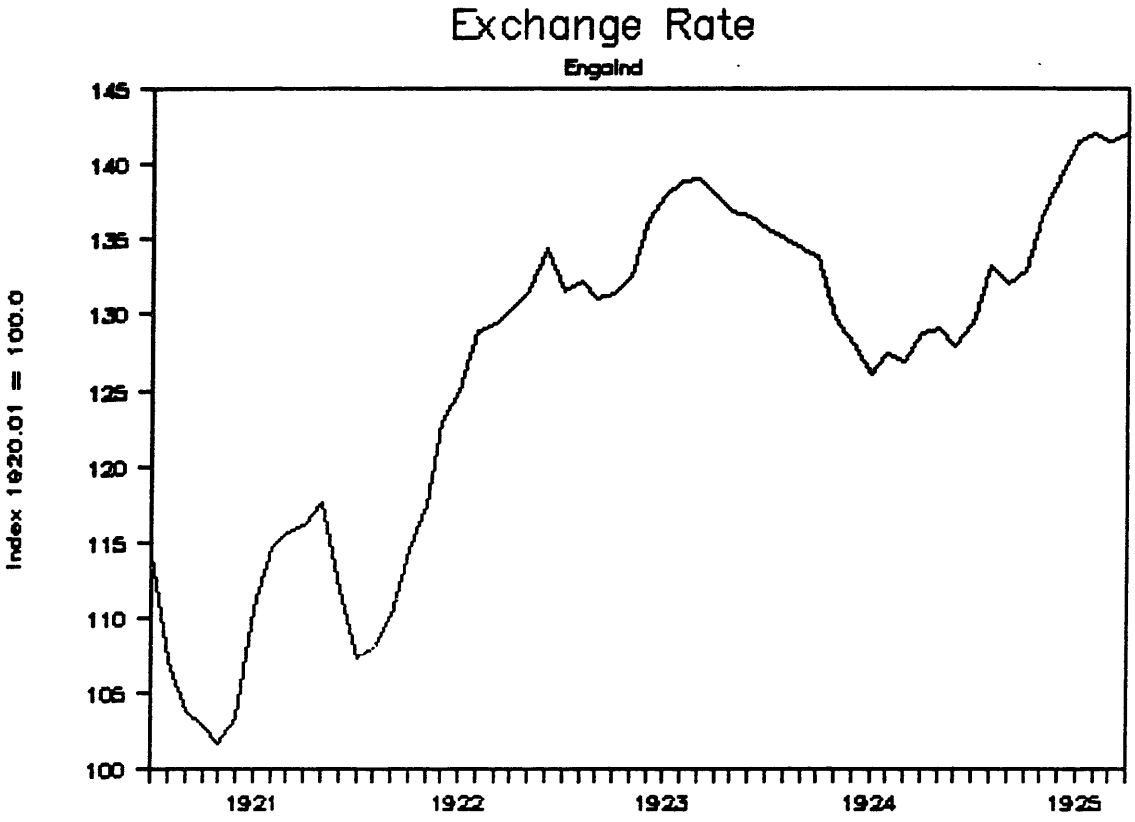
After 1895, the official Puerto Rican currency was the 'peso regulador' which was a unit of fiduciary money created by the Spanish authorities to substitute the Mexican peso which had been the official money

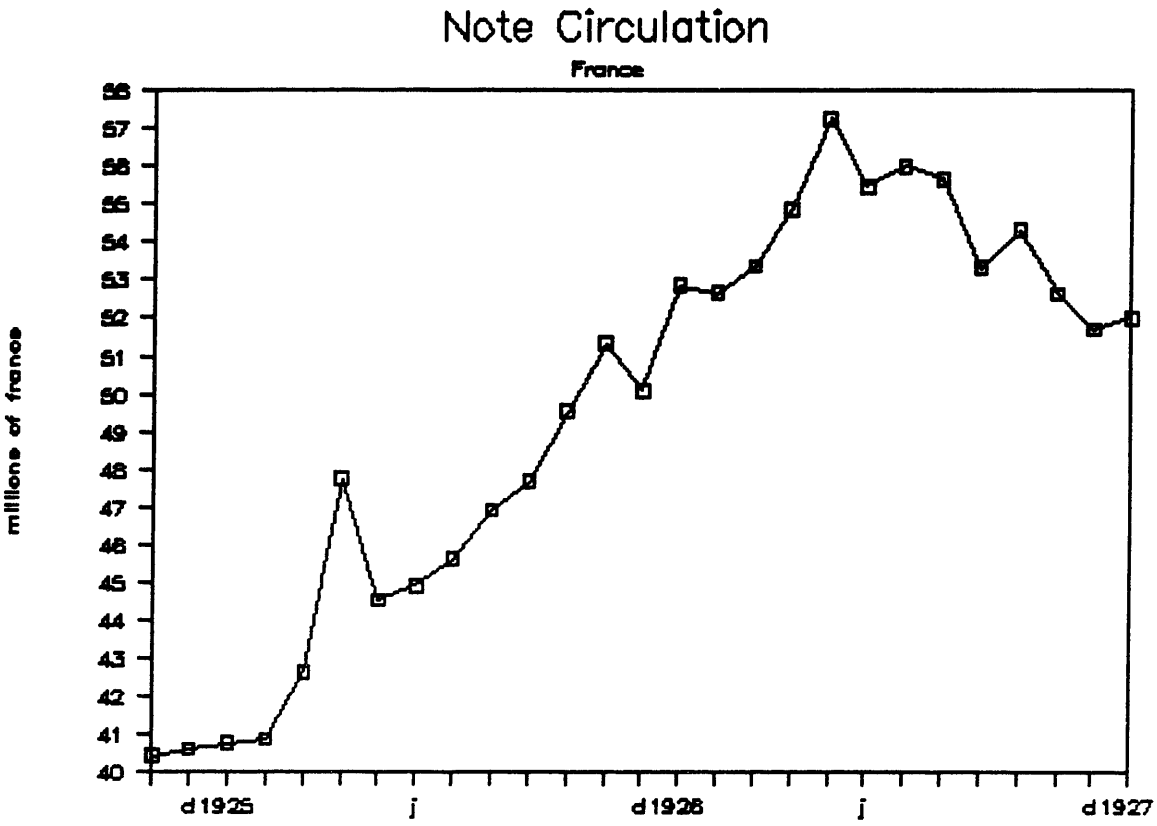
during colonial times. This unit will be again substituted by the American dollar by the end of 1899. The transition period starts with the Spanish-American War . During the first months of 1898 the value of the peso regulador depreciates substantially without any noticeable increase in its supply, mostly attributed to its decreasing demand due to the uncertainty about its convertibility to the dollar after the end of the hostilities. The recovery starts in the summer of 1898 with the occupation of Ponce where American troops start accepting pesos at a rate of two per dollar. Although the magnitude of the operations was small (Kemmerer, 1907, pp.171-172) the exchange rate returned almost immediately to its fundamental (.60 dollars per peso) as there was the prospect for a general conversion operation at the end of the hostilities. Most fluctuations during 1898 seem to have had more an expectations component rather than a change in fundamental. To stress this idea Kemmerer quotes the Subgovernor of the Spanish Bank of Puerto Rico who commenting on the exchange rate behavior between April and September 1898 said: "...(they were) merely nominal and at the same time capricious and arbitrary..." (pp. 170).

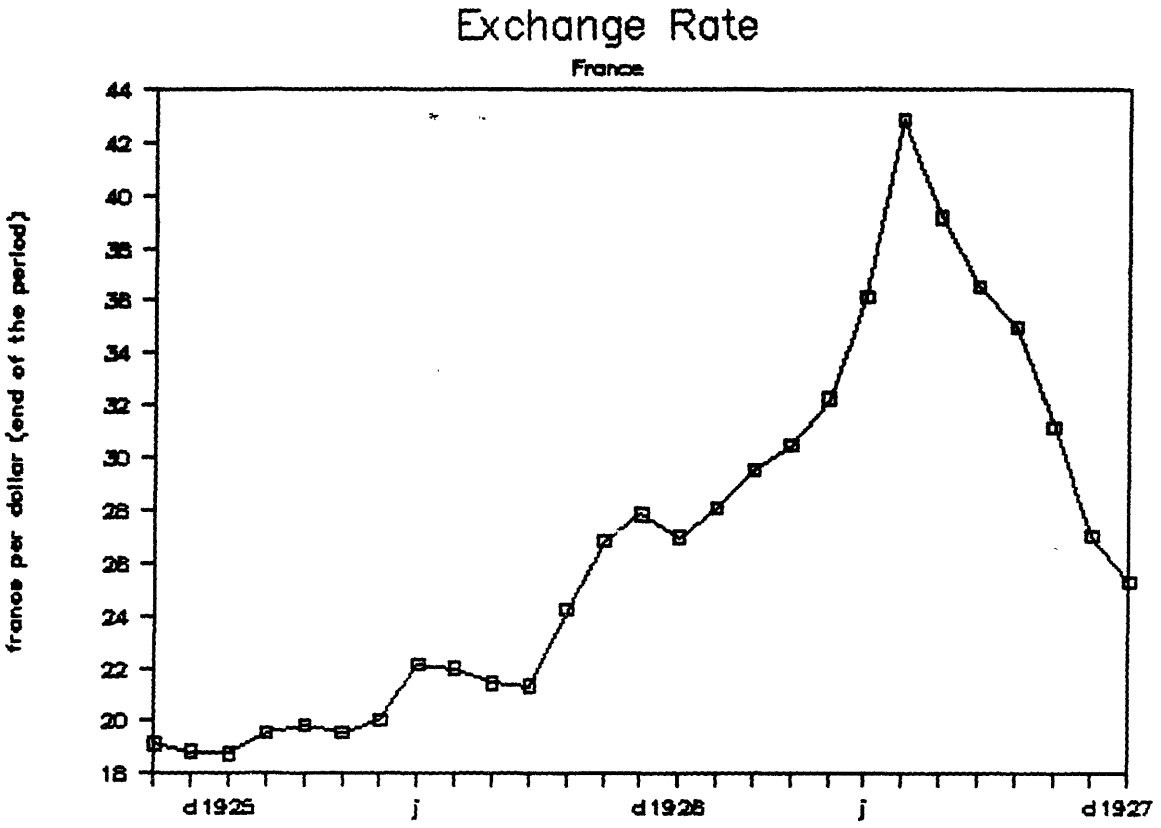

Note Circulation and Premium of Gold
(United States)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1862
1868
1874
(maximum and minimum)
Note Circulation
Premium (% x 10)

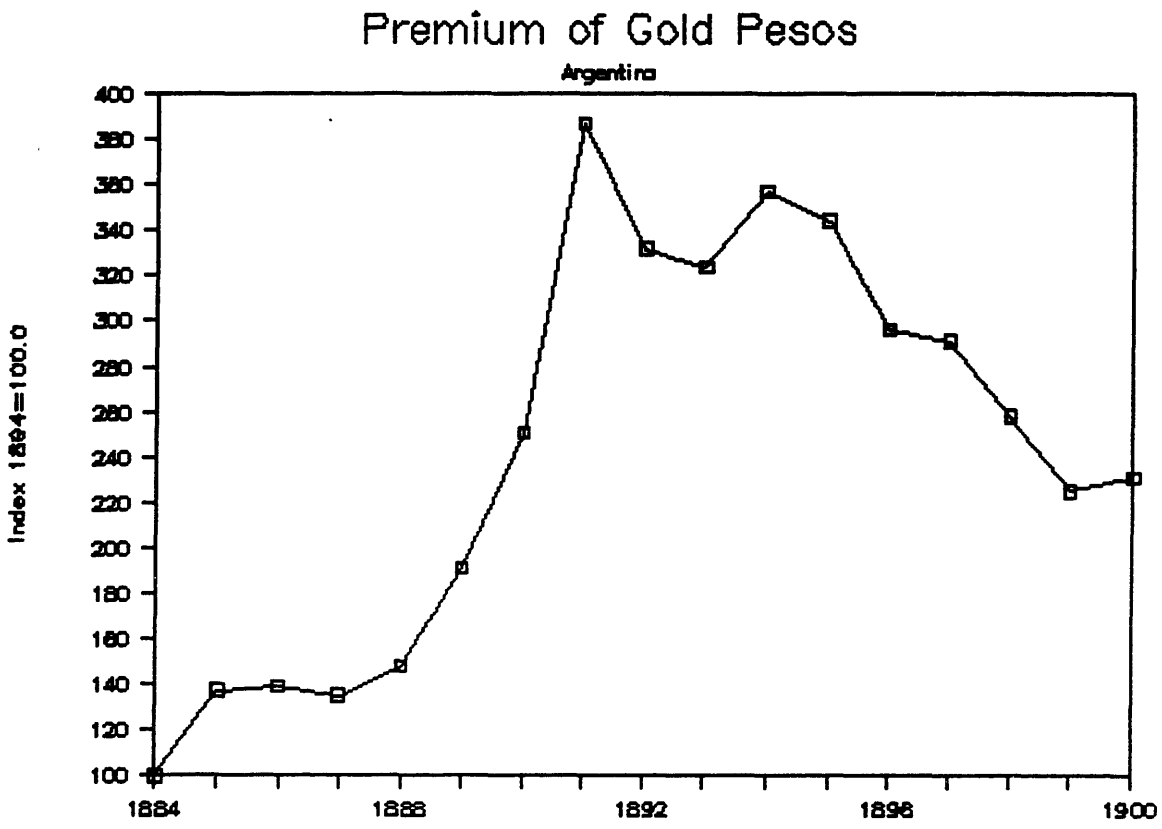

Price in Gold of 100 Greenbacks
(United States)
100
90
80
70
60
50
40
30
1862
1865
1868
1871
1874
1877
(maximum and minimum)

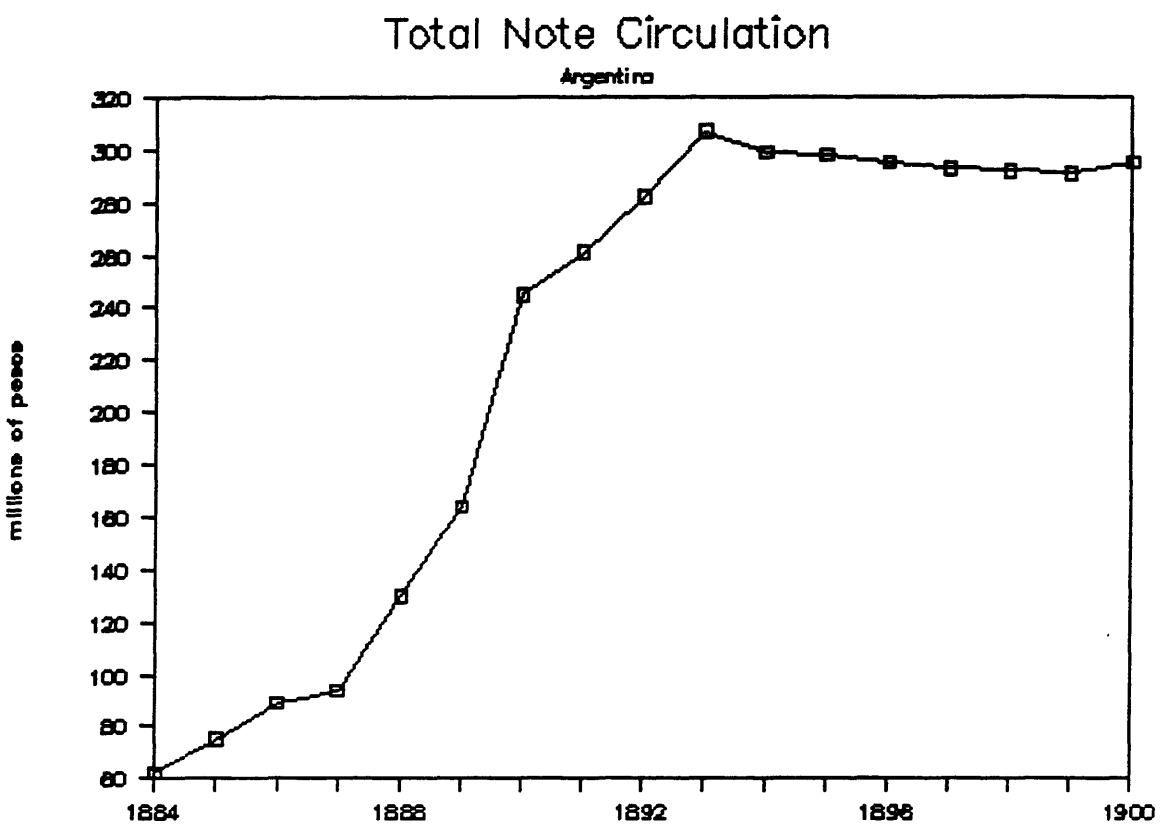

Total Note Circulation
England
millions of pounds
470
460
450
440
430
420
410
400
390
380
1921
1922
1923
1924
1925

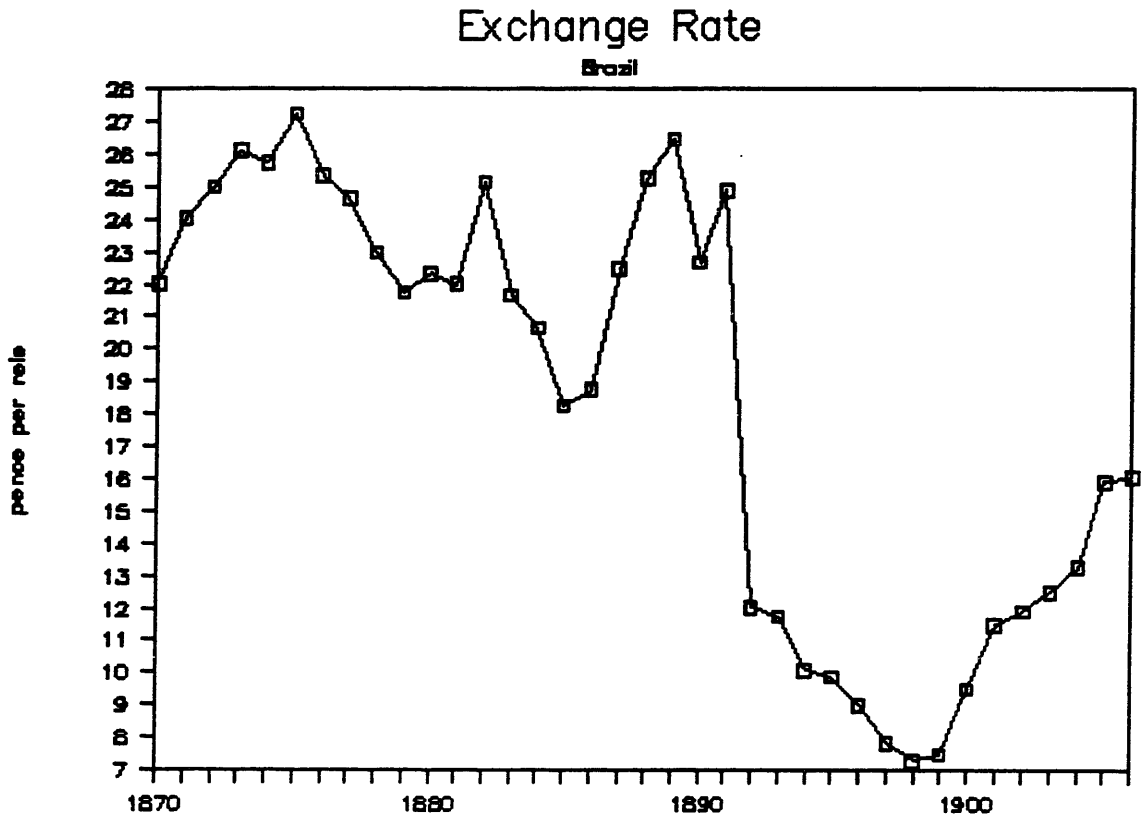

Exchange Rate
EngaInd
Index 1920.01 = 100.0
145
140
135
130
125
120
115
110
105
100
1921
1922
1923
1924
1925

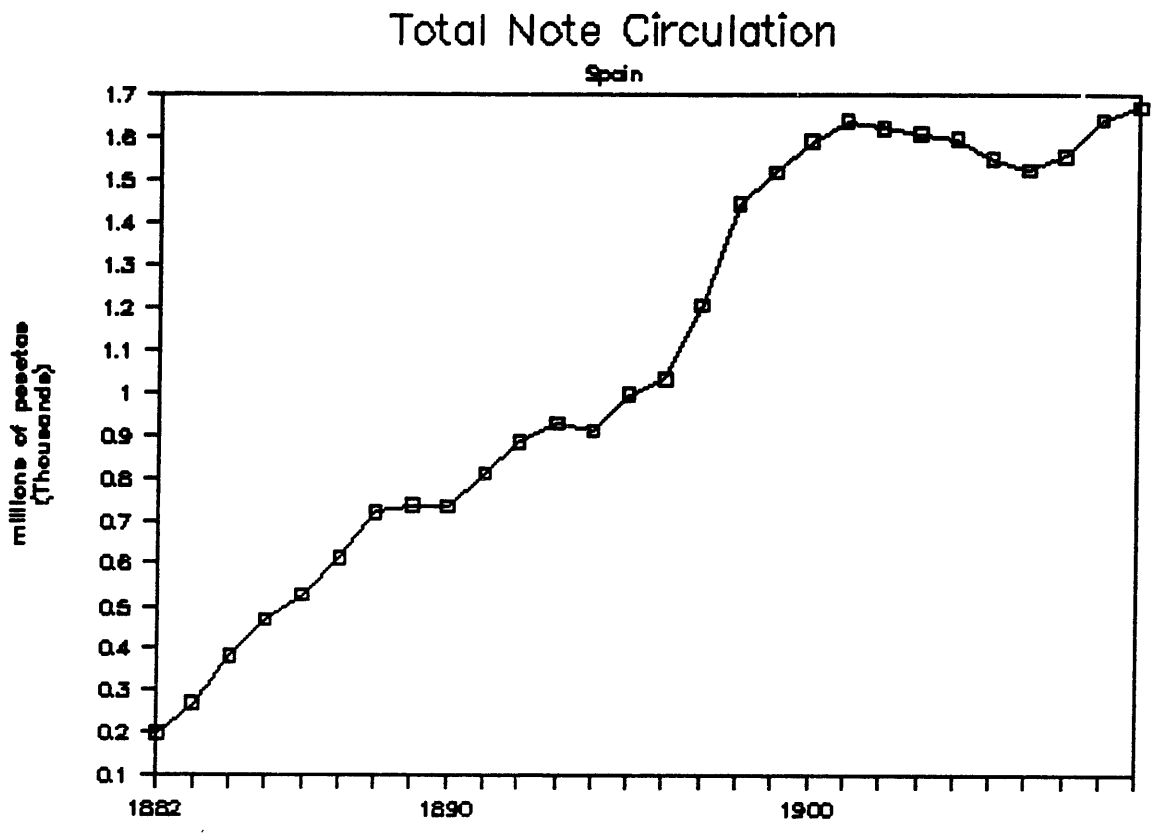

Note Circulation
France
millions of francs
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
d 1925
j
d 1926
j
d 1927

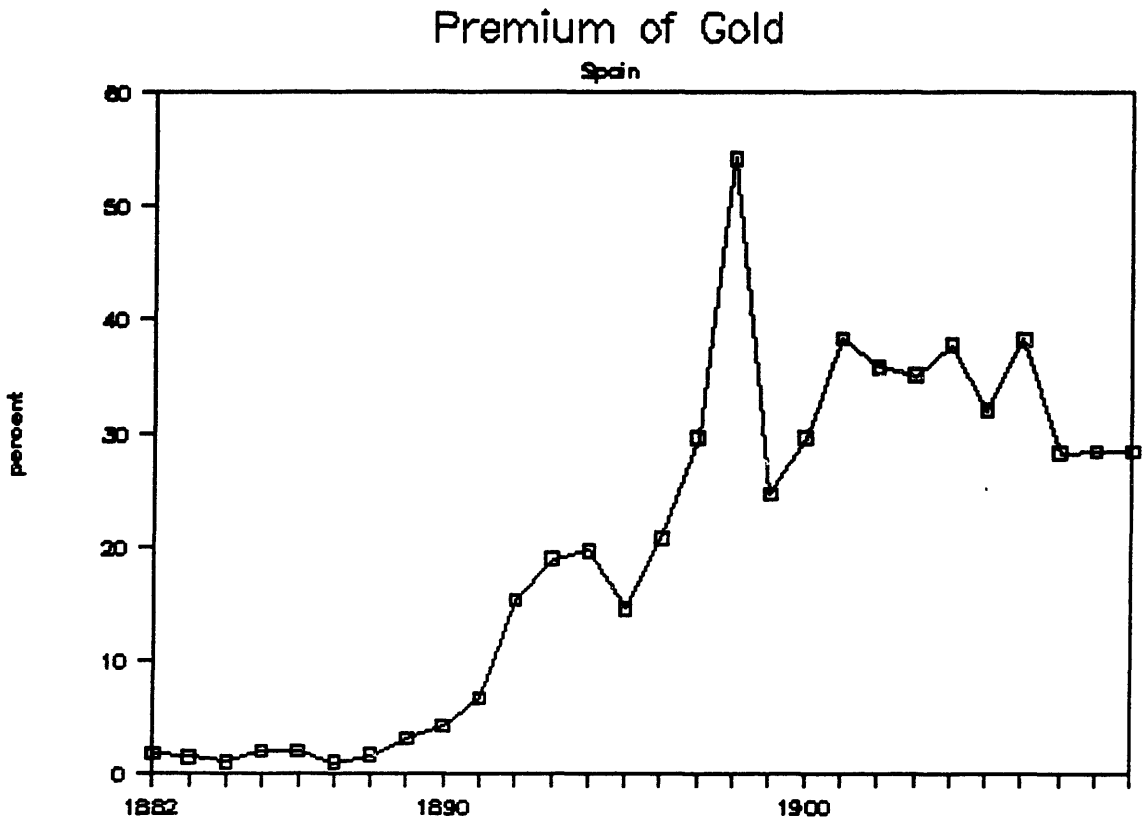

Exchange Rate
France
francs per dollar (end of the period)
44
42
40
38
36
34
32
30
28
26
24
22
20
18
d 1925
j
d 1926
j
d 1927

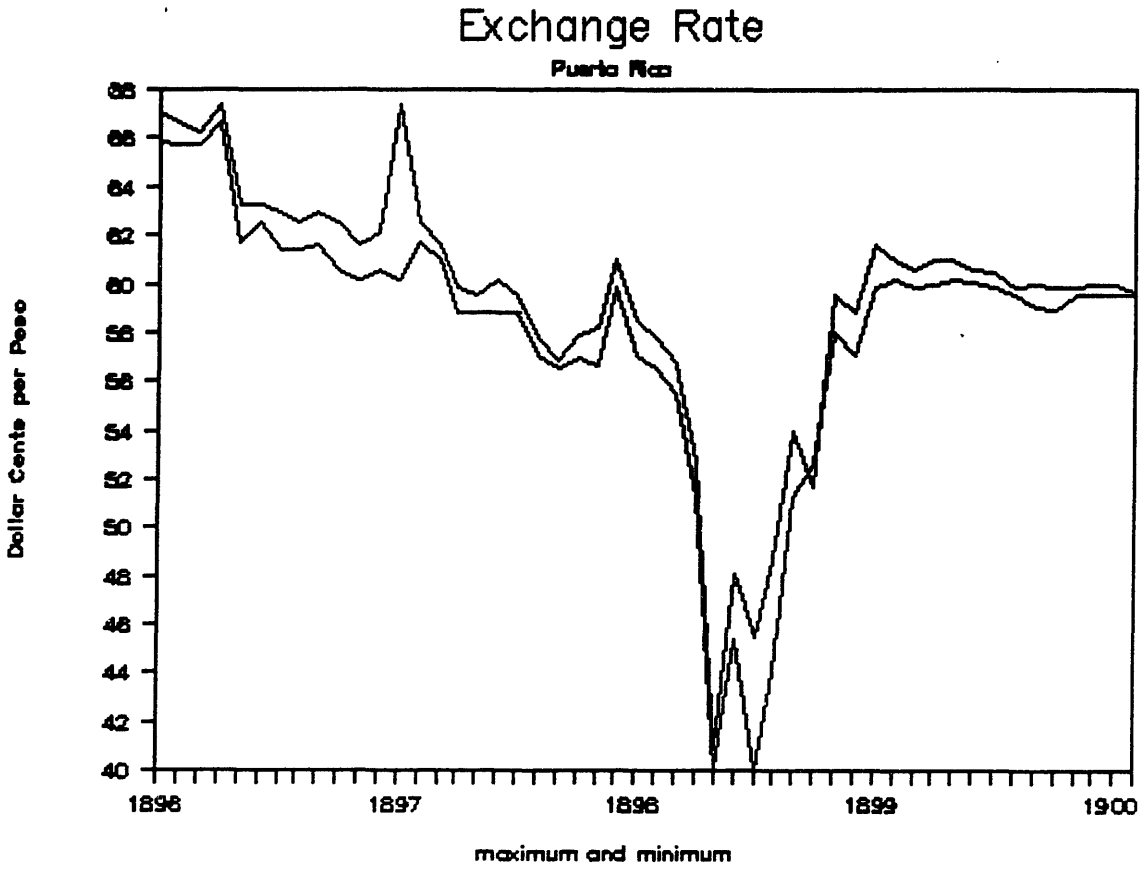

Premium of Gold Pesos
Argentina
Index 1884=100.0
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
1884
1888
1892
1896
1900

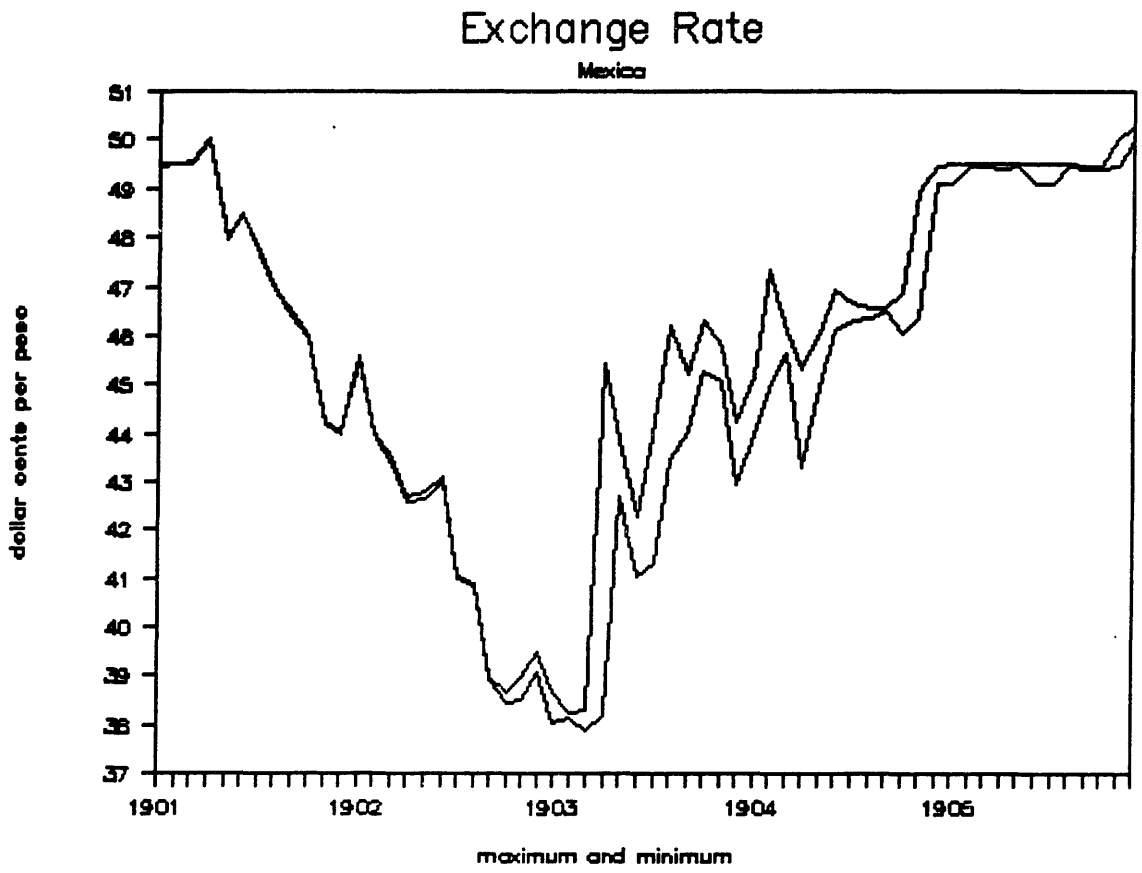

Total Note Circulation
Argentina
millions of pesos
320
300
280
260
240
220
200
180
160
140
120
100
80
60
1884
1888
1892
1896
1900


Exchange Rate
Brazil
pence per reis
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
1870
1880
1890
1900


Total Note Circulation
Spain
millions of pesetas
(Thousands)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1882
1890
1900


Premium of Gold
Spain
percent
60
50
40
30
20
10
0
1882
1890
1900


Exchange Rate
Puerto Rico
Dollar Cents per Peso
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40
1896
1897
1898
1899
1900
maximum and minimum


Exchange Rate
Mexico
dollar cents per peso
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
1901
1902
1903
1904
1905
maximum and minimum

PART II

FOREIGN DEBT PROBLEMS, BUDGET CORRECTION AND INERTIAL INFLATION. THE CASE OF MEXICO

FOREIGN DEBT PROBLEMS, BUDGET CORRECTION AND INERTIAL INFLATION: THE CASE OF MEXICO 1982-1986[1]

Introduction.

After 1982's budget and balance of payments crisis, the Mexican economy has been struggling to regain economic stability and a solid basis for future economic progress.

The magnitude of the fiscal effort has been fantastic, real wages have dropped to unbelievable low levels and non-oil exports are booming after a very substantial real exchange rate depreciation.

In spite of all these steps in the 'right direction' the macro-economic performance has been very poor: inflation remains high and per-capita GDP could decrease anywhere between 7% and 10% in the present 'sexenio'.

Among both, official and public opinion circles there are worries and questions brought about by the persistence of the current situation, for instance: Have not been spending cuts and devaluations deep enough to return to a healthy economy?; Is it possible that exogenous shocks such as the decline of international oil prices in 1986 be accounted for the failure of the stabilization program ?, if that is the case, Is there something that could have been done? or Is there something to be done now?... and what if the balance of payments and primary budget corrections are substantial to withstand external shocks, then how much of the observed inflation is purely inertial?, Is a shock program the answer?,

---

[1]This essay was finished in January of 1988. At that time Mexico had just taken the first steps of an heterodox stabilization and the phase of generalized price and wage freeze had not started yet.

Could an heterodox program be sustained if it had been implemented in 1985 or 1986?, if not , What would have been the magnitude of the additional budget adjustment necessary to keep the domestic deficit and the balance of payments in line with price stability?

It is obviously very difficult to find definite answers to all these questions, specially in a country where social and institutional conditions are changing very fast as they are in Mexico. Nevertheless, with the help of some basic economic relations it is possible to better evaluate the seriousness of the current situation and the feasibility of alternative courses of action, which constitutes the main purpose of this essay.

Section 1 is a brief description of the evolution of the Mexican Economy between 1980 and 1987. Section 2 presents a simple model which helps to present some definitions which will be used to review current and potential macroeconomic scenarios. Finally, in section 3 we use an estimation of an econometric version of the model to give some answers to the questions presented above.

1. The Mexican Economy 1982-1986.

After almost five years to rapid growth and moderate inflation the Mexican economy experienced in 1982 his worst crisis since the Great Depression. The combination of fundamental disequilibria in the budget and current account with the sudden stop in flows of foreign savings marked, with a huge exchange rate collapse, the beginning of a period of high inflation and very poor economic growth.

TABLE 1

	INFLATION (%)	GDP (%)
1978-1981	23.6	8.4
1982	98.8	-0.5
1983	80.8	-5.3
1984	59.2	3.6
1985	63.7	2.8
1986	105.7	-3.8
1987	159.2	1.0

Source: Indicadores Economicos, Banco de Mexico.

Beginning in 1983, the De la Madrid Administration put into effect the PIRE (Immediate Program of Economic Reordering) which implied important spending cuts and substantial increments in prices and fares of public sector goods and services as well as a fiscal reform. Due to the wide support it received from almost every sector, the actions of the PIRE permitted to see an impressive improvement in the primary and operational deficits, although the total public sector borrowing requirements remained a high fraction of GDP.

Between 1983 and 1985 the government continued with a policy of public spending austerity and continuous updating of his sources of revenue to keep up with inflation. In 1986 as a result of the decline in oil prices the economic cabinet considered necessary to put in effect a new program of spending cuts (ironically named PAC which stands for program of incentives and growth). In contrast with the PIRE which looked at both, current and capital spending, the PAC affected mainly investment projects.

TABLE 2

	Government Outlays		Budget Deficit		
	Increase(%) (Real)	Capital Spending/ Current Spending	PSBR	Operational (as a proportion of GDP	Primary
1982	5.3	51.2	17.7	5.2	7.8
1983	-24.9	56.8	8.9	1.9	-4.4
1984	0.1	51.2	8.7	0.6	-4.7
1985	2.2	43.4	10.0	0.0	-3.6
1986	-13.5	38.7	16.3	1.7	-1.6
1987	2.0	35.0	17.4	-0.9	-5.0

Source: Cuenta de la Hacienda Publica Federal, SHCP.

The balance of payments also improved after 1982. As a result of the maxi-devaluation and nominal wage contention policies the trade account surplus grew large enough to cover debt servicing and even some reserve accumulation.

TABLE 3

Balance of Payments

	Current Account	Capital Account	Errors and Omissions	Change in Reserves
	(Millions of Dollars of the U.S.)			
1980	-7 223	11 948	- 3 647	1 078
1981	-12 554	21 859	- 8 372	933
1982	-4 878	8 753	- 8 361	- 4 286
1983	5 418	- 852	- 1 432	3 134
1984	4 238	389	- 924	3 703
1985	1 236	-1 526	- 2 133	-2 123
1986	-1 270	2 270	- 210	790
1987(a)	3980	3740	211	7931

(a) January to September
Source: Indicadores de Comercio Exterior, Banco de Mexico.

Starting in 1984 and as part of the anti-inflationary strategy of the government, the real exchange rate began to appreciate. This had a strong negative impact on manufacturing exports which started to decline very

fast, particularly during the first semester of 1985. Aware of the fact that this policy could not be sustained for long without creating conditions for a more serious crisis the crawling peg was speeded up again in the second semester of 1985 and first part of 1986.

TABLE 4

	Real Exchange Rate (1970=100.0)
1982	124.2
1983	133.3
1984	110.5
1985	106.2
1986	156.4
1987	170.7

Source: Indicadores Economicos, Banco de Mexico.

The decline in oil prices of 1986 turned the current account to the deficit side once again, but in this case a combination of a surplus in the capital account an increasing manufacturing exports, which by the way, were a consequence of the real exchange rate adjustment of 1985, and government import reductions allowed to cope with the potential crisis without reserve loses and an exchange rate collapse.

A variable which has played a central role in the stabilization attempts of 1983 and 1986 is the real wage. It has played a double role allowing higher competitivity of Mexican traditional exports and fostering the development of the maquiladoras (assembly plants) in the border with the U.S., as well as keeping aggregate demand down through income distribution. In the course of the last five years the national average of the general minimum wage has fallen more than 40% in real terms and 33.5% in dollars.

TABLE 5

Trade Balance
(Millions of dollars of the U.S.)

	Exports		Imports	
	Oil	Non-Oil	Private	Public
1982	16 447	4 752	9 036	5 400
1983	16 017	6 249	4 244	4 306
1984	16 601	7 594	6 464	4 789
1985	14 776	6 897	8 825	4 386
1986	6 307	9 723	8 808	3 343
1987	8 629	12 026	9 442	2 780

Source: Indicadores de Comercio Exterior. Banco de Mexico.

TABLE 6

National Average Minimum Wage

	Real Wage (1982=100.0)	Daily Wage in $U.S.
1982	100.0	$4.47
1983	71.3	$3.58
1984	67.6	$3.96
1985	66.0	$4.03
1986	59.0	$2.94

Real Wage computed using the CPI.
Source: Comision Nacional de Salarios Minimos.

In the last quarter of 1987, a foreign exchange panic triggered by the Mexican stock exchange crash and the decision of the authorities of not using reserves to accommodate the run caused a new maxi-devaluation in November. The impact of this new cost shock put the economy right into the path of hyperinflation , being the increase in the consumer price index above 12% .

The response is a new stabilization program called PASE (Pact of Economic Solidarity) which contemplates further budget adjustments (taking

the primary surplus to 8.4% of GDP) as well as introducing some heterodox measures intended to control the rates of growth (rather than a total freezing) of prices and wages. The results of this new effort are yet to be seen as not only economic forces but political factors put Mexico in one of the most critical moments of his post-revolutionary life.

2. A Model for the Mexican Economy.

Any attempt to describe the Mexican economy in a simple system of macroeconomic relations, has to take into account at least the following four issues to have any practical relevance:

-The foreign debt problem.

-The sensitivity of the federal budget to external shocks.

-The role of real wages and income distribution in macroeconomic performance.

-The presence of institutions which create price inertia.

The first point implies that any sensible story shall be able to describe how the decline in foreign lending and the burden of debt servicing could impose a constraint on feasible employment and inflation combinations.

With respect to the budget one has to be aware of the basic channels of transmission between public finances and external variables: on the one hand, most of Mexican foreign debt is held by the government and consequently changes in both, the availability of foreign credit and interest rates should affect the need for domestic borrowing or seignoriage

2.1 The Framework.

We could use a variation of a Taylor-type model (1983,1986), aggregating the economy into three sectors: nontradeables, exportables and importables. On the demand side of nontradeables we assume that they are used basically in consumption or in current consumption by the government. Profits and part of the wage income are saved under the form of real balances and accumulation of public debt. Total income derives from production in the non-tradeable and exportable good sectors where the production functions are assumed to be Leontief in labor and imported inputs.

$$PX = PC + PG \tag{1}$$

$$PC = \left(w\beta \; x \; -1w\beta^{*}E - \hat{p}\,\frac{M}{P}\,(\hat{P})\right)(1 - s) \tag{2}$$

where X means total production in the home goods sector, E is total manufacturing exports, β and β^{*} the unit labor requirements in each sector respectively and s the marginal propensity to save.

Total exports have two main components: oil and non-oil

$$E \text{ (in dollars)} = P^{0}O + P^{*}E^{m}(\epsilon) \qquad \epsilon = \frac{eP^{*}}{P} \tag{3}$$

where imports can be capital goods and intermediates.

$$IM \text{ (in dollars)} = P^{*}I + aP^{*}x + a^{*}P^{*}E^{m} \tag{4}$$

here a and a^{*} are the unit intermediate-input requirements. The interest rate paid on foreign debt, r^{*}, is taken as exogenously given leaving the balance of payments equation as in equation (5).

$$\dot{D} = r^{*}D + P^{*}I + aP^{*}X - P^{0}O - P^{*}(1 - a^{*})E^{m} \tag{5}$$

On the budget side, the inflation tax covers the difference between

outlays, domestic and foreign indebtedness and revenues as shown in (6)

$$\hat{P}\,\frac{M}{P}\,(\hat{P}) + e\dot{D} + \dot{B} = er^{*}D + \hat{P}B + PG + PI \qquad (6)$$

The price equation for the home goods sectors is given by (7). We assume a Kalecki-Taylor economy where prices incorporate two elements: costs and a mark-up 't' which can be rationalized by the presence of imperfect competition.

$$P = (1 + t)(wb + aeP^{*}) \qquad (7)$$

the implied inflation equation is

$$\hat{P} = \theta\hat{w} + (1 - \theta)\hat{e} \qquad (8)$$

where:

$$\theta = \frac{w\beta}{w\beta + aeP^{*}}$$

To keep the solution of the model bounded we normalize them in terms of a numeraire. For our specific interest it will prove to be very useful to use a measure of capacity given by the stock of capital in the non-tradeable goods sector k.

$$\zeta = [\zeta bz + zb^{*}\lambda f\epsilon - c\hat{P}](1 - s) + g, \qquad z = \frac{W}{P} \qquad (1')$$

$$\hat{P} = \theta\hat{W} + (1 + \theta)\hat{e}, \qquad \hat{P} = \frac{\theta}{1-\theta}\,\hat{z} + \hat{e} \qquad (2')$$

$$C\hat{P} = \epsilon(r^{*} - \gamma)\,d + g + \epsilon P^{0}\sigma h - \dot{b} \qquad (3')$$

$$\dot{d} = (r - \gamma)d + \gamma + ap^{*}\zeta - P^{0}\sigma h - (1 - a^{*})\lambda f\epsilon \qquad (4')$$

The inertial component given by the Kalecki-Taylor equation, rather than restricting the specific form of the inflation persistence, suggests that inertia is present when relative prices take some time before

returning to their long term levels once a shock has moved them to a different value.

$$Z = \psi\zeta + \delta(z^* - z) \tag{5'}$$

$$\hat{\epsilon} = -\frac{\theta}{1-\theta}\hat{z} \tag{6'}$$

corresponds to the normalized difference of production with respect to its trend, f the relative sizes of the export to the non-traded good sector, b and d normalized domestic and foreign debt, besides it was assumed that m/p 1/k=c $E(\epsilon) = \lambda\epsilon$, I/K=$\gamma$, z the real wage and z^* the long term "desired" wage level. Substituting (5') in (2') gives us an inflation condition which can be drawn as an upward sloping schedule in the inflation-production space, reason why it will sometimes be also referred as supply curve.

$$\hat{P} = \frac{\theta}{1-\theta}\left[\psi\zeta + \delta(z^* + z)\right] \tag{7'}$$

2.2 Balance of Payments crisis and Domestic Borrowing constraints.

When an economy faces unlimited access to external borrowing and also has a public finance situation which keeps domestic borrowing in line with GDP and capacity growth, equations (1') to (6') can be seen as a closed recursive system of equations where the demand and price equations solve $\hat{P}$, ϵ, z and ζ, and the balance of payments and domestic borrowing equations solve for b and d. Besides, along this system the relative price variables z and ϵ never jump as they move smoothly along their paths described by (5') and (6'). When, in contrast, foreign credit is scarce and the budget faces a fundamental disequilibrium threatening to make domestic debt accumulation far above the rate of economic growth, then it

will be the case for at least some time and for some range of values of foreign interest rates, real exchange rate and government spending that b and d will have to be taken as exogenous rather than endogenous variables. Namely, when we have a combination of external strangulation and domestic borrowing constraints equations (3') and (4') should be treated as inequalities

$$c\hat{P} \geq \epsilon(r^* - \gamma)d + g + \epsilon\gamma - \epsilon P^0 \sigma h \qquad (3'')$$

$$0 \geq (r^* - \gamma)d + \gamma + aP^*\zeta - \epsilon P^0 \sigma h - (1 - a^*)\lambda f_\epsilon \qquad (4'')$$

As a consequence, both budget and balance of payments conditions impose a lower bound to inflation and an upper bound to production respectively.

The impact of these constraints can be better understood with the help of figure (1). The DD schedule represents the aggregate demand given by equation (1'). The SS' schedule is the price equation (7').

Before the debt crisis the economy could be in a point like Eo where there is a current account deficit financed by foreign lending which also helps in covering the budget deficit.

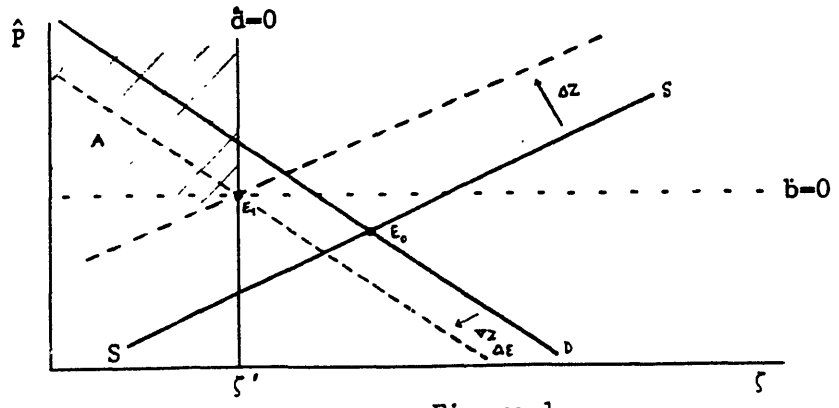


Figure 1

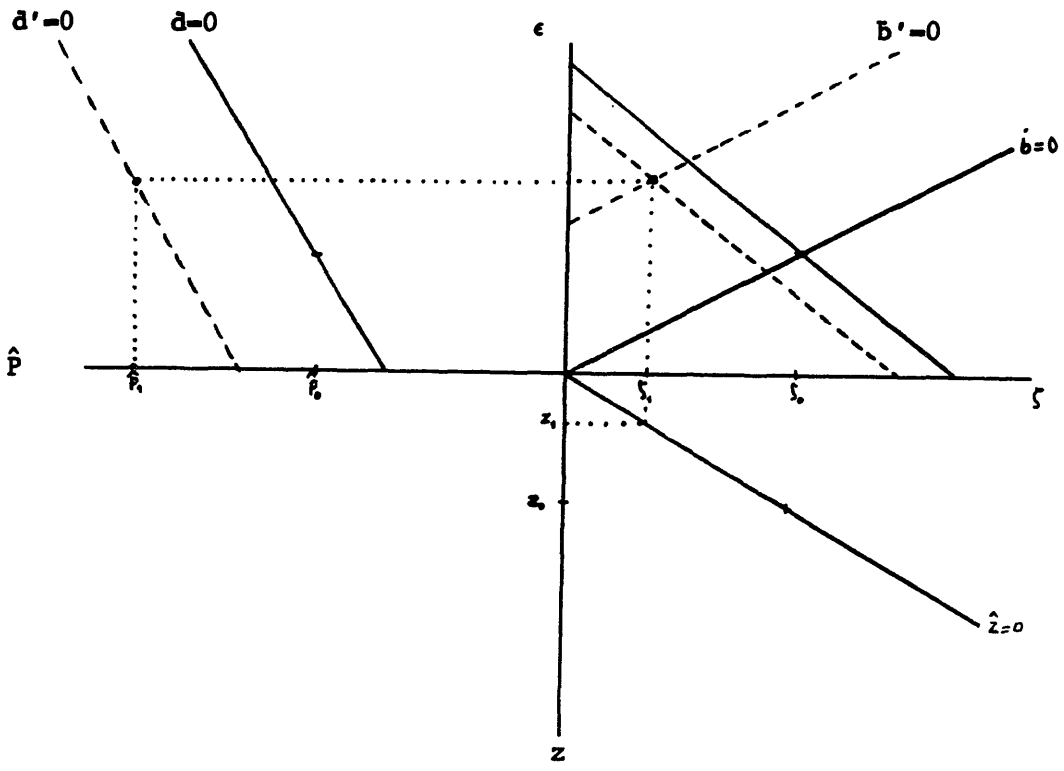
When foreign lending stops, the government no longer has the option of financing its deficit borrowing abroad; when it is also necessary to keep the debt/GDP ratio (or debt/capacity) constant, then appears a constraint, which as we mentioned puts a lower bound to inflation here shown by the $\dot{b} = 0$ schedule. The balance of payments restriction $\dot{d} = 0$ shows that, when foreign exchange becomes scarce, then imports have to be reduced which also means a lower level of activity.

After the debt shock any point in area A represents a feasible equilibrium. For instance, an equilibrium like E 1 can be reached letting relative price variables jump, which in practice happens when the nominal exchange rate jumps and nominal wages and other cost components move sluggishly. The fall in real wages is consistent with an increase in inflation by means of the dynamics described by equation (5'). The downward movement of the aggregate demand corresponds to the Diaz-Alejandro (1963) contractionary effect of the devaluation.

For E1 being a steady state solution, the comparative statics of employment, inflation, real wage and real exchange rate can be illustrated by figure (2), which consists on taking (3'') and (4'') as equalities and $\hat{\epsilon}=\hat{z}=0$.

Starting on the first orthant, the upward sloping schedule corresponds to the balance of payments constraint, and the downward sloping curve results from the substitution of the steady state conditions on (3''):

$$\varsigma = (1 - S)(\varsigma b(z^* + \frac{\psi}{\delta}\varsigma) - \epsilon[(r - \gamma)d + \gamma - P^0 \sigma h]) \qquad (8')$$



The second orthant plots equation (5') for $\hat{z} = 0$ and the fourth has the government budget constraint. Figure 2 shows the impact of a worsening in the external strangulation as a result of, say a drop in oil prices. This moves the $\dot{b} = 0$ schedule to the left, the DD schedule moves downward as the inflation tax requirements increase, and the $\ddot{b} = 0$ schedule upwards as a the exchange rate has to depreciate to cover the reduction in foreign exchange revenues. A sufficient condition for a real exchange rate depreciation $1-(1-s)\zeta\ bz^{*}-aeP>0$. This is guaranteed by a positive mark up rate. What is clear, and very consistent with our intuition is that inflation will go up as the foreign exchange problems aggravate and output and real wages will decline.

2.3. Stabilization Alternatives.

After the initial phase of the adjustment, that is, the jump in relative price variables is completed, there is the problem of taking inflation down again.

As it should be clear by now, it was the combination of external and internal strangulation what caused the contraction in output and high inflation, but it will not take a lot to see that the very presence of mechanism of propagation for the initial shock means that breaking the strangulation will not necessarily translate into a substantial improvement.

2.3.1. Budget Correction and Manufacturing Export Targets.

With the newly depreciated real exchange rate, the months following the collapse are times of increasing manufacturing production (exchange rate sensitive, non-traditional exports). In many occasions the memory of the problems caused by the appreciation which preceded the crisis make the authorities to set, at least for some time, the crawling peg such as to the real exchange rate at its new low levels. In the meantime there is a process of budget correction taking place either trimming down current spending or shooting down investment projects.

In spite of the effort, inflation remains high and income remains very depressed when both, the budget and the current account improve very much. This seems to have been the case in Mexico between 1983 and 1984.

This phenomenon can be illustrated with the help of the model. What an export target means is to keep the real exchange rate fixed which implies to set $\hat{e} = \hat{P}$. In terms of the real wage dynamics this makes $\hat{\epsilon} = \hat{z}$

= 0, and consequently ζ stays constant at the level $\delta/\psi(z^*-z)$, independently of the fiscal adjustment, unless one of the constrains becomes binding again and a new crises forces relative price variables to jump.

In terms of figure 3, what we see are the consequences of setting an export target and at the same time the government cuts down in investment projects.

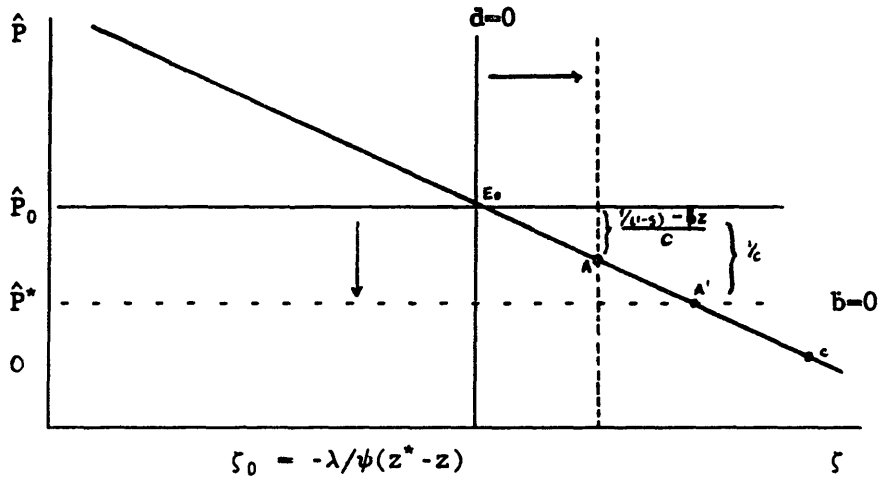


Figure 3

Lets take Eo as the initial equilibrium. The budget change moves the $\dot{b} = 0$ and $\dot{d} = 0$ schedules down and to the right respectively. Inflation and output remain at the same levels but the balance of payments and the budget improve. Thus, the export promotion policy keeps inflation too high compared to the levels compatible with the new domestic and balance of payments constraints.

In this example point A represents the minimum inflation that could be reached in an heterodox stabilization program where nominal wages and nominal exchange rate are controlled to grow at the rate P*. If P* is greater than 0 means that a plan of total price and wage freezing (represented by point C) is inconsistent with the balance of payments (and the

budget) and can not be sustained for long before a new exchange rate collapse happens.

Another point worth noticing in this particular example is that the domestic borrowing constraint is not binding. This shows that the usual criterion of looking at the operational deficit to see if a shock program of the 'austral-cruzado' type is sustainable turns out to be a necessary but not a sufficient condition.

Consider now the example where the largest part of the budget adjustment comes from a reduction of spending in home goods and services, and we still keep the assumption of an export target.

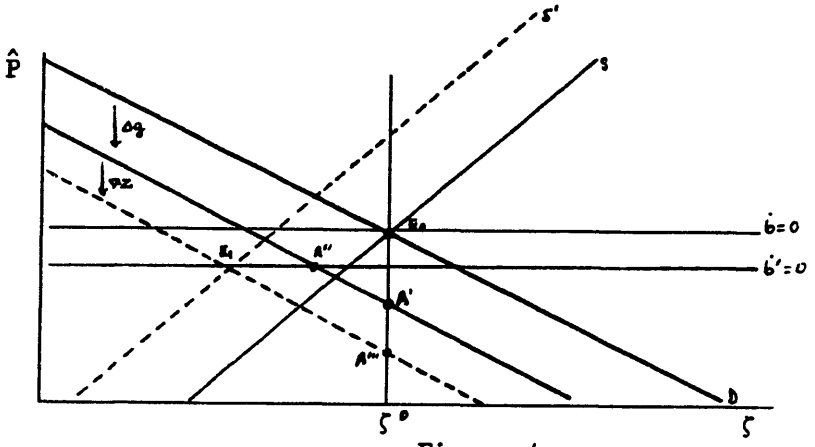


Figure 4

The very fact that the government spending multiplier makes the contraction of aggregate demand (in terms of inflation at a given level of output) bigger than the reduction in potential inflation on the borrowing constraint side makes it binding. At the initial real exchange rate and real wages and new government spending level, the steady state solution is given by point A'. Obviously, at this level inflation is too small in the sense that debt would be rising too fast and consequently, this is again a solution which can not be sustained in the long run.

Once again, being one constraint binding, the adjustment would require a jump in the price level to take real wages down. This means an equilibrium like E1, where income distribution is even worse, would be the feasible steady state solution.

This case is the most 'monetarist' in the sense that budget correction gets immediately reflected in lower inflation and reduced output, such that equation (3'') is always satisfied.

As we will comment in more detail in paragraph 2.3.2., what we see in practice is a combination of these two exercises together with some real exchange rate appreciation, as some attempts for soft-landing are put in effect for some time, before deciding that the balance of payments is worsening too fast and going back to a fixed real exchange rate. This situation is summarized in figure 5.

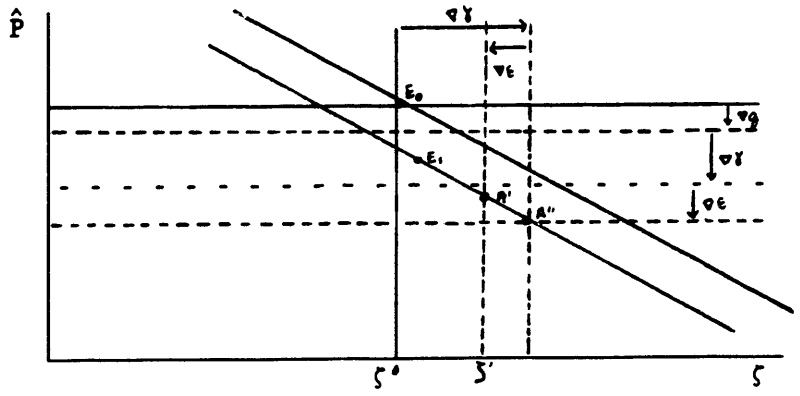


Figure 5

The economy moves from E0 to E1, but still inflation is too high. The minimum inflation consistent with both constraints is represented by A' and is again reachable by means of an heterodox program like PASE. At this level of inflation , seignoriage revenues allow a reduction of real domestic debt.

2.3.2. Soft-Landing.

After having explored the two polar cases: export targets and shock programs, the natural question to ask is if there is another way of taking inflation down <u>after</u> the fiscal correction is completed.

If, as we saw in paragraph 2.3.1., inflation is too high because the real exchange rate is too depreciated and real wages too low, this should mean that any attempt directed to take it down has to imply at least a period of appreciation, unless one is willing to continue through a path of output contraction as in the example of figure (4).

The problem with the appreciation issue is that it affects competitiveness, and with it worsens the problem of external strangulation. At the end of the process, when the constraint is finally binding the steady state inflation of the soft-landing will be way above the inflation level that could have been reached through a shock program .

Figure 6 shows three basic concepts of inflation.

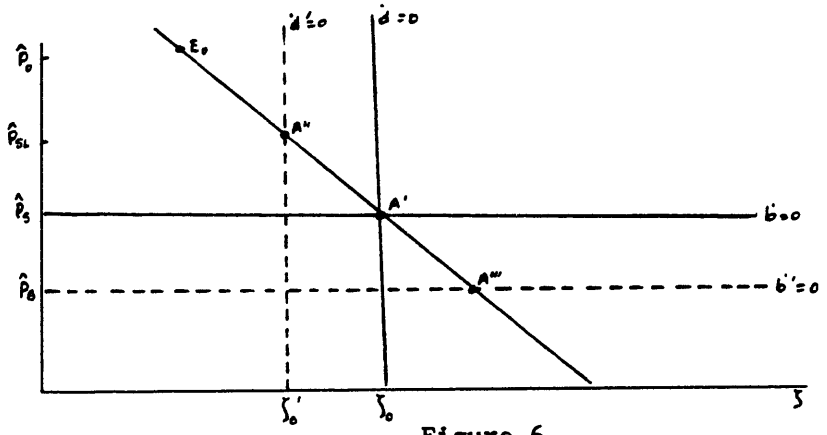


Figure 6

E_0 represents the equilibrium reached immediately after the debt crisis. In an economy with export targets this would also be the steady state solution. Now, if we adopt a soft-landing solution by allowing an exchange rate appreciation by means of a 'crawling peg' rate equal to $\hat{P}_{s1}$

the new steady state solution would be given by A'', which will be the closer to E_0 the more inertia in the system and the higher the real exchange rate elasticity of manufacturing exports. A' is the solution of a shock program and A''' is the solution of a simple monetary model with no inertia. Notice how a real appreciation improves the budget, pointing to the fact that a soft-landing solution could give better results that a shock program in the cases where the first constraint to become binding is the domestic balance and $(r - \gamma)d + \gamma - P^0oh > 0$.

Starting from pair of initial conditions for the real exchange rate and real wages (z_0) we can develop a simple expression for the soft-landing inflation and output compared to a shock program. Leaving all the details in appendix A, it can be shown that the minimum steady state inflation for the class of crawling peg rules which fix the rate of depreciation to their long-term values from the beginning of the soft-landing is given by

$$\hat{P}_{s1} = \hat{P}_s + \frac{\theta'\lambda(z^* - z_0)}{(1 - \psi/\delta)} \cdot (1-\zeta_0\psi\theta') \qquad \theta' = \frac{\theta}{1 - \theta} \qquad (9)$$

$$\zeta_0 = \frac{-(1-s)c}{1-\beta z_0(1-s) + (1-s)c\theta'\psi}$$

Expression (9) is very appealing to common sense: a soft landing program will be less effective the more serious the initial crisis (given by the distance between the steady state real wages in the model where no constraint is binding at before the crisis and the solution after the economy adjusts to the domestic and external strangulation z_0, the higher the real exchange rate elasticity of exports and the larger the inertia in the system, given by the ψ/δ ratio. With respect to this last point we say that a system has no inertia when the price equation is totally

vertical at the 'natural, level of output ς=0 which happens, either if ψ grows arbitrarily large or δ tends to zero.

We can derive a similar expression for the level of activity achievable with soft-landing compared with an heterodox shock program.

$$\varsigma_{s1} = \varsigma_s - \frac{\varsigma_0}{1 - \psi\theta'\varsigma_0} \frac{\theta'\lambda(z^* - z_0)}{1 - \psi/\delta} + \frac{\varsigma_1}{1-\varsigma_0\theta'} g \qquad (10)$$

Once again, the more inertia there is in the system, the less favorable it appears the alternative of a gradual program versus wage and price controls

2.4. Oil policy and Long-Term policy.

Mexico is the fourth largest oil producer and is also fourth in the world in term or proved oil reserves. This fact rises questions about its role in the stabilization.

As it was seen in paragraphs 2.2 and 2.3 there are substantial differences between a policy of reduction of government spending and increased oil exports (or stopping projects, which in the short run is equivalent). More oil exports relax both, domestic and external constraints whereas government spending reduction depresses more the economy and the standard of living, which is not longer a feasible option in Mexico.

In the long run, export promotion provides also a valid answer. As we see in Appendix B, where treat our model in a context of economic growth it can be seen that keeping a 'correct' level of real exchange rate does contradict growth targets when inertia dominates the system. On the other hand the combination of measures to break inertia with strong export



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promotion would mean even lower sustainable inflation and faster overall economic activity.

This exercise is for the case in which the balance of payments is the first binding constraint. Another possible case is when the balance of payments is the first binding constraint independently of the stabilization strategy chosen. In this situation the difference between soft-landing and shock inflation is given by

$$\hat{P}_{SL} = \hat{P}_S - \frac{\zeta_0 \epsilon_0}{(1-\psi\zeta_0\theta)e} \frac{\psi}{\delta} \left[[(r-\gamma)d + \gamma - P_0\sigma - h] + g\right] \qquad (11)$$

Not surprisingly, the steady state inflation could be less than the shock inflation depending on the sign of the external balance of the public sector.

3. Simulating a shock program.

The model in section 4 provides a simple framework to see the macroeconomic constraints to a successful shock program. This section presents a simple macroeconometric model of the Mexican economy which to simulate a shock program and to highlight the importance of the external accounts on inflation stabilization. Before going in the numbers it is important to bear in mind the Lucas' critique to macroeconometric policy evaluation. For this reason the results presented in the section shall be taken as points of reference rather than definite answers.

3.1. The Econometric Model.

We will estimate the following system of equations:

$$lgnp = c1 + \beta_1\ lgnp(-1) + \beta_2\ lgaspu + \beta_3\ lrexch + \beta_4\ lxpu + + inf + e1 \quad (E1)$$

$$inf = c2 + \alpha_2\ inf(-1) + \alpha_2\ wage + \alpha_3\ depr(-1) + \alpha_4\ lgnp + + lgnp(-1) + e2 \quad (E2)$$

$$curacp = c3 + \mu_1\ lrexch + \mu_2\ lrexch(-1) + \mu_3\ lrexch(-2) + + \mu_4\ lgnp + \mu_5\ lgnpusa + e3 \quad (E3)$$

The first equation is the aggregate demand, the second is a price equation and the third is the balance of payments constraint.

lgnp natural logarithm of the gdp of the industrial sector in millions of pesos of 1970.

lgaspu natural logarithm of the total government spending in domestic goods (total spending -imports of goods and services) in millions of pesos of 1970.

lrexch natural logarithm of the real exchange rate. 1978=100.0

lxpu natural logarithm of exports of the public sector in millions of dollars.

inf quarterly inflation of the consumer price index.

wage quarterly increase in the index of wages in the manufacturing sector (in percents/100).

depr quarterly rate of depreciation of the nominal controlled exchange rate (in percents/100).

curacp curac-xpu+interest+impu

curac current account balance in millions of dollars

xpu exports of the public sector in millions of dollars

impu imports of the public sector (except interest on the external debt)

interest interest payments on total(public+private) external debt

gnpusa annual rate of real gnp growth in the United States (in percents).

3.2. The Data.

All information comes from Indicadores Economicos of Banco de Mexico and the data bank SIE-BANXICO. The GDP of the industrial sector is used as a proxy for the overall level of activity (quarterly GDP is not available before 1985.1). The sample used for estimation is 1977.1 1987.2.

3.3. The Estimation.

Equations (E1) and (E2) are estimated simultaneously using 2SLS. Equation (E3) is estimated using instrumental variables to take account for the possible correlation between lgnp and the error term. In the estimation of all three equations the instruments used are lgnp(-1) inf(-1), lgaspu, lrexch current and lagged one and two periods, lxpu, wage and depr(-1).

Results of the Estimation

1. Dependent Variable : lgnp

	Coefficient	t-Statistic
constant	2.22	2.81
lgnp(-1)	.811	9.03
lgaspu	.037	2.18
lrexch	-.026	-1.59
lxpu	.0005	1.06
inf	-.115	-1.70
	R2=.971	DW= 2.04

2. Dependent Variable : inf

constant	.001	0.95
inf(-1)	.581	5.24
wage	.153	2.52
depr(-1)	.109	2.95
lgnp	.001	1.83
rho	-.408	-2.42
	R2=.833	

3. Dependent Variable : curacp

constant	51522	2.01
lgnp	-5615	-2.83
lrexch	720.2	1.21
lrexch(-1)	1435.0	2.30
lrexch(-2)	1680.1	2.83
gnpusa	137.2	2.38
rho	0.530	3.57
	R2=.904	

Simulations.

There are three questions that one has to answer before knowing if a heterodox stabilization has a good chance to work:

- Is the rapid desinflation inconsistent with the available unused capacity in a way that there will be rationing and consequently repressed inflation ?

- Is the expansion associated with the reduction of the inflation tax inconsistent with the constraint imposed on the balance of payments by the availability of external savings?

- Is the reduction in inflation tax revenues inconsistent with a stable ratio of domestic public debt to gnp?

The following exercises try to answer this question.

a) Expansionary effects of a desinflation.

To get a sense of how expansionary is the reduction of the inflation tax we can substitute a zero inflation and the value of the real exchange rate fixed at the level it has when the stabilization program starts, while all remaining exogenous variables are kept at their observed values in the equation of aggregated demand. The following two tables compare the simulated level of activity with the values actually recorded and with the industrial GDP reached at the peak of the 1981 expansion

Expansionary Effects of the Desinflation
(percent difference between simulated and observed GDP)(a)

1985.1	3.1%	---	---	---	---	---	---	---	---	---
.2	4.9	5.9	---	---	---	---	---	---	---	---
.3	7.2	8.1	7.0	---	---	---	---	---	---	---
.4	8.6	9.3	8.7	8.3	---	---	---	---	---	---
1986.1	10.7	11.3	10.3	10.5	8.8	---	---	---	---	---
.2	12.4	12.8	13.1	12.5	10.8	7.5	---	---	---	---
.3	13.8	14.1	14.8	14.4	13.0	9.5	11.1	---	---	---
.4	16.4	16.7	16.6	16.2	15.1	11.3	12.5	7.9	---	---
1987.1	16.9	17.2	17.0	16.5	16.1	14.5	15.0	13.8	13.1	---
.2	16.2	16.5	16.4	15.9	15.2	12.9	13.2	13.3	13.6	13.6

(a) (simulated-observed) *100/observed

Expansionary Effects of Desinflation.
(percent difference between simulated and industrial DGP in 1981.4)

1985.1	0.5%	---	---	---	---	---	---	---	---	---
.2	2.9	3.9	---	---	---	---	---	---	---	---
.3	5.1	5.9	5.2	---	---	---	---	---	---	---
.4	5.6	6.2	6.0	5.3	---	---	---	---	---	---
1986.1	5.2	5.7	5.8	5.1	2.8	---	---	---	---	---
.2	8.3	8.7	9.0	8.3	6.6	3.6	---	---	---	---
.3	3.8	4.1	4.7	4.3	2.9	-.5	1.0	---	---	---
.4	5.8	6.2	6.1	5.6	4.5	0.8	2.0	-2.6	---	---
1987.1	6.3	6.7	6.5	6.0	5.6	4.0	4.5	3.2	2.5	---
.2	6.9	7.3	7.2	6.6	6.2	4.0	4.3	4.4	4.7	4.7

The tables above simulate the expansion in activity that would be obtained if a zero inflation program was started anywhere between 1985.1 and 1987.2. It is apparent that the expansion is substantial. This is specially noted in 1986. But, regardless of the fact that the levels of activity that would result could be higher than 10% above the actually observed levels this does not necessarily means that this would mean that the expansion is unmanageable. One has to remember that in the last years the Mexican economy has been in a deep recession, then a more reasonable comparison is between the simulated GDP and the level of activity reached in 1981.4. Using this number as benchmark one finds that the elimination of inflation means an expansion in the order of 4 to 6% above these levels. This level is clearly obtainable, although some attention has to be given to the timing of aggregated demand. An expansion 3% above the 1981.4 level can be absorbed in a year or so, but the reduction in inflation tax can have immediate effects and then it would be necessary to contain government spending in the first stages and resume spending as capacity expands. Some adjustment previous to the enactment of the shock

program can help. For example, say that we are looking at the case of an heterodox stabilization starting on 1985.1. If one sets as a target the level of activity reached in 1981.4, a combination of a 10% real exchange rate depreciation and a 5% reduction in government spending can do it.

b.) Desinflation and the balance of payments.

Another type of capacity constraint is given by the balance of payments. The expansion brought about by the elimination of the inflation tax could be consistent with an economy with unemployment of labor and capital but the problem arises when foreign exchange is scarce. To know if a shock program is sustainable from the perspective of the balance of payments we can simulate the level of inflation that would make that constraint exactly binding. The following computes this level of inflation for a maximum current account deficit of 600 million dollars per quarter, which is a reasonable goal.

Minimum Inflation consistent with the Balance of Payments Constraint (maximum current account deficit of 600 million dollars per quarter).(a)

85.1	-4.9	---	---	---	---	---	---	---	---	---
.2	-0.1	2.9	---	---	---	---	---	---	---	---
.3	1.2	1.1	-2.0	---	---	---	---	---	---	---
.4	-2.4	-3.7	-12.3	-13.7	---	---	---	---	---	---
86.1	33.7	30.3	8.3	7.5	6.8	---	---	---	---	---
.2	45.4	43.8	22.1	16.5	11.8	13.7	---	---	---	---
.3	43.8	42.1	20.8	16.4	13.9	15.5	17.1	---	---	---
.4	27.4	25.7	3.6	-0.8	5.1	-7.7	-6.5	-11.1	---	---
87.1	21.2	19.5	-2.4	-7.1	-0.9	-13.0	-12.1	-15.9	-13.8	---
.2	20.0	17.9	-3.2	-8.1	-2.0	-14.2	-13.3	-16.2	-14.5	-14.6

(a) quarterly rate of inflation

This table highlights the fact that a zero inflation program is very sensitive to external shocks. The inflation rates reported would be the

ones one would obtain with perfect indexation. That is, if the disequilibrium in the current account has to be corrected using the inflation tax as only element to reduce domestic absorption. Although it is hard to believe that this is necessarily the case, it points at the fact that it is possible to go from a low inflation scenario to a three digit yearly inflation rather easily. For example, for an program starting in 1985.4 it would take the drop in oil exports to put the inflation in the range of 20% per quarter. This inflationary pressure disappears as the effects of the real exchange rate depreciation of 1985.3 and 1985.4 begin to have a favorable effect on the balance of payments and the terms of trade recover. I want to point out, that for computing the inflation rate in this I assumed that along the exercise the level of activity remains at the zero inflation level for the effects of computing lgnp(-1) in equation (E1). This means that one should interpret the results above as the 'shadow rates of inflation', which in the case of being positive mean that there has to be rationing of foreign exchange. A more clear picture of how the foreign exchange constraint affects the viability of a zero inflation target we can take the determine the magnitude of the fiscal adjustment that would be necessary to keep the foreign exchange constraint binding at a zero inflation (or less) under different scenarios of terms of trade and availability of foreign resources. We use as benchmark the values of real exchange rate and public spending in 1987.2 (The values reported are simulated setting lgnp=lgnp(-1) in equation (E1) because the intention is to see the size of the permanent adjustment needed to sustain a zero inflation target)

Percentage Reduction in Real Government Spending for a Sustainable Zero Inflation Program. (a)

Effective Interest Rate	Maximum Current Account Deficit(b)	Average Price of Mexican Oil Exports (dollars per barrel)		
		$10	$15	$20
8.0	1200	0.7%	n.r.	n.r.
	600	3.7	0.0	n.r.
	0	6.7	3.0	n.r.
9.0	1200	1.9	n.r.	n.r.
	600	4.9	1.2	n.r.
	0	7.9	4.2	0.5
10.0	1200	3.1	n.r.	n.r.
	600	6.1	2.4	n.r.
	0	9.1	5.4	1.7
11.0	1200	4.3	0.6	n.r.
	600	7.3	3.6	n.r.
	0	10.3	6.6	2.9.

(a) includes public imports (b) millions of dollars per quarter. (n.r.) no correction required.

This table stresses the sensitivity of an heterodox program to terms of trade shocks or, which is the same, the importance of available external borrowing to cover these exogenous changes. For example, a reduction of 2.4 billion dollars in external savings a year requires a 3% reduction in government spending; a drop of 5 dollars per barrel needs a 3.7% reduction in spending and one point in interest rates has to be compensated with a 1.7% spending cut to make aggregate demand compatible with the balance availability of foreign exchange.

c.) Zero Inflation and the Government Deficit.

A zero inflation program is consistent with the public sector borrowing requirements as long as one has an operational deficit close to zero. In the case of Mexico where the ratio of domestic and external

public debt to GDP is respectively 57% and 21% and a reasonable long term rate of GDP growth is 5.0% and a real interest rate of 2% means that a primary deficit of 2.3% is consistent with a non-inflationary deficit financing. From the tables in the last section one can see that even in times of low oil prices that constraint is not violated. In fact there is a very large primary surplus which leaves a wide margin for action. Summarizing what we have seen in the simulation exercises above it is clear that it is not enough to see an operational surplus to be sure that the budget correction has been enough. There are other considerations to make, specially with respect to the balance of payments and the extent of unused capacity with which the economy starts the program. For example, it can be inferred that starting a stabilization in 1985, would have failed in 1986 due to the oil shock which would have put too much pressure on the balance of payments and forced an exchange rate adjustment. The real exchange rate correction undertaken through 1985 and the recuperation of the oil prices by the end of 1986 and beginning of 1987 put the Mexican economy at a very realistic possibility of going for a sustainable shock program , perfectly consistent with the budget, with the balance of payments and levels of unused internal capacity (the Encuesta de Expectativas Empresariales (survey of entrepreneurial expectations) generated by Banco de Mexico for the second semester of 1987, reveals that the percentage of capacity used in the industrial sector is only 65%). The alternative is a soft-landing. We could simulate what the potential of a soft-landing experiment. The soft-landing inflation reported for each quarter is the value that would be reached (keeping the values of the exogenous variables, lxpu and lgaspu at the levels reported

for that quarter and allowing for full ex-post wage indexation: wage=inf(-1)) at the moment when the balance of payments constraint becomes binding having set the crawling peg of the exchange rate at 9% and 6% respectively. If we set a balance of payments constraint of 600 million dollars per quarters, there would be three quarters in 1986 where there is not even a chance to start the crawling peg. We can give even more flexibility to the constraint and notice that even in this situations the gains in inflation reduction are very modest. We could modify the scenario of the simulation to rationalize the oil shock of 1986 as temporary by setting in the simulation the price of oil exports at 15 dollars per barrel and defining the current account constraint at a moderate surplus of 150 million dollars per quarter.

Soft-Landing Inflation

	Crawling Peg	
	9%	6%
1985.1	11.5	12.8
.2	5.5	6.4
.3	8.3	9.5
.4	11.3	12.5
1986.1	13.1	14.5
.2	12.7	13.7
.3	13.8	16.7
.4	16.3	18.2
1987.1	20.4	21.5
.2	22.0	23.3

From this table it can be said that the gains of the soft-landing strategy are very modest, and that setting a lower crawling peg rates can leave one with a higher steady state inflation because the real exchange rate appreciates very fast making the balance of payments constraint to be reached too soon.

Concluding Remarks.

Coming back to some of the questions suggested at the beginning of this essay after our brief review of some basic features of the Mexican economy lead us to the following remarks:

-The sluggish response of real and nominal endogenous variables to exchange rate, wages and fiscal variables indicates the presence of a strong inertial component which reduces significantly the potential of soft-landing stabilization programs when compared to heterodox strategies. As a consequence of this inertia and the purpose of avoiding a deep recession, fiscal policy has not had control over total PSBR, even though basic indicators such as primary and operational deficit remain very satisfactory.

-The balance of payments crisis of 1986 seem to have been strong enough to make impossible a total wage and price control program without further and rather substantial aggregate demand adjustments or a fast recovery in oil prices. Nevertheless, the recovery of manufacturing exports was large enough to make feasible an effective program of 'inflation' control at levels substantially lower than those observed.

-Although it was not explicitly considered as such in the empirical section, the magnitude of the decline in real wages points to the possibility that income distribution effects have been huge and consequently make an additional attempt to continue the stabilization through further reductions in the standard of living highly unlikely and questionable from the standpoint of social justice.

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APPENDIX A

To obtain the soft-landing solution we start from the following simplified system:

$$\zeta^{max} = \lambda\epsilon \tag{A1}$$

$$\dot{\epsilon} = \dot{e} - P \tag{A2}$$

$$\zeta = [\zeta bz - cP](1-s) + g \tag{A3}$$

$$\dot{z} = \psi\zeta + \delta(z^* - z) \tag{A4}$$

$$P = \theta'\dot{z} + \dot{e} \tag{A5}$$

Substituting (A5) and (A4) on (A1) we obtain the equation describing the relation between output and the 'crawling peg' for a given level of real wages

$$\zeta = -\zeta_0(\theta\delta(z^* - \dot{z}) + e) + \zeta_1 g \tag{D1}$$

where

$$\zeta_0 = \frac{-(1 - s)c}{1 - \beta z_0(1 - s) + (1 - s)c\theta'\psi} \qquad \zeta_1 = \frac{1}{1 - \beta z_0(1 - s) + (1 - s)c\theta'\psi}$$

$$\theta' = \frac{\theta}{1 - \theta}$$

The differential equation for the real wage dynamics is

$$\dot{z} = \psi\zeta + \delta(z^* - z) \tag{D2}$$

Substituting (D1) in (D2) it results

$$\dot{z} = \delta(1 - \zeta_0\psi\theta')(z^* - z) - \psi\zeta_0 e + \psi\zeta_1 g \tag{D3}$$

the solution of this equation is given by:

$$z = (z_0 - \hat{z})\exp(-\delta(1-\psi\zeta_0\theta')t + \hat{z}$$

$$\hat{z} = z^* + \frac{\psi(\zeta_1 g - \zeta_0 e)}{\delta(1 - \psi\zeta_0\theta)}$$

the stability condition sets

$$\delta(1 - \psi\zeta_0\theta') > 0$$

Consequently, for a given crawling peg, the steady state solution for the real wage is :

$$\hat{z} = z^* + \frac{\psi(\zeta_1 g - \zeta_0 \dot{e})}{\delta(1-\psi\zeta_0\theta)} \tag{A6}$$

and the corresponding level of production is

$$\hat{\zeta} = \frac{\zeta_1 + g - \zeta_0 \dot{e}}{1 - \psi\zeta_0\theta} \tag{A7}$$

to simplify the exposition and without loss of generality it can be assumed $\epsilon_0 = z_0 = 0$, then

$$\epsilon^* = -\theta'\hat{z} \tag{A8}$$

and

$$\zeta^{max} = -\lambda\theta' z^* \frac{\psi}{\delta} + \left(\frac{\zeta_1 g - \zeta_0 \dot{e}}{1 - \psi\zeta_0\theta}\right) \tag{A9}$$

(A9) and (A7) have to be the same in the steady state, hence:

$$\left(1 + \frac{\lambda\theta'\psi}{\delta}\right) \frac{\zeta_1 g - \zeta_0 \dot{e}}{1 - \psi\zeta_0\theta} = -\lambda\theta' z^*$$

$$\hat{P} = \dot{e} = \frac{\zeta_1}{\zeta_0} g + \frac{\lambda\theta'(1-\psi\zeta_0\theta')}{1 - \psi/\delta} z^* \tag{A10}$$

where the heterodox shock solution is $(\zeta_1/\zeta_0)g$. The dynamics of the process are described in figure (A1) where the arrowed path describes the dynamics of the soft-landing process from a given set of initial conditions.

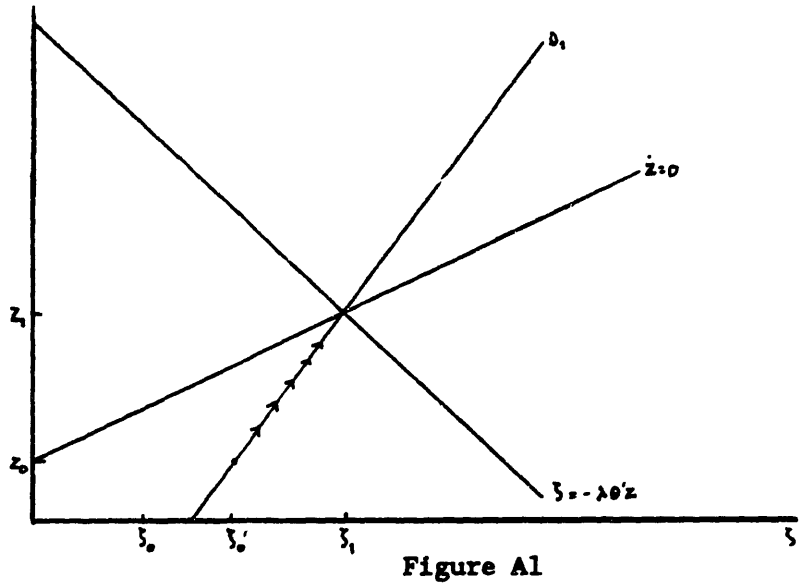


Figure A1

The next case is when the first binding constraint is given by the borrowing requirements of the government. In that case the soft-landing inflation satisfies

$$\dot{e} = \dot{P} = \frac{\epsilon_{S1}}{C}\left[(r-\gamma)d + \gamma - P_0\sigma h) + \frac{g}{c}\right]$$

$$\dot{\epsilon} = \dot{P} - \dot{e}$$

$$\dot{P} = \theta\dot{z} + \dot{e}$$

$$\zeta = [\zeta\beta z - C\dot{P}](1-S) + g$$

and the shock inflation is given by

$$\hat{P}_S = \frac{\epsilon_0}{C}\left[(r-\gamma)d + \gamma - P_0\sigma h) + g/c\right]$$

and consequently one gets the relation:

$$\hat{P}_{s1} = \hat{P}_s \frac{\zeta_0\epsilon_0}{(1 - \psi\zeta_0\theta)c}, \frac{\psi}{\delta}[(r - \gamma)d + \gamma - P_0\sigma h] \quad ; \qquad \text{(A11)}$$

APPENDIX B

To see the impact of alternative policy actions in the long run, we have to pay more attention to the issue of capacity accumulation. Taking again our three sector model with some minor changes will allow us to evaluate the effect of export-promotion and income distribution policies on long run capacity and shock-sustainable inflation. (This appendix is an extension of Taylor's (1986) models of distribution and growth).

1. Non-Traded Goods Sector.

1.1. Equation of Material Balances.

$$PX = PC + PI + PG \qquad (B1)$$

P Price of Non-traded goods

C Consumption in the Non-traded goods sector

G Public Spending in Non-traded goods.

I Investment spending in Non-traded goods

1.2. Consumption Function

$$PC = wbX - Pc'(\hat{P}) + wfE \qquad (B2)$$

$wbX + wfE$ = Total wages

1.3. Investment function

$$\frac{PI}{P_k K} = \frac{PI}{hP + (1 - h)eP^*} = g_0 + g_1 r = g \qquad (B3)$$

h = fraction of total investment spent in domestic goods.

1.4. Formation of internal prices.

$$P = (1 + t)(wb + aeP^*)$$

t = mark-up rate

1.5. Definition of rate of return.

$$r = \frac{t}{1 + t} \frac{\zeta}{h + (1 - h)eP^*} \qquad (B5)$$

$$\zeta = x/K$$

K≡Capacity in the Non-traded goods sector.

1.6. Equilibrium condition in the Non-traded goods sector

$$(tz\zeta + (1 + t)aqP^*\zeta - zfk) + c(\hat{P}) = pg + d \qquad (B6)$$

z = Real wage (w/P)

q = Real exchange rate (e/P)

d=G/K

p = (h + (1-h)qP*)

k=Ke/K

2. Traded Goods Sector

2.1 Production of exportables.

$E = \zeta Ke$

$Ke \equiv$ Capacity in the traded goods sector.

2.2 Prices in the Exportable goods sector

$Pe = 1$

2.3 Prices in the importable goods sector

$Pi = P^*$

2.4. Investment equation in the exportable goods sector

$$I_e/K_e = d^*/k + g_e r_e \qquad (A7)$$

$k \equiv Ke/K$

$d^* \equiv G^*/K$

$G^* \equiv$ Public spending in importable goods

$r_e \equiv$ profit rate in the exportable goods sector

$r_e = ((q - zf)/qP^*)$

2.5 Balance of Payments (Net exports)

$$qk - kd^* - (1 - t)aqP^*\zeta - qP^*k\left(d + g_e \frac{q - zf}{qP^*}\right) - (1 - h)\left(g_0 + g_1 \frac{t}{1 + t} \frac{\zeta}{h + (1 - h)qP^*}\right) = qb \qquad (A8)$$

b is exogenously given when there is external strangulation

3. Capital Stock composition

$$\hat{k}/k = d^*/k + g_e - g_0 - g_1 r \qquad (A9)$$

Solution to the model.

If one assumes external strangulation the balance of payments equation determines the prevailing level of income for each given composition of the capital stock

$$\begin{aligned} \varsigma &= (1/\phi_0)(\phi_1 - qb) \\ \phi_0 &= (1 + t)aqP^* + (1 - h)g_1\left(\frac{t}{1 + t}\,\frac{1}{h + (1 - h)qP^*}\right) \\ \phi_1 &= qk - kd^* - qP^*k\left(d^* + g_e\,\frac{(q - zf)}{qP^*}(1 - h)g_0\right) \end{aligned} \qquad (S1)$$

The balanced growth condition is reached when $\hat{k}/k$ is equal to zero

$$\varsigma = \frac{1}{\phi_3}\left(d^* - g_0 + g_e\left[(q-zf)\right)/qP^*\right]$$

$$\phi_3 = g_1\,\frac{1}{(1 + t)(h + (1 - h)P^*)} \qquad (S2)$$

Inflation is obtained solving, at any point in time $\hat{P}$ in equation (B6)
The rate of capital accumulation in balanced growth is given by

$$g = d^* + g_e\,\frac{q - zf}{qP^*} \qquad (S3)$$

Along this model it has been assumed that the balance of payments constraint is binding, and consequently the level of aggregated savings is basically determined by the size of the international obligations. The price level in the non-tradeable goods sector are determined domestically while the country is price-taker in the international markets. We finally assumed that investment in both home sectors has two components: public

and private. Public investment is treated as an exogenous variable and private investment is a function of the rates of return.

Solution equations (S1) and (S2) can be analyzed with the help of several graphs. Figure B1 summarizes the dynamics of capacity accumulation. The k=0 diagram corresponds to equation (S2).

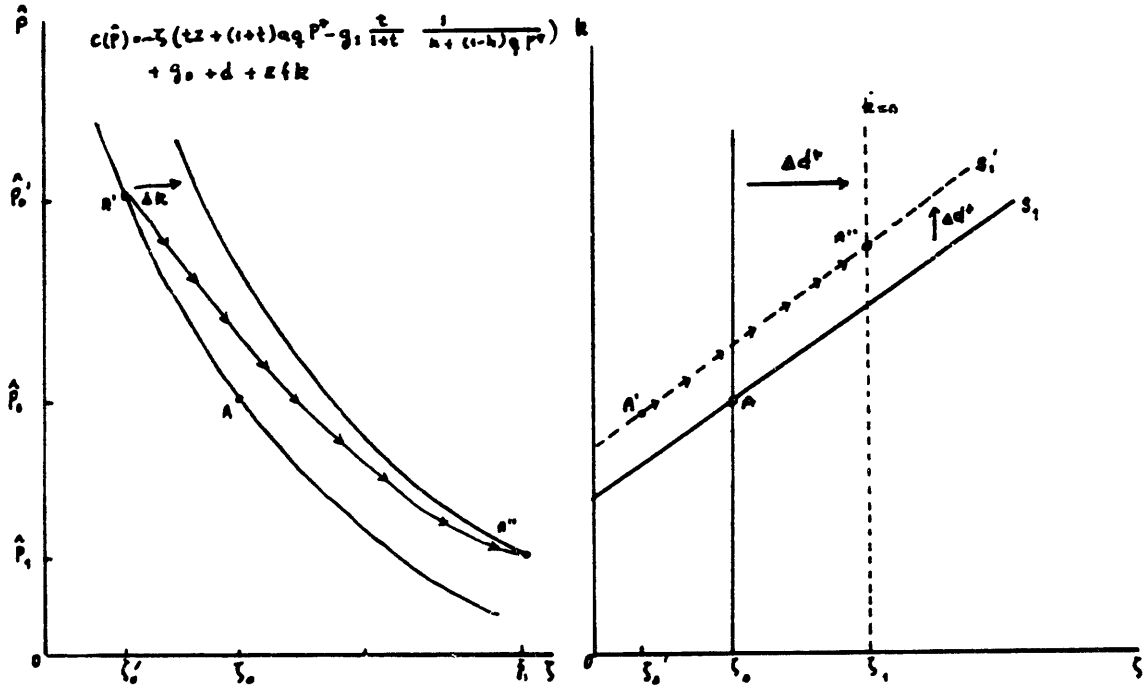


Figure B1

For example, an increase of d* (public spending in exportables) moves the S1 schedule up and to the left. In the very short run the economy moves from A to A' which represents a drop in the production of home goods (ζ), the exportable goods sector increases its output. As the spillover effect begins to be felt in the home goods sector production increases. At the end, production in both sectors has risen (S3). With respect to inflation, the higher level of (ζ) in the long run means that inflation will be lower as the export-led growth has reduced the external strangulation. In the short run, though, the balance of payment problems could get

worse as capital formation is import-intensive.

As we know further real exchange rate depreciation has different impact on observed inflation and the minimum inflation sustainable by a shock program, it can be also seen that using the real exchange rate as the main instrument for export promotion could not be the best alternative if compared with direct investment in exportables, because, as it comes from (S1) to (S3) real exchange rate depreciation and real wage reduction depress aggregate demand and the dynamics of domestic production and, whereas the export sector grows it does it more slowly because the real depreciation also elevates the cost of imports and with it the rate of return on capacity expansion. In any case the real exchange rate depreciation reduces the level of sustainable inflation which would also be the case if real wages decline keeping the real exchange rate fixed.

The basic message of this model is that in an economy with debt problems there are two main things to do: break inertia and once it is done move toward exports using the instrument which affects them more directly taking direct investment and subsidies to the export sector as first best, and real exchange rate depreciation and real wage reduction as second best.

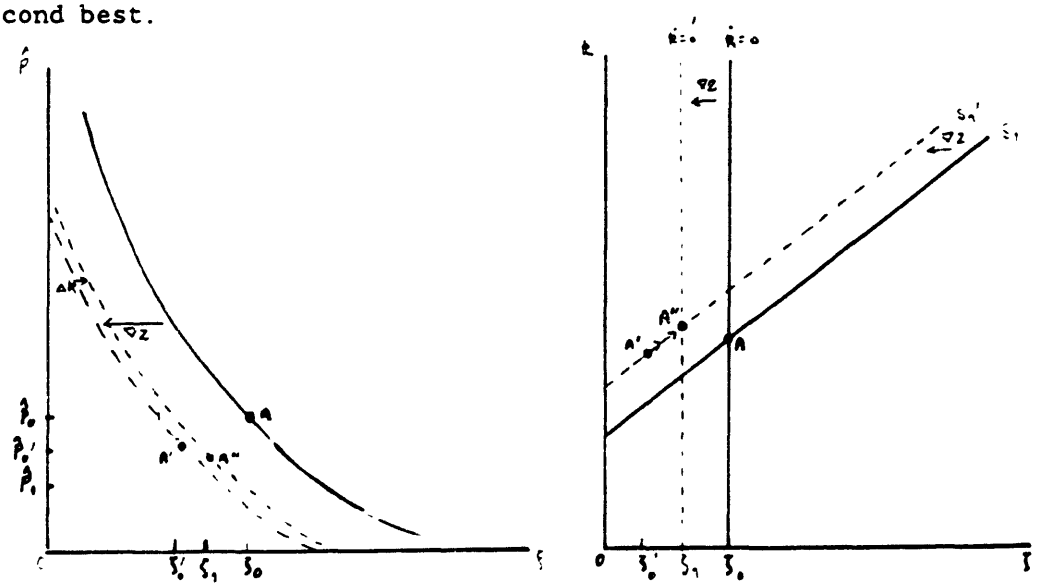


Figure B2

Part III

FINANCIAL REPRESSION, FINANCIAL LIBERALIZATION AND THE INTEREST RATE ELASTICITY OF SAVINGS IN DEVELOPING COUNTRIES

FINANCIAL REPRESSION, FINANCIAL LIBERALIZATION AND THE INTEREST RATE ELASTICITY OF SAVINGS IN DEVELOPING COUNTRIES.

Introduction.

As a result of the world inflation of the 1970's that affected many developing countries the literature began to reflect the worries about the inconveniences of very negative real returns on financial instruments. Unfortunately, the debt crisis got in the way and diverted the attention of economists from this topic, vital for the policy making of the recovery and resumption of growth in the next decades.

The initial motivation for the study of the role of financial structure in overall economic performance can be found in Goldsmith (1966, 1969). His work points to the fact that credit institutions play a crucial role in the development process, and seems to carry the message that some degree of repression on interest rates is always present in successful experiences.

On the other side of the table we have the responses of McKinnon (1973) and Shaw (1973) who put much emphasis on the evils of regulating credit market variables. For example we have Shaw's (1973) statement in this direction:"... distortions of financial prices including interest rates and foreign exchange ...[is] in all cases [an] strategy [which] has stopped or gravely retarded the development process."

This debate gave place to some empirical work directed at finding the relation between financial repression, financial liberalization and growth. First we have Fry (1982) who got regression results going against the argument of those in favor of liberalization. What he found is that

the interest rate elasticity of saving in LDCs was not large enough to justify moving real interest rates up to boost the flow of real resources from consumption to productive activities.

The response comes from Giovannini (1983) who revises Fry's results to discover that, specially in the case of Korea, they were very sensitive to the sample chosen for the regressions. Then he pools cross section and time series data for LDC's to find from Modigliani (life-cycle) type of regressions for savings that the interest rate elasticity was unstable through time.

In spite of the ambiguity of the results and the previous debate, they may be pointing to some important regularities with some strong policy implications. It may be possible to find some testable reasons for which it is valid to say that too much repression is bad and that too much liberalization can be also damaging. In fact, the instability of the interest rate elasticity of savings through time could reveal something about the conditions and ranges within which negative interest rates are convenient and the reasons why liberalization should be implemented carefully.

This paper revises the experience of 26 countries, looking for some regular pattern behind the results obtained in previous empirical work.

Section 2 contains a model which looks at income distribution reasons for an aggregate savings function with interest rate elasticity which also depends on the interest rate level, leading to a Laffer-curve shaped savings function and consequently to a criterion for an optimal regulated interest rate in the presence of other rigidities in factor and/or goods markets.

Section 3 presents the regression results of savings functions for 26 LDC's, putting special care to the sample partition in each case according the level of the real interest rate prevailing in each sub-period for each country. In the end of this section we look for some connection between the hypotheses of the model in section 2 and the available evidence.

Section 4 concludes on the results giving some comments on their policy implications in matters of financial reform.

2. A Model.

Here we will present a very simple model which stresses the role of income distribution and credit market rigidities as determinants of private savings.

Consider an economy with a very large number of price-taking agents, which can be classified in entrepreneurs (e) and workers (o). All of them are identical, and have the same utility function. Workers and entrepreneurs take their current consumption decisions trying to maximize their welfare which depends on present and future consumption. To simplify the analysis we can think of a utility function like (1) where C_t is current

$$U = U(C_T, Y^P_{t+1}) \tag{1}$$

consumption, and Y^P_{t+1} is the permanent income each agent will obtain from their decisions at time 't'.

Workers can sell only one unit of labor for which they receive w units of consumption goods per period. Besides, at the current time t, they are endowed with W_0 of goods which they have lent to productive units in return for r units of goods per period.

For the Cobb-Douglas case, the optimization problem for workers is:

$$\text{Max} \quad U = AC_T^{\alpha} {}_{\delta}Y^{d}_{P\,T+1\,\sigma} \tag{2}$$

$$\text{ST.} \quad Y_{P,T+1} = {}^{\sigma}_{T}W_{T+1} + w$$

$$W_{t+1} = W_0^{\sigma} + TW_0^{\sigma} + w - C_T$$

Solving (2) we obtain a savings function (3).

$$S_T^{\sigma} = (\alpha - r - \alpha r)W_0^{\sigma} + \left(1 - \alpha(1 + 1/r)\right)W \tag{3}$$

For this sector of the population, the sign of the elasticity depends on their initial W_0 and the interest rate itself. From (4) we can see that for a strictly positive W_0 the interest rate elasticity declines monotonically and can become negative for a sufficiently large real interest rate.

$$\frac{\partial S^{\sigma}}{\partial r} = -(1 + d)W_0 + \frac{\alpha}{r^2} w \tag{4}$$

Expression (5) gives a necessary and sufficient condition for a positive interest rate elasticity of savings.

$$\frac{w}{rW_0^{\sigma}} > \frac{r(1 + \alpha)}{\alpha} \tag{5}$$

This means, that as long as wage income is a relatively large proportion of total income (either because financial wealth of workers is small or because the interest rate is low) the interest rate elasticity of current savings will be positive. On the other hand, if financial wealth is high, increasing interest rates will boost permanent income in such a way that people will smooth the consumption path reducing current savings.

Consider now the case of entrepreneurs. They own productive units with a constant returns to scale technology.

$$Y_T^e = P(W_T^e + W_T^\sigma) \tag{6}$$

Their optimization problem is given by (7).

$$\text{Max} \quad U = A\, C_{T,\bullet}^{\alpha}\, Y_{P,T+1,\bullet}^{1-\alpha} \tag{7}$$

$$\text{S.T.} \quad Y_{P,T+1,\bullet} = PW_{T+1}^e + (p - r)W_{T+1}^\sigma - w$$

$$W_{T+1}^e = PW_T^e + (p - r)W_{T+1}^\sigma - C_{T,\bullet} + W_T^e$$

and the resulting saving function is given by (8).

$$S_E = \left[\left((1 - \alpha)(1 - P)\right) - 1\right] W_{\bullet,t} + \frac{2(1 - \alpha)}{P}\left[\left((p - r)W_0^\sigma - w\right)\right] - 1 + \tag{8}$$

$$\frac{2(1 - \alpha)}{P}(p - r)S_\sigma$$

Before saying anything about the shape of this function, it is important to assume that entrepreneurs have rational expectations. For this we try to say that by seeing prices, firms will be able to know not only how much they will pay per unit borrowed but also how much workers will lend.

From the way in which problem (7) is formulated, we have that an increase in interest rates could mean either an increase or decline in revenues for entrepreneurs. This is because, on the one hand, a higher interest rate means that firms will have to pay more for what they are borrowing; but on the other hand, this means that they could borrow more and earn more as long as (p-r)>0. For high interest rates, the effect is a reduction in permanent income which is met by lower savings today.

$$\frac{\partial s}{\partial r} = -(1 + \alpha)W_0^\sigma + \frac{\alpha}{r^2} W - \frac{2(1 - \alpha)}{P}(W_0^\sigma + S_\sigma) + \tag{9}$$

$$\frac{2(1 - \alpha)}{P}(p - r)\left(\frac{\alpha}{r^2} w - (1 + \alpha)W_0^\sigma\right)$$

It is important to remember that in this economy neither interest rates nor wages are fully flexible which means we consider some form of disequilibrium. The interest rate can be taken as regulated by the government and wages rigid in an economy with surplus labor.

To simplify the algebra and see how this model works. Lets consider for the moment the case where W_0 is small. This would be the case of a country which starts from low financial deepening. Here, the derivative of aggregate savings with respect to interest rate is given by (10). Figure 2.1 plots this derivative and the derivative of its components.

The empirical counterpart of savings in the non-capitalist sector would be banking (financial) intermediation. The exercise predicts that it is reasonable to expect a positive elasticity for a very wide range of interest rates.

The difference between total domestic savings and banking intermediation is self-financing of firms. Its derivative is positive for low interest rates and will turn negative as the interest rate increases.

Appendix A looks at the response of financial intermediation to changes in interest rates in some detail for our sample of countries. The result is a downward slop ing relation of the elasticity similar to the one implied in this section.

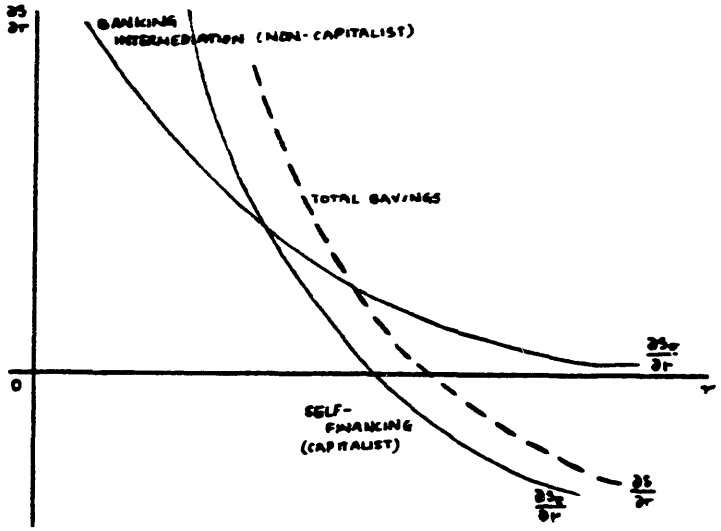


Figure 2.1.

A natural implication for the change in sign of the elasticity of aggregated savings and interest rates is the existence of a rate that maximizes total savings (and permanent GNP) for p-r>0.

$$\hat{r} = \sqrt{\frac{\alpha(1+\theta)p}{\theta}} \qquad \theta = \frac{2(1-\alpha)}{P} \tag{10}$$

An interesting question is what would happen if the interest rate is freed and let the credit market forces decide.

In that case the credit market would clear where r=p due to the constant returns to scale technology. But it is possible for this rate to be too high, and have, instead some degree of financial repression as an optimal solution.

In this Cobb-Douglass economy, a sufficient condition for having some degree of financial repression dominate the free market solution is:

$$\frac{\alpha}{2(1 - \alpha)} + \frac{1}{P} < 1 \qquad (11)$$

This result indicates that the lower the individual discount rate of future consumption (the lower alpha) and the larger p, the better will be to have some form of repression.

The next section looks at the savings functions of 26 countries paying special attention to the effects of changes in the average real interest rate levels on aggregate savings.

3. Some Empirical Evidence on the Response of Savings to Interest Rate changes in LDC's.

The intention of this section is to take a look at the experiences of 26 developing countries and try to assess the impact of financial liberalization in aggregate savings and consequently on potential growth.

3.1. The Sample.

For all countries selected the period considered goes from 1955 to 1986 using annual data.

As the basic idea of the exercise is to see what happens when real interest rates in the domestic credit market goes from negative to positive, the sample tries to include countries which either, have had long periods of very negative or very positive real rates or countries which have experienced financial reforms at some point in the period taken. To get a global view at what happened to the interest rate in each case one could take a look at table 3.1.

Table 3.1. Ex-post Real Interest Rate[a]

Country	1955-1986	1955-1972	1975-1986
Malaysia	0.90	3.54	0.55
Korea	0.98	4.81	-2.16
Jamaica	3.67	1.78	7.50
Nepal	2.17	1.82	3.93
India	-0.45	-0.06	2.63
Singapore	1.15	1.20	3.50
Philippines	-1.38	1.22	-2.86
Pakistan	-0.57	1.64	1.48
Thailand	3.88	5.48	4.14
Morocco	-1.25	1.54	-3.86
Colombia	-1.87	-2.68	0.53
Greece	0.88	3.48	-1.29
South Africa	0.04	2.18	-2.32
Kenya	-0.77	3.22	-4.27
Portugal	-3.90	-1.56	-5.83
Zambia	-4.70	-1.44	-7.79
Peru	-9.77	0.03	-27.45
Turkey	-9.63	0.02	-28.86
Mexico	-1.45	5.22	-8.27
Ivory Coast	-1.73	0.20	-2.72
Costa Rica	-1.31	1.81	-4.16
Ecuador	-3.78	1.11	-9.88
Spain	-2.44	-1.84	-2.45
Guatemala	0.50	3.40	-2.30
Venezuela	0.89	2.89	-1.85
Sri Lanka	1.02	2.03	-0.23

(a) IFS(series 60) minus the rate of inflation of the CPI (real rates in percent per year).

3.2. Estimation of Interest Rate Elasticities.

The next step is to estimate a savings function for each one of these countries. The specification used is given by (12)

$$S/Y = C + c_1 DUMMY + b_1\ TIME + b_2\ DEEP + b_3\ GNP + b_4\ TIRR + b_5\ DTIRR + b_5\ INF + e \qquad (12)$$

where:

S/Y	Private real savings as a fraction of GNP
TIME	A trend component.
DEEP	Measures financial deepening. Is defined as the ratio of Quasimoney to Nominal GNP.
GNP	Logarithm of the Gross National Product in Real terms.
TIRR	Ex-post Real interest rate (IFS serie 60)
INF	Inflation of the Consumer Price Index.
DTIRR	DUMMY*TIRR

The regressions are estimated using ordinary least squares, and when first order autocorrelation was found it was corrected using the Cochran-Orcutt method.

To see what happens to the real interest rate elasticity in times of financial repression and times of positive real returns it was necessary to break the samples for each country. To save in degrees of freedom we apply a Dummy variable and an interaction term between TIRR and this Dummy. The values reported correspond to the derivative of savings to real interest rate, adding when necessary, the direct coefficient and the

one for the interaction term; the t-statistic is computed considering the sample covariance of this two coefficients.

Table 3.2. Estimates of the Response of Savings changes in the Ex-Post Real Interest Rate.

Country and Sample (*)	Coefficient. (t-statistic)	R^2
Malaysia		
1955-1986 (**)	-0.019 (-2.07)	.822
1975-1986	-0.011 (-0.55)	
South Korea		
1955-1986 (**)	0.0013 (0.39)	.804
1975-1986	0.016 (1.11)	
Sri-Lanka		
1955-1985 (a)	0.0270 (1.72)	.637
1955-1977 (b) (**)	0.0085 (0.98)	.783
1978-1985 (**)	0.0199 (1.77)	
Singapore		
1955-1986 (**)	-.0071 (-1.79)	.983
1976-1986	-.0075 (-1.94)	

Table 3.2. Continued.

Philippines		
1955-1985 (c)	-.006 (1.24)	.691
1955-1972 (b) (**)	-.002 (-0.78)	.721
1975-1985 (**)	0.008 (1.61)	
Pakistan		
1955-1985 (**)	0.009 (1.38)	.689
Thailand		
1955-1986 (d) (**)	-0.014 (-2.06)	.861
Morocco		
1955-1979 (**)	-0.013 (-1.68)	.776
1980-1985 (**)	0.002 (1.08)	
Greece		
1955-1974 (**)	-.003 (0.99)	.902
1975-1984 (**)	0.012 (2.10)	
Colombia		
1955-1973 (**)	0.001 (0.89)	.625
1974-1986 (**)	-0.001 (0.39)	

Table 3.2. Continued.

South Africa		
1960-1978 (**)	-0.0109 (-2.31)	.842
1978-1985 (**)	-0.003 (-0.05)	
Kenya		
1957-1972 (**)	-.002 (-.330)	.545
1973-1984 (**)	0.009 0.513)	
Portugal		
1960-1979 (**)	.0007 (0.88)	.695
1980-1985 (**)	0.009 (2.54)	
Zambia		
1957-1985 (**)	0.008 (1.768)	.512
India		
1955-1986 (e)	0.011 (1.855)	.921
1955-1973 (**)	0.099 (1.722)	.962
1975-1986 (**)	-0.021 (-2.754)	
Costa Rica		
1955-1986 (f) (**)	-0.006 (-1.70)	.640

Table 3.2. Continued.

Guatemala		
1955-1972 (**)	-.012 (-2.78)	.829
1973-1985 (**)	-.003 (0.45)	
Ecuador		
1955-1970 (**)	-.010 (-1.11)	.903
1970-1984 (**)	0.022 (2.88)	
Spain		
1955-1986 (g) (**)	0.0006 (0.84)	.713
Peru		
1955-1973 (**)	-0.002 (-0.828)	.681
1974-1985 (**)	0.005 (2.22)	
Turkey		
1960-1985 (a)	0.006 (1.69)	.546
1960-1975 (b) (**)	-0.003 (-1.28)	.588
1976-1985 (**)	0.0187 (1.93)	
Jamaica		
1955-1986 (e)(**)	-0.0128 (-1.85)	.633

Table 3.2. Continued.

Mexico		
1955-1971 (**)	-0.0100 (0.46)	.900
1972-1986 (**)	.0172 (1.823)	
Venezuela		
1955-1986 (a)	-0.015 (-1.74)	.801
1955-1972 (b)(**)	-0.0248 (-4.49)	.850
1973-1986 (**)	0.0086 (1.05)	
Ivory Coast		
1957-1985 (**)	-.0089 (-1.18)	.881

Notes. (a) The result corresponds to the regression ran for the entire sample space without a dummy term.
(b) The following two results come from a single regression with a dummy interaction term.
(c) The 1974 observation was excluded.
(d) The 1975 observation is excluded.
(e) 1974 and 1975 excluded.
(f) 1973 and 1982 excluded.
(g) 1977 excluded.
(h) 1980 excluded.

Data Source: IMF International Financial Statistics, 1987.
(i) Sometimes the partition of subsamples skips some data in the middle when the observations are considered atypical (i.e. short episodes of real return swings of more that 2.5 standard deviations from the mean). When a datum is deleted and it is necessary to make a correction first order autocorrelation it is substituted by the corresponding geometric interpolation only for the effects of the autocorrelation correction, in which case, the persistence (rho) coefficient is computed using the residuals of the longest uninterrupted interval and the reported estimation obtained by generalized differences for which the interpolated value is used to avoid loosing degrees of freedom in end points.

(**) These are the observations used to compute the regression of slope (and std. slope) against real rates.

3.2. Interest rate elasticity and financial repression.

The next step in the exercise is to put together the results of table 3.1 and 3.2, that is, to get a sense of the relation between the average real interest rate and the elasticity of savings to interest rates.

Figures 3.1 and 3.2 in the next page show a plot of two measures of this elasticity and the real return of domestic financial instruments (the source is table 3.2; in the cases where the sample for a country was partitioned, the values plotted include both sub-samples and omit the result of the complete sample. To indicate which observation was used it was marked (**)). The variable, called slope, is the reported value of the interest rate coefficient in equation (12). The other, called standard, normalizes these coefficients dividing them by their corresponding standard errors - in other words we are using the t-statistics-.

The null hypothesis of a Laffer-curve shaped savings function (figure 3.3) would not be rejected if the correlation between real interest rate and its elasticity is negative. This is apparently the conclusion we would reach by looking at figures 3.1. and 3.2.

We could also run a regression to see if this correlation is significantly less than zero. Using OLS we obtain the following results for which we have 35 degrees of freedom (because in some cases there is more than one observation per country).

$$\begin{array}{llll} \text{SLOPE} & = -0.0021 - 0.001901\ \text{TIRR} & \text{N=37} & (13) \\ & (-1.31)\quad (-4.319) & R^2=.354 & \end{array}$$

STANDARDIZED

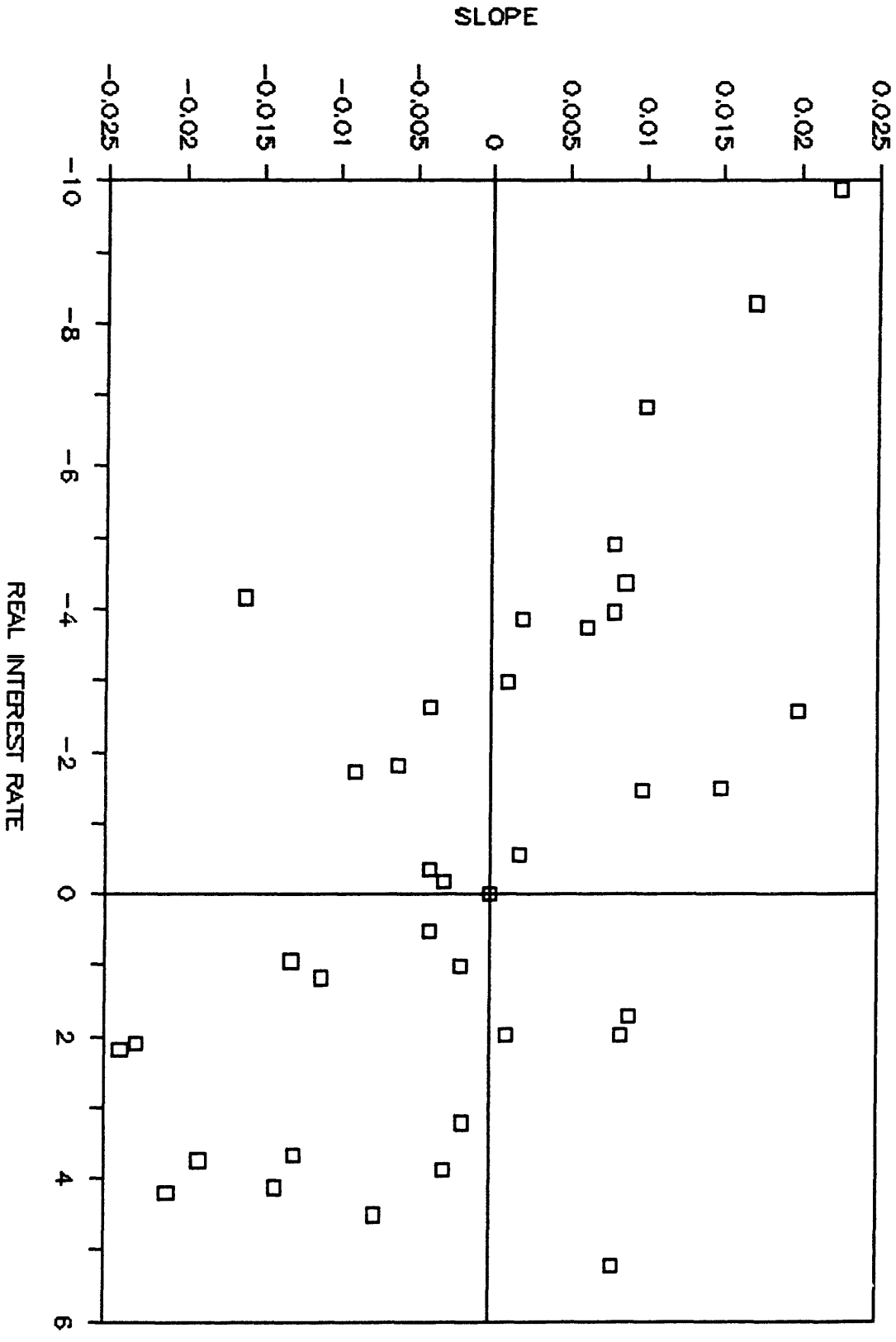
$$\text{SLOPE} = -.25971 - 0.3038\ \text{TIRR} \qquad N=37 \qquad (14)$$
$$(-1.08)\quad (-4.79) \qquad R^2=.403$$

Although this could not be expected to provide a general recipe to be applied to any country, we could get a notion of what we could call "optimal financial repression": that is, the value of the real interest rate that maximizes domestic savings to GNP which happens where either the standardized or plain slopes are equal to zero.

From equation (13) we arrive at an optimal rate of -1.1% and using (14) to a rate of -0.85%.

In section 2, we have a model which stresses the role of income distribution and labor market rigidities to arrive to a backward-bending savings function. It would be interesting here to see if there is some evidence supporting this causal relation.

The empirical counterpart of the concepts used in the model is difficult to obtain and we will need to rely on some proxies. Following the logic of section (2) we could think that the more concentrated is income the smaller (less positive o more negative) will be the interest rate elasticity of savings.


Interest Coefficient vs. Real Interest
SLOPE
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-10
-8
-6
-4
-2
0
2
4
6
REAL INTEREST RATE

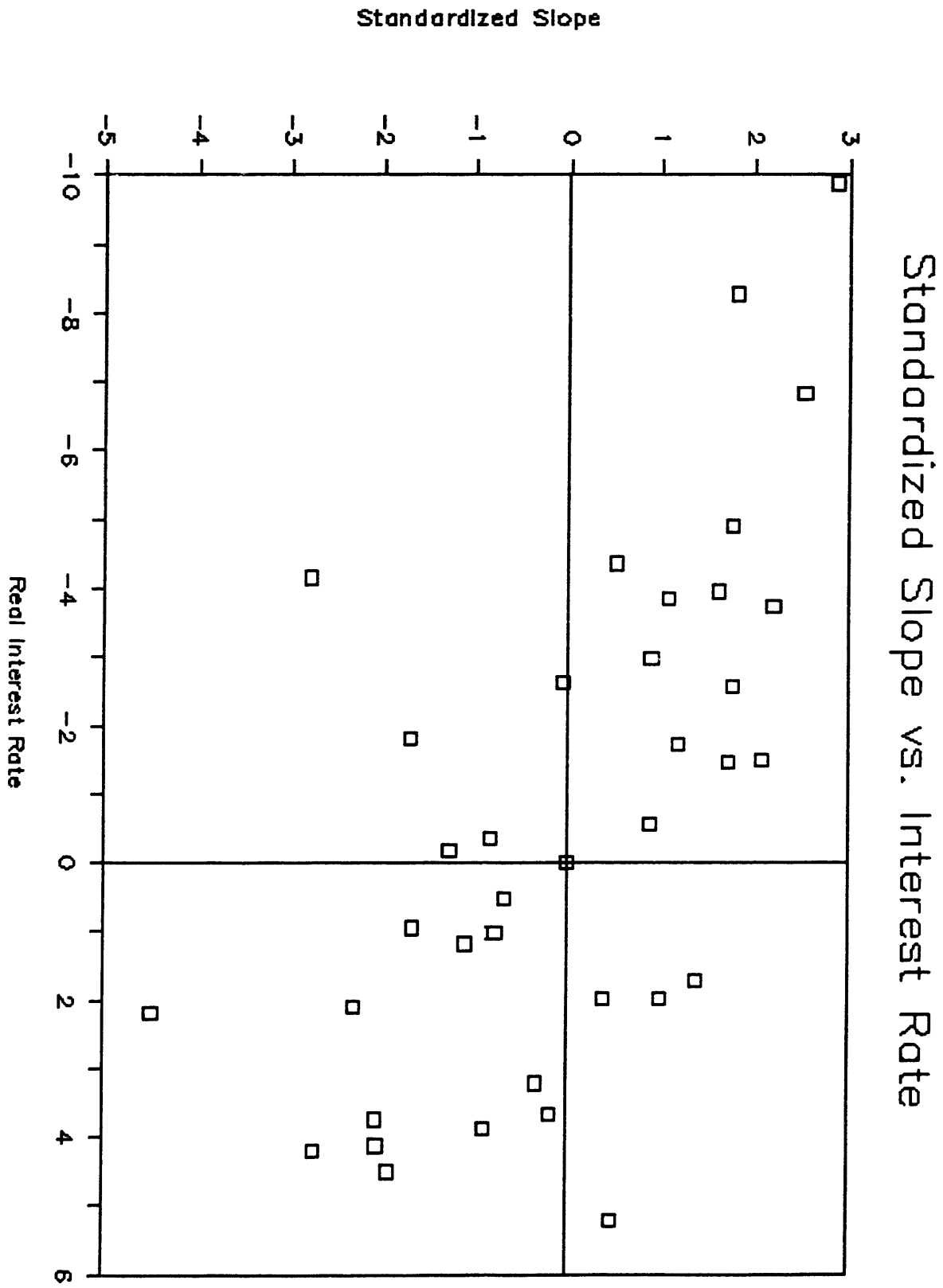
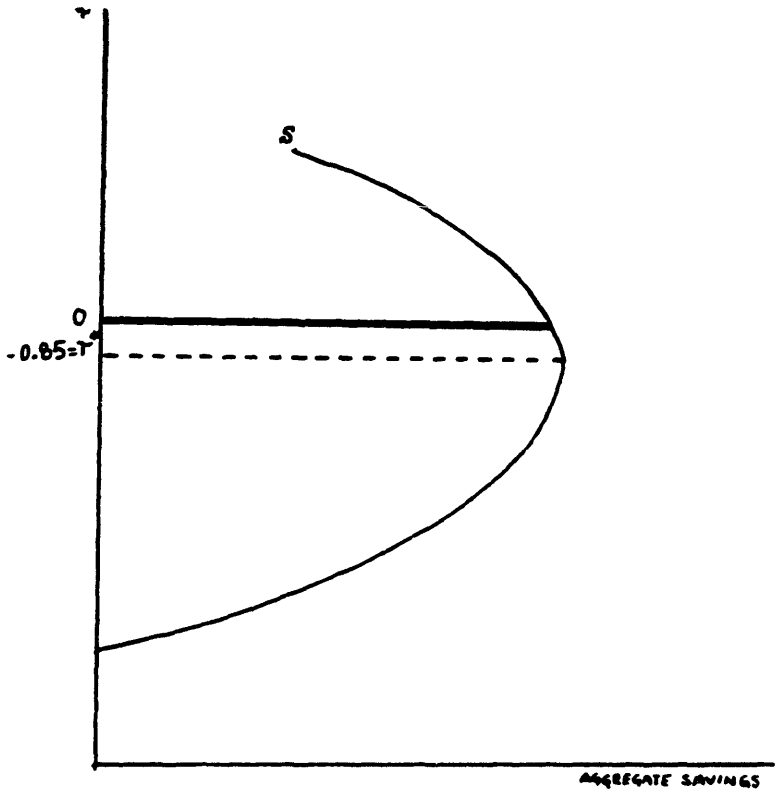

Standardized Slope
-5
-4
-3
-2
-1
0
1
2
3
-10
-8
-6
-4
-2
0
2
4
6
Real Interest Rate
Standardized Slope vs. Interest Rate

Figure 3.3



Finally, and in order to avoid the problem of omitted variables, we could introduce some demographic variables which convey the ideas of the permanent income hypothesis such as the rate of population growth, and some indication of the degree of economic development by per-capita GNP.

For the next equations it was necessary to define some variables.

INCODI Is a proxy for income distribution. It intends to reflect the proportion of income earned by workers with a perment income high enough to generate savings. This variable is the fraction (in percents) of total National Income earned by the third and fourth quintils. Source: World Bank.

INTERA Is an interaction term. The result of multiplying INCODI times the real interest rate.

POPUL Rate of population growth. Source: World Bank.

PERCAP Per-capita GNP in dollars. Source: IMF.

Using these concepts, together with the previously defined SLOPE and STAND (Standardized Slope) we obtained table 3.3.

What this regressions reveal is that there is an important interaction between income distribution and the response of the interest rate elasticity to the level of real interest rate.



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A way of interpreting the sign of the coefficient of INTERA is that STAND and ELAST will be more likely to decline after an interest rate increase the larger the participation of these intermediate quintils in total GNP. A reason for this is that the larger this middle class more important is the fraction of total investment financed from savings of non-capitalists, making the cost effect of changes in the interest rate to have a significant contractionary effect on capitalists income and savings. On the other hand, if the middle class is small, most capitalist investment will be of the form of self-financing and the interest rate will play only a minor role in income distribution.

Table 3.3. Effects of Income Distribution on the Interest Rate Elasticity of Savings.

	C	TIRR		INCODI	INTERA	POPUL	PERCAP
STAND	6.17	1.03	-.107	-0.040	-.931	-.0003	.570
	(1.19)	(0.81)	(-0.80)	(-1.73)	(-2.00)	(-1.18)	
	2.14	0.96		-0.038	-.754	-.0003	.550
	(1.74)	(0.76)		(-1.69)	(-1.85)	(-1.34)	
	2.02			-.0094	-.808	-.0003	.542
	(1.77)			(-3.94)	(-2.04)	(-1.14)	
ELAST.010				-6.1D-5	-.003	-1.8D-6	.448
	(1.15)			(-3.58)	(-1.52)	(-0.92)	
	.0002	-7.4D-5		-5.8D-5	-.003	-1.8D-6	.452
	(0.75)	(-0.04)		(-1.49)	(-1.49)	(-0.52)	

* These regressions were run with 26 observations, because information on income distribution was not available for all countries in the sample. Remember that there may be more than two observations per country.

4. Concluding Remarks.

In this essay it was found that there is international evidence supporting the notion of a backward bending saving function.

It was suggested that a reason for this could be found income distribution: an increase in the interest rate means higher opportunity cost of present consumption to non-capitalist and an additional cost for capitalist. Depending on the relative weight of each sector and the level of the real interest rate is it possible to have aggregate savings to go down with a financial liberalization.

The fact of a backward bending savings function suggests an optimal rate to maximize savings as a fraction of GNP. It was found that for the sample chosen some degree of interest rate repression could bring us to this optimal level.

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APPENDIX.

The idea of this section is to complement some of the results we have already obtained.

In terms of the model in section (2), it would be interesting to see if we can say something about the response of financial deepening to the increase in real returns.

The idea is that, although financial liberalization is expected to increase financial intermediation it may not do the same to aggregate savings.

The testable hypothesis that comes from the model in this respect, is that the interest rate elasticity of deepening will remain positive for a much ample of real returns compared to the elasticity of savings; although, the same as the slope of the savings function, will decline with rising interests.

A.1. The regressions.

We proceed in the same way as in the empirical section of the paper. First running regressions for each country of the form:

$$DEEP = B_0 + B_1 TIME + B_2 GNP + B_3 TIRR$$

Table A.1. Estimates of the Response of Financial Deepening to the Real Return on Banking Instruments.

Country and Sample	Coefficient. (t-statistic)	R^2
Malaysia		
1955-1986	.000077 (0.447)	.920
1975-1986	0.00031 (0.865)	
South Korea		
1955-1986	0.00178 (1.19)	.863
1975-1986	0.0008 (1.369)	
Sri-Lanka		
1955-1985 (a)	0.00173 (1.41)	.498
1955-1977 (b)	0.00498 (0.98)	.560
1978-1985	0.0023 (1.54)	
Singapore		
1955-1986	0.00223 (1.396)	.979
1976-1986	0.00277 (1.067)	

Table A.1. Continued.

Philippines		
1955-1985 (c)	0.0013 (2.09)	.439
1955-1972 (b)	0.00176 (1.190)	.501
1975-1985	0.00078 (1.68)	
Pakistan		
1955-1985	0.00163 (1.03)	.538
Thailand		
1955-1986 (d)	0.000515 (1.451)	.889
Morocco		
1955-1979	0.000794 (0.734)	.878
1980-1985	0.000570 (1.276)	
Greece		
1955-1974	0.0138 (0.77)	.965
1975-1984	.00309 (1.134)	
Colombia		
1955-1973	-0.00004 (-.10)	.521
1974-1986	0.000101 (0.438)	

Table A.1. Continued.

South Africa		
1960-1978	0.00164 (0.662)	.774
1978-1985	0.00501 (-0.05)	
Kenya		
1957-1972	0.00154 (0.457)	.917
1973-1984	0.00183 (1.241)	
Portugal		
1960-1979	0.00049 (0.194)	.875
1980-1985	0.0012 (1.784)	
Zambia		
1957-1985	-0.00031 (-.283)	.769
India		
1955-1986 (e)	0.00182 (2.425)	.850
1955-1973	0.00211 (2.814)	.876
1975-1986	0.000781 (1.710)	
Costa Rica		
1955-1986 (f)	0.00022 (0.377)	.585

Table A.1. Continued.

Guatemala		
1955-1972	0.00193 (0.668)	.888
1973-1985	0.00389 (2.925)	
Ecuador		
1955-1970	0.000081 (0.434)	.531
1970-1984	0.000116 (0.285)	
Spain		
1955-1986 (g)	0.00058 (0.31)	.831
Peru		
1955-1973	0.0009 (1.082)	.557
1974-1985	0.0018 (2.19)	
Turkey		
1960-1985 (a)	0.00094 (4.73)	.700
1960-1975 (b)	0.00005 (0.748)	.763
1976-1985	0.00099 (1.94)	
Jamaica		
1955-1986 (e)	0.00231 (1.432)	.404

Table A.1. Continued.

Mexico		
1955-1971	0.000488 (0.167)	.788
1972-1986	0.00264 (1.994)	
Venezuela		
1955-1986 (a)	0.00035 (0.19)	.681
1955-1972 (b)	-0.00004 (-0.104)	.701
1973-1986 (**)	0.00183 (2.12)	
Ivory Coast		
1957-1985 (**)	0.00158 (0.972)	.860

Notes same as in table 3.2.

The same as in section (3) we could run a regression of the slope of financial deepening (SLOPEDEEP) on interest rates and income distribution variables.

Using the same definitions as in the paper (a):

SLOPEDEEP = .0007213 - .000093 TIRR + .000043 INCODI

(1.23) (-1.79) (1.69)

R^2 = .372 N = 37

(a) In this exercise INCODI includes people from the second to the fourth percentile. The coefficient of INCODI gives a t-statistic of only .76.In that case the coefficient for TIRR is -.000081 with a t of 1.71.

Part IV.1

CAPITAL FLIGHT AND INCOMPLETE FINANCIAL MARKETS: TWO MEXICAN STORIES

CAPITAL FLIGHT AND INCOMPLETE FINANCIAL MARKETS: TWO MEXICAN STORIES[1]

Introduction.

The Mexican financial markets have been closely linked to the United States in such a way that speculative capital movements and dollarization have played a prominent part in the recent monetary experience of Mexico.

For many years now, deposits in the U.S. banks and other dollar denominated saving instruments of the American financial system represent an easy to reach shelter against fluctuation in the exchange rate of the peso.

Starting in the early 1970's, as a result of a change in the economic policy, there have been several episodes of capital flight. In the beginning they were of short duration and of moderate size. It is not until 1981 that the problem begins to call the attention of policy makers when, in a matter of a few months, between 6 and 16 billion dollars flew from Mexico inducing a huge real exchange rate collapse and left the economy with an additional burden of foreign debt.

The dollarization and capital flight of 1981 brought up several questions about the determinants of the size and the speed with which events took place, but especially from the fact that most capital flight was financed with private external borrowing. Then, we had at the same time capital moving out, via portfolio decisions of maximizing agents and coming in through additional borrowing of presumably maximizing commercial

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[1]This note is intended to serve as an introduction to the next section. It contains some basic information about the structure and reforms of the Mexican financial system that is known later on.

banks and private firms.

This essay looks for an answer to this question in the institutional characteristics of the Mexican financial system. The hypothesis is that the coincidence of a very specialized banking sector which saving instruments paid rates of return regulated by the Central Bank and a very underdeveloped non-banking financial sector limited the capacity of response of the system to external shocks (i.e. terms of trade shocks), making possible simultaneous capital flight and private borrowing by means of a process essentially unstable.

To test this proposition we will benefit from the fact that the 1983-1984 financial reform allows us to compare the performance of the Mexican economy when facing external shocks (such as negative oil shocks of 1981 and 1986) under substantially different institutional arrangements, giving us some sense of the role of financial repression on the dynamics and repercussions of capital flight.

1. The Mexican Financial System (1970-1986)[1]

After 1971, the scenario of stability that characterized the Mexican economy was abandoned in favor of high inflation and rates of growth in aggregate demand. The financial system was not flexible enough to adapt to the new circumstances. Between 1970 and 1982 it was very rigid and specialized. Commercial and Development Banks were just about the only intermediaries whereas money and capital markets were practically inexistent. The saving instruments offered by the banking sector were peso denominated and paid a nominal (passive) rate determined by Banco de Mexico without regard to short term fluctuations in the conditions of domestic and international credit markets. On the other hand, most

government borrowing takes place by means of what is known as 'encaje legal' which imposed on commercial and development banks the obligation to lend the government a predetermined amount at fixed rate by Banco de Mexico. There were not such things as Treasury Bills.

After abandonment of the fixed exchange rate regime in 1976 it became apparent that some steps towards an integral reform of the system were necessary. Some modernization started in the last months of 1977, but the experience if 1981 proved it to be too little and to have come too late.

The first innovation came in October of 1977 with the creation of the 'petrobono'. It was a Federal government bond whose value is indexed to the dollar value of a certain quality of crude oil. A secondary market for this instrument developed but the amounts of successive issues were very limited. By the end of 1980 petrobonos represented a little less than one percent of the major money aggregate and this share decreased to .5 percent in 1982.

In January of 1978, the Federal government issued the first Certificates of the Federal Treasury (CETES) which had the purpose of giving the government direct access to the money market and to provide the Central Bank, for the first time with an instrument that enabled it to perform open market operations. At first CETES were offered to the public at a fixed discount rate because of the reluctance on the part of the authorities to allow the market to determine interest rates. Again a secondary market was permitted but with the central bank intervened it continuously. By mid 1982 CETES were less than 3% of M5. The first movement towards an instrument with freely determined returns occurred in October of 1982 when market oriented auctions for CETES began.

An authorization for a limited issue of Banker's acceptances was released in November of 1980. It allowed banks to obtain at market determined terms and rates for an amount which could not exceed 10% of their capital (this was less than 300 million dollars in December 1981). By the end of 1982 this represented less than .5 percent of M5.

After the 1982 crisis, the Mexican economy faced the burden of a huge debt, the lack of foreign credit resources, insufficiency of domestic savings and for the first time a three digit inflation. Then the change in the way markets operated was imperative. The De la Madrid Administration promoted major reforms to the Central Bank Law, the General Law of Insurance Companies and the Law of the Stock Market. The most obvious consequences of these reforms were the diversification in the operations and instruments of the banking system; the changing role of Banco de Mexico which ceases to act as an intermediary between the Federal government and financial institutions, the creation of bank deposits insurance institution and, most important of all the development of a more complete and active money market as the new legislation relaxed most regulations limiting the issue and trading of non-banking financial assets.

The area where less progress has been achieved has to do with the return of banking instruments which is still determined exogenously by monetary authorities.

Among non-banking instruments CETES and bankers acceptances were the more dynamic. The first explained by the borrowing needs of the public sector and the second by the combination of a repressed banking sector which this time can rely on the issue of this new instrument with its

Diversification of the Mexican Financial System

Instrument	Characteristics
Petrobono	Created in November of 1977. Operated in a secondary market with freely determined rates since its creation.
CETE	Created in January 1978 as a three month instrument. Discount rate fixed and limited issues until 1982. Beginning of the auction system for market determination of rates in August 1982 when the 28 day emission starts.
Bankers Acceptances	Created in April 1981. Issues limited to 10% of capital of banks (meant a maximum of 300 million dollars). Limits relaxed and first operated in the stock market in September 1984.
Commercial Paper	Created in October of 1980. First operated in the stock market in September 1984.
Pagare Empressarial Bursatil	Created and first operated in the stock market in April, 1986.
Pagafe	Dollar indexed bond. First operated in the stock market in August, 1986.
Pagare Bancario (CD)	Created and first operated in the stock market in April 1984.

money market determined returns to prevent further erosion of its penetration. By the end of 1985 bankers acceptances rose from .5 percent to 4 percent of total credit in the system, while total non-banking instruments passed from 4 percent to 15 percent in less than three years. As we will see the institutional characteristics of the financial markets determine decisively the extent of the effects of external shocks on the economy. For instance, an economy with incomplete credit markets, as it was the case in Mexico in 1981, will make the banking sector very vulnerable to capital flight as there is no way to keep the levels of banking penetration when interest rates are regulated and at the same time an external disequilibrium makes expected depreciation positive and high. Besides, when a huge government deficit is mostly financed via 'encajes', then terms of trade shocks which also affect the budget will force further external borrowing on the part of commercial banks, and do nothing to stop capital flight as there is no way in which this increase of total borrowing requirements is translated into changes in the rate of return of domestic assets. In this kind of world, things tend to happen fast and to feedback on themselves making the process unstable: the rate of expected depreciation causes capital flight, which itself is financed with additional foreign debt which will require of a larger depreciation to be serviced once the exchange rate is freed, closing with this the vicious cycle.

On the other hand, when the system has more diversified and less regulated credit markets, it is more difficult to have capital flight as response to an external shock, unless the monetary authority intervenes to peg the 'equilibrium' interest rate. Here, if capital flight occurs it

will not go accompanied of additional external borrowing, unless it is the Central Bank which is borrowing abroad.

2. A simple model.

Let us see first the case when there is a missing market for bankers' acceptances. To do that assume that this economy has banks as the only financial intermediaries. They lend to the government and to the private sector. The amount of loans outstanding is assumed given in the exercise. Banks get their resources from demand deposits of the public 'd' and borrowing abroad 'f'. Their accounting identity is

$$c = d + f \qquad (1)$$

$$c = c_0 = 1$$

Private portfolios have either peso deposits 'd' or dollar assets in the U.S. market 's'. Peso deposits pay a predetermined (repressed rate i and s pays $i^* + \hat{e}$ where $\hat{e}$ is the rate of expected depreciation). Starting from a fixed exchange rate regime we could normalize the problem setting e = 1 and total initial wealth (in this case given by initial total credit) also equal to one.

$$d + s = 1 \qquad (2)$$

$$s/d = h\,\hat{e} \qquad (3)$$

The rate of expected depreciation has two components: the size of the real exchange rate appreciation ($e^* - e / e$) and the probability of transition to the new exchange rate 'π' which is the one step transition probability in a Markov process. In this simple exercise it is assumed constant, although in an economy where external borrowing is possible it could be more reasonable to imagine it depending on the size of total foreign debt relative to a maximum debt that can be serviced by the export potential of the country. At each time the equilibrium exchange rate is given by $e^* = \frac{i^*}{p^*} \frac{(b + f)}{\eta}^2$ where η is the inverse of the exchange rate elasticity of net exports and P^* is the price in dollars of national exports. The terms of trade are given by i^*/p^*.

$$\hat{e} = \pi\left[\frac{i^*}{p^*} \frac{b + f}{\eta} - 1 \right] \tag{4}$$

where b is the public foreign debt.

Now we can see the impact of a terms of trade shock. The equilibrium condition is described in figure 1. If we set the initial condition to be $\frac{i^*}{p^*} \frac{b}{\eta} = 1$ the equilibrium is given by $s = 0$ and $f = 0$. It is though possible to have another equilibrium if and only if the slope of the D schedule (which is the result of substituting (3) and (4) in (2)) is greater than one when $f = s = 0$.[3] This is the situation when the very expectation of an exchange rate depreciation is self-fulfilling as capital flight increases external debt and with it the actual depreciation required to equilibriate the current account. To keep things simple consider the case when there is only one equilibrium. The 45 degree line

is given by the balance sheet identity of the banking system. A terms of trade shock is represented by an increase of i^*/P^* which moves the DD schedule up and to the left and also the schedule of expected depreciation in the lower diagram.

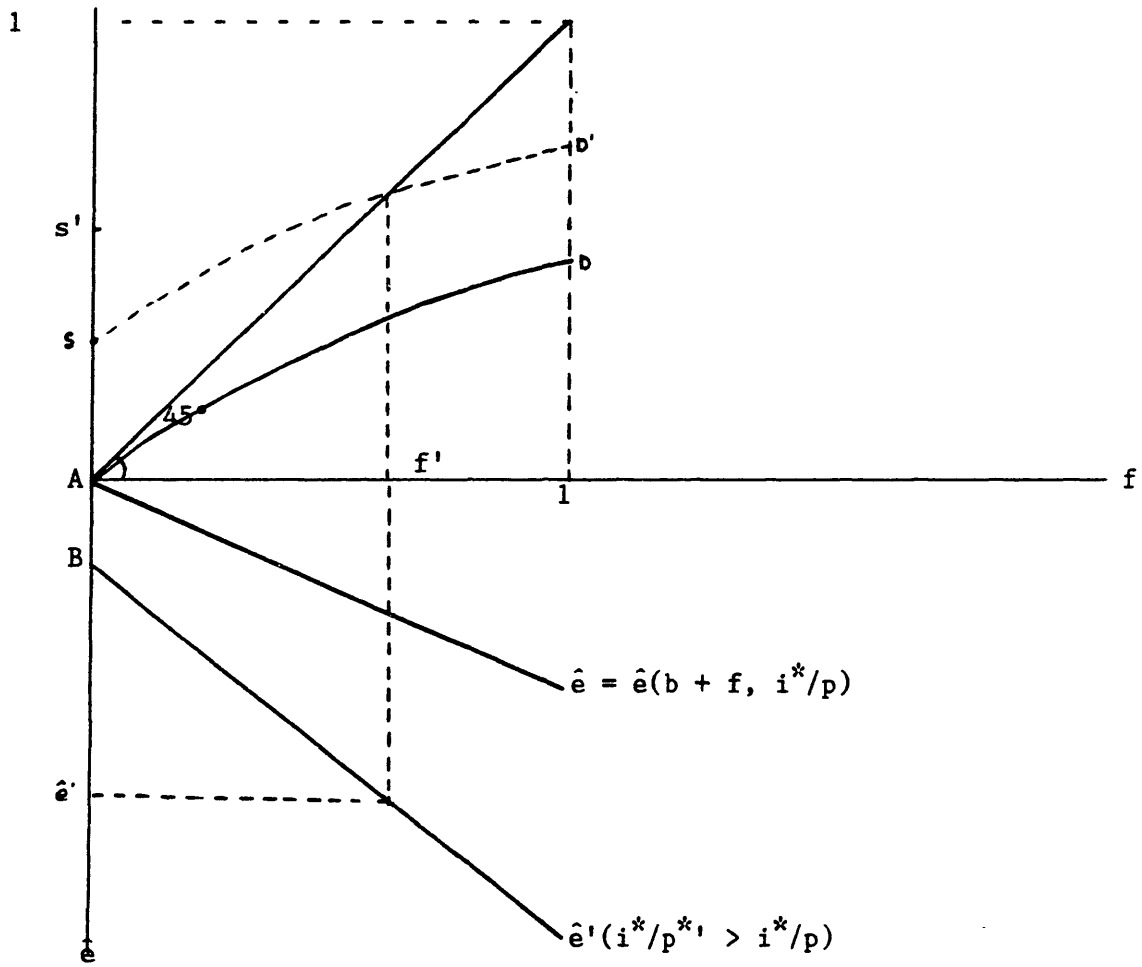


Figure 1.

As a result of the external shock capital flight happens. People take out As' dollars which are financed Af' dollars borrowed by commercial banks from the rest of the world. We can distinguish two components in the reaction of capital flight and expected depreciation. The terms of trade shock 'per se' justifies a portfolio shift from A to s, but this is financed with additional debt Af which in turn increases expected depreciation provoking more capital flight. After this process is completed expected depreciation will be given by Ae' instead of AB which corresponds to the depreciation needed to correct the balance of payments if capital flight did not take place.

Let us see now what happens if there is a free market for bankers acceptances. This instrument can be thought to be a close substitute of dollar denominated assets, from the standpoint of the public. This is equivalent to assume that they pay a rate equal to the interest on U.S. deposits plus the rate of expected depreciation. If this is the case banks will never go for foreign borrowing (which is the cost of the prime rate rather than the deposit rate plus the rate of expected depreciation). The Accounting identity of the banks is given by

$$c - c_0 = a_1 + d + f = 0 \ . \qquad (1')$$

The wealth constraint of agents a + d + s = 1 plus the assumption of 'a' and 's' being perfect substitutes together with (1') makes s = 0 in equilibrium, which means no capital flight.

$$s + a/d = a/d = h\,\hat{e} \qquad (3')$$

$$a/(1 - a) = \hat{h}$$

and again the rate of expected depreciation depends on the current account disequilibrium.

$$\hat{e} = \pi\left[\frac{i^*}{p^*}\ \frac{b}{\eta} - 1\right] \qquad (4')$$

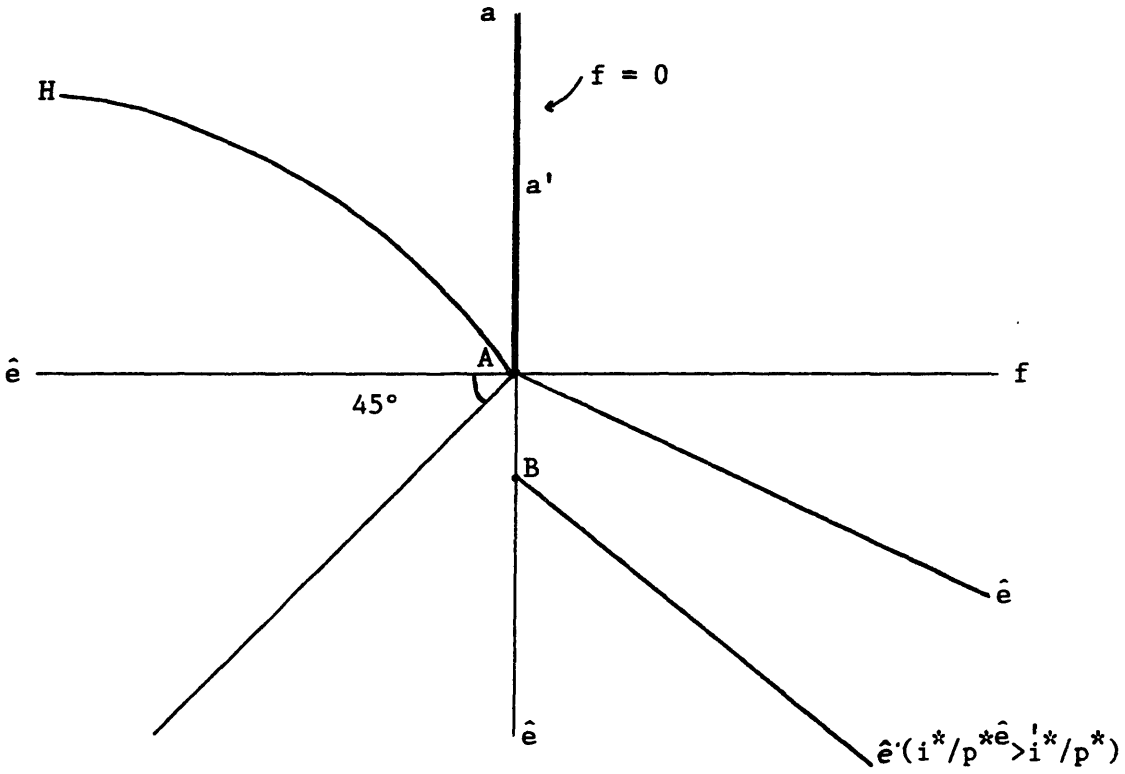


Figure 2.

The upper right diagram in figure 2 shows the condition by which banks will always prefer to issue acceptances to borrow abroad. The upper left diagram show is the demand for interest non-banking saving instruments as a function of the expected rate of depreciation under the assumption of them paying $i^* + \hat{e}$ (perfect capital mobility). The lower left diagram is the same as in figure 1.

A deterioration in the terms of trade increases expected depreciation moving people away from interest regulated banking instruments and buy acceptances Aa'. This portfolio operation by its own nature does not affect external borrowing and consequently does not have an additional impact on expected depreciation which stays AB.

It is apparent from this simple exercise that missing financial markets can make a big difference. When banks face a flexible credit market, even if their rates on their deposits are regulated, there is a way to make the external shock be felt, and somehow absorbed, via changes in interest rates stopping then capital flight and the final adjustment less severe.

These two examples are different not only in terms of the initial impact of the exogenous shock, which is what figures 1 and 2 illustrate, but also with respect to the future dynamics. When markets are missing the newly contracted debt will have to be rolled over (as well as the fraction of outstanding debt which cannot be serviced any more by exports because its price fell) until the exchange rate adjusts. If that is the case then, after the first portfolio adjustment (after the first chunk of capital flight As' leaves) additional flows will continue which will again feedback in expectations and additional capital flight. To illustrate the point take

$$\dot{f} = i^* f + \dot{s} \qquad (1'')$$

from (3)

$$\hat{e} = (i^* . P^*) f/\eta \qquad (3'')$$

and $$s/1\text{-}s = h\hat{e} \qquad (2)$$

solving one can see that borrowing will always increase faster than the

interest rate, especially during the first phases of dollarization (when s is small).

$$\frac{\dot{f}}{f} = \frac{i^*}{1 - (1 - s)^2 \frac{h}{\eta} \frac{i^*}{p^*}}$$

In contrast, in the case of more diversified financial markets the current account deficit is financed by what we might call 'capital return' which is nothing else but additional direct foreign investment. As a result f remains constant. Interest rates (and the rate of expected depreciation) will also stay at the levels reached after the initial shock. Consequently, the introduction of a new market not only reduces the effects of the initial impact but also eliminates the explosive behavior of capital flight and external borrowing that follows.

3. Two Mexican Stories.

Since 1978 the most important component of Mexican exports has been oil. Consequently a great deal of its recent trade and monetary experience can be linked to the dynamics of international oil prices. In the last ten years Mexico has been hit by two negative oil shocks. The first one in 1981 when it was realized that reserve accumulation and conservation efforts in industrialized countries would effectively mean stagnant rather than fast increasing prices. The second in 1986 when the value of Mexican oil sales dropped almost 50 percent as the price of a barrel went well below 10 dollars and stayed there for most of the year.

In both cases the Mexican monetary authorities do not go for an immediate maxi-devaluation allowing people perceive, from the time of shock on, an additional return on dollar denominated assets.

The Mexican Economy

	Inflation	GDP Growth	Public Deficit/ GDP	Current Acc/ GDP
1980	29.8%	8.3%	6.8%	-5.3%
1981	28.7	7.9	13.6	-7.1
1982	98.8	-0.5	16.2	-3.7
1983	80.8	-5.3	8.5	4.7
1984	59.2	3.7	7.3	2.7
1985	63.7	2.8	8.4	0.4
1986	105.7	-3.8	15.2	-1.0

Source: Banco de Mexico, Indicadores Economicos.

Capital Flight, Terms of Trade and Financial Structure

	Capital Flight (1)	(2)	Non-Banking Instruments/M4	Oil Price (1978=100)	Real exchange (1981.01=100)
1979	4 038	3 676	.005	143.1	121.5
1980.3	6 236	3 510	.027	183.1	104.3
.4	7 408	3 550	.026	196.1	102.1
1981.1	7 722	4 390	.046	261.2	98.8
.2	11 741	5 405	.045	252.8	98.4
.3	13 768	6 431	.047	244.3	97.6
.4	16 001	7 279	.039	243.8	95.8
1982.1	16 776	7 831	.050	230.8	157.4
.2	16 982	8 771	.041	222.6	136.7
.3	19 207	9 660	.070	230.8	155.9
.4	23 486	8 207	.087	223.1	188.4
1983	25 941	10 737	.113	209.3	178.5
1984	26 865	12 909	.121	195.0	151.5
1985.3	28 054	14 028	.154	190.5	193.9
.4	28 998	14 091	.156	192.5	205.3
1986.1	28 678	13 500	.190	109.4	186.2
.2	29 408	13 461	.240	103.2	210.1
.3	29 209	13 510	.260	96.2	210.3
.4	28 548	12 980	.285	96.1	206.4

All values are at the end of the period.

(1) Cumulative errors and omissions in millions of U.S. dollar. 1970 = 0.0

(2) Liabilities of U.S. banks to residents of Mexico. Source U.S. Treasury Bulletin

Non banking Instruments include Cetes, Bankers acceptances, Petrobono, Pagafe, Commercial paper, Pagare empressarial bursatil and Pagare bancario.

Sources. Oil price index SPP. Monetary information and Balance of Payments. Banco de Mexico.

It is interesting to see that in spite of the fact that the 1981 and 1986 shocks have the same origin they had very different aftermaths. For instance, the delay in the exchange rate adjustment of 1981 was followed by a huge capital flight and heavy public and private external borrowing ending with a maxi-devaluation. On the other hand, the apparently more serious terms of trade shock of 1986 was mostly reflected in higher interest rates; capital flight not only did not occur but there was some capital return and the exchange rate could happen gradually without the size and chaotic overtone of a maxi-devaluation.

The reason for this difference could be in the financial system. In the first scenario the lack of a non-banking financial sector with market determined interest rates made it impossible to stop capital flight and translated it into foreign debt. In the second case a more developed credit market allowed the fiscal disequilibrium and the portfolio shift out of banking instruments to have an impact on interest rates stopping capital flight leaving a lighter burden on the banking system.

3.1. The 1981 story.

After two years of fast growing oil prices the first signs of trouble appeared in early march of 1981 when they had their first small decline. In spite of this change in the future profile of foreign exchange (and government) revenues, imports (mostly public) continued increasing at their previous rates. The result was a rapid deterioration of the balance of payments. The current account deficit which had been 2.6 billion dollars in 1981.1 reached 3.6 billion in 1981.2 and 5.2 billion the next quarter.

Logically people began to anticipate an exchange rate adjustment. Nevertheless passive interest rates on instruments of the banking sector remained practically constant even as the probability of a collapse and the size of the exchange rate correction necessary to bring the balance of payments back in order increased.

Interest Rates of Saving Instruments
of the Banking System

	Time Deposits		Deposits with preset
	30 days	90days	withdrawal dates (2 days/week)
1980.3	16.81	18.20	14.8
.4	25.20	23.25	19.6
1981.1	25.31	24.56	20.3
.2	25.45	24.00	19.2
.3	25.98	24.19	19.2
.4	25.28	23.33	17.6
1982.1	26.86	24.91	18.5
.2	43.40	41.40	32.3
.3	45.30	42.30	33.8
.4	49.90	27.80	22.8

Annual Rates. Source. Banco de Mexico, Indicadores Economicos.

Capital flight starts in the second quarter and accelerates during the second half of the year. Although it is difficult to get an exact figure we could construct an interval where the lower bound is given by the balances of Mexican citizens in U.S. banks and the upper bound by the concept of errors and omissions in the balance of payments which includes all private non-registered capital movements. The fact is that in 1981 and 1982 deposits in U.S banks coming from Mexico increased by 4 billion dollars whereas cumulative errors and omissions surpassed 16 billion dollars.

On the other hand, the increase in the public sector borrowing requirements put pressure on the banking system. Total resources channeled to the government via 'encaje' on commercial banks increased from 2.7 billion dollars in 1980 to 4.6 billion in 1982.1 and 5.5 billion in 1982.1.

The decline in the demand for banking instruments coupled with the additional 'encaje' had to be matched with more resources which could not come from CD's or acceptances because their market simply was not there. Banks had no alternative, but to stay in business, they had to borrow abroad. This is clearly seen in the next table which shows the ratio of domestic liabilities (saving instruments to total non-monetary liabilities of the consolidated banking system.

Consolidated Banking Sector
Saving Instruments/External Liabilities (non-monetary)

1980	3.23
1981.1	2.74
.2	2.68
.3	2.46
.4	2.22
1982.1	1.54
.2	1.45
.3	1.38
.4	1.06
1983	1.15
1984	1.24

Calculated using balances at the end of the period from Indicadores Economicos. Banco de Mexico.

Reviewing the capital account for 1981 and 1982 one can perceive that bank borrowing played a crucial role.

Capital Account
(Net Inflows. Millions of U.S. Dollars)

	Banking Sector (a)	Non-Banking Sector	
		Public	Private (b)
1980	3 728	2 927	3 749
1981 (total)	13 369	10 560	3 851
.1	1 174	1 317	565
.2	2 578	2 019	1 848
.3	3 738	3 039	501
.4	5 879	4 185	937
1982 (total)	- 808	5 889	2 216
.1	- 231	2 017	861
.2	2 656	921	586
.3	-2 993	3 459	285
.4	-240	-508	484

Source: Banco de Mexico. Indicadores Economicos.
(a) Does not include Banco de Mexico.
(b) Direct foreign investment excluded.

In 1981 the banking sector borrowed more than 13 billion dollars of which around 7 billion went to development banks and helped to a large extent, to finance the government deficit. The rest corresponded to commercial banks and was used to cover the decline in real holdings of banking instruments by the public and consequently to support the capital flight.

All this process ended with a series of devaluations of the peso in February (69%), August (45%) and December (112%) of 1982. Capital flight which had started in the second quarter of 1981 stopped temporarily after the first depreciation. But it resumed the next quarter as the current account did not give clear signals of a clear improvement. The deficit in the first two quarters of 1982 amounted nearly 7.5 billion dollars. Errors and omissions turn to a negative sign again. This time financed with declining reserves of Banco de Mexico: whereas the Central bank had

accumulated reserves for more than 1 billion dollars during 1981 it lost the same amount in the second quarter of 1982. Errors and omissions in the second and third quarters of 1982 reached 3 billion dollars. The final collapse comes in September when the exchange rate hits 70 pesos per dollar. The commercial banks (in very bad shape by then due to the heavy dollar borrowing of the year before) are nationalized and an exchange rate control is imposed for three months.

The De la Madrid Administration takes office in December of 1982 announcing a new devaluation and a reform of the financial system.

3.2. The 1986 Story.

After three years of current account surpluses, the Mexican economy is badly hit by a negative terms of trade shock at the beginning of 1986. Oil prices halved making the economy go from current account surpluses of the order of 700 million dollars to deficits of 500 million dollars a quarter. The fall in oil revenues also affected the Federal government which total revenues were 15% below the budgeted figures for that year. This new crisis triggered expectations of exchange rate depreciation, but this time there was no capital flight. Interest rates and the volume of operation in the markets for the recently created credit instruments increased very significantly.

The interest rate adjustment was large and fast enough. Disintermediation of traditional instruments is immediately compensated by a higher circulation of bankers acceptances, especially during the first quarter of 1986. Errors and omissions move to the surplus side in the third quarter of 1986 (200 million dollars) and keep growing well through

Interest Rates on Peso Denominated Instruments

	Non-Banking		Banking	
	CETES (28 days)	Acceptances (1 month)	Pagare (1 month)	Time Deposit (1 month)
1984	47.66	49.18	46.35	45.60
1985.3	67.24	67.93	66.12	63.12
.4	71.18	73.03	67.81	65.20
1986.1	75.98	78.36	68.68	66.10
.2	83.36	85.85	72.43	70.30
.3	98.37	98.32	87.57	83.67
.4	99.21	98.96	93.25	90.20
1987.1	92.89	94.99	93.25	90.20

Annual rates.
Source: Indicadores Economicos. Banco de Mexico.

Operations in the Money Market
Total Allocation of Non-Banking Instruments (a)

	Total	CETES	Acceptances	Other (b)
1984	354.4	338.5	6.9	1.8
1985.3	367.7	265.9	59.6	42.2
.4	333.6	252.9	63.5	17.2
1986.1	375.4	205.6	129.0	40.8
.2	566.8	293.3	220.9	52.6
.3	655.3	366.9	239.1	49.3
.4	609.5	379.6	184.9	45.0
1987.1	724.9	523.6	141.4	59.9

Source: Indicadores Economicos. Banco de Mexico.
(a) Consolidated. Excludes operations among Casas de Bolsa. Allocation per unit period.
(b) Includes commercial paper, Pagare empressarial bursatil, Pagafe, Petrobono, bonds of bankers compensation and bonds of urban renovation.

the first quarter of 1987 (650 million dollars). Dollar deposits of Mexicans in the U.S. drop more than 1 billion dollars in the year. With the new rules of the financial system a negative current account shock had very different consequences. Whereas in 1981 it propelled capital flight in a sequence of events which ended in a huge collapse, in 1986 it is followed by non-bank capital flows which prevented the maxi-devaluation.

Concluding Remarks.

We have seen the importance of the financial structure in an economy with perfect capital mobility. When the system is inflexible, that is, when it is not diversified and interest rates on saving instruments controled, terms of trade shocks will immediately translate into capital flight, rapid reserve losses or, if it is the case, heavy foreign borrowing and a sharper exchange rate collapse when the current account disequilibrium is finally corrected.

In contrast, when the economy has a financial infrastructure that allows interest rates to move fast in response to changes in credit conditions, negative terms of trade shocks are covered by capital return (as opposed to capital flight). Consequently, here the financial system works as an absorber rather than as an amplifier of exogenous fluctuations.

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Notes:

[1]For a good look at origins and evolution of the Mexican Financial System see Brothers and Solis (1970), Ortiz and Solis (1979), Mancera (1979), Bazdresch (1982). For a discussion of the most recent developments see Gil Diaz (1988).

[2]What this equation does is to specify the rate of expected depreciation as a function of the stock of external debt. In Mexico there is some evidence for the dependence of capital flight on total external debt. It can be presented in three ways. The first thing to do is to perform a Granger-Sims causality test. Using as dependent variable Mexican deposits in the U.S. and the differential of passive rates (r^*-r) and the real exchange rate as explanatory variables. The regressions are run on them plus 4 lags and 4 future values and a contemporary value of total foreign debt.

Granger-Sims Causality Test
Dependent Variable: Liabilities of U.S. Banks to Mexicans

Total Foreign Debt			
Lagged Values	Future Values	df	SSR/df
4	4	50	35185.14
0	4	54	65241.28
4	0	54	77947.41

F(Ho): Debt does not cause capital flight = 1.854
F(Ho): Capital flight does not cause debt = 2.215
Fc(1%) = 1.84

It is possible to reject the null hypothesis of no mutual causation.

The other alternative is to use in the regression a proxy variable which is caused by expected depreciation but does not feedback in expectation as it is the case with mex-dollar deposits in the banking system.

The 2SLS regressions presented next used the balance of payments identity and the determinants of the trade account to make the identification. The instruments are an index of activity, government investment, government imports and oil prices. The dummy variable presented in the following results is intended to capture the impact of the oil shock having a value of one from March of 1981. Series use monthly data and the sample goes from January 1977 to February 1982.

[3]A necessary and sufficient condition for two equilibria is given by

$$\left.\frac{ds}{df}\right|_{s=0} = \frac{h}{\eta}\frac{i^*}{p} \; ; \; \frac{i^*}{p}\frac{b}{\eta} = 1$$

this requires that the component of debt not sensitive to expectations (b) is small enough.

$$\left.\frac{ds}{df}\right| \quad > 1 \iff h > b$$

Dependent Variable: CAPT (Total deposits of Mexicans in U.S. Banks)

Constant	1336	1854	859	1176
(t-statistic)	(.95)	(2.30)	(.58)	(.65)
CAPT (-1)	.739	.485	.617	.437
	(3.56)	(1.65)	(4.04)	(1.85)
DEBT	.029	-.026	.043	.015
	(1.65)	(-.88)	(2.40)	(.619)
Dummy*DEBT		.0618		.042
		(2.15)		(1.86)
r-r*	-35.63	-25.50	-40.46	-19.20
	(-1.62)	(-1.19)	(1.83)	(1.89)
Real Exch.	-40.53	-8.27	2.036	-9.40
	(-.45)	(.48)	(.02)	(1.01)
Dummy*Real Ex.		-88.5		-59.0
		(-2.10)		(-1.76)
R-squared	.96	.97	.96	.97
DW	1.97	1.91	1.96	1.88
Method	OLS	OLS	2SLS	2SLS

Dependent Variable: V (Mex-dollars/peso liabilities of the banking system. Banco de Mexico is excluded)

Constant	.0141	.0512
(t-statistic)	(1.56)	(1.89)
V (-1)	.907	.961
	(17.6)	(17.4)
DEBT	1.0 E-6	1.87 E-7
	(6.48)	(0.98)
Dummy*DEBT		8.97 E-7
		(3.87)
r-r*	-.002	-.003
	(-4.73)	(-5.07)
Real Exch. Rate	.0003	-.0002
	(0.12)	(0.03)
Dummy*Real Exch. Rate		-.0025
		(-1.67)
R-squared	.95	.97
DW	1.99	1.99

Part IV.2

DOLLARIZATION AND CAPITAL FLIGHT:
THE ROLE OF FINANCIAL REPRESSION IN THE MEXICAN EXPERIENCE
(1981-1982)

DOLLARIZATION AND CAPITAL FLIGHT.

A look at the role of financial repression in the Mexican experience of 1981-1982

Introduction.

In 1981 and 1982 Mexico experienced a very serious episode of dollarization. In a matter of 18 months an estimated 14 billion dollars left the country and the dollar liabilities of the banking system to Mexican nationals increased in more than 5 billion.

Although it has not been carefully studied, it is reasonable to believe that this huge portfolio shift had a mayor impact on the domestic credit market, affecting not only total financing but also resource allocation and the needs for additional foreign borrowing on the side of the private sector.

Understanding the dynamics of this experience requires yet to answer some questions about the way in which the banking system reacted to financial disintermediation, in terms of the amount of credit given as well as with respect to the allocation of available resources in times of rising expectation of an exchange rate collapse, in an economy where borrowing (passive) and lending (active) rates are not fully flexible and there is high international capital mobility.

The purpose of this paper is to present a look at the at the Mexican dollarization experience which improves what has been said so far in two directions: first, viewing not only at the aggregates but trying to learn about the structural effects of capital flight such as its impact on credit rationing and credit allocation, examining the portfolio decisions of banks and assessing the role of mex-dollarization during the crisis.

Second, this essay tries to present under a unified scheme, the problem of capital flight and its financing; answering how, why and when private and public foreign debt were recycled to the international markets.

The essay has 5 sections and several appendices where we leave the model and all technical details. Section 2 contains the basic set of identities which we need to estimate to have a complete picture of the composition of capital flight and its sources of financing. Section 3 starts in these definitions disaggregating capital flight according to its form: either coming from changes in portfolio composition of individual agents and firms, or from firms which borrow in pesos and buy dollars or from banks deviating resources from credit to get dollar instruments. Section 4 looks at the dynamics and composition of capital flight financing, determining at each time how much of dollarization came from private (bank and non-bank) foreign debt and public external borrowing. Section 5 concentrates all the results of sections 3 and 4 to give a global view of the problem, together with some lessons and conclusions.

2. Capital Flight in Terms of Some Basic Accounting Identities.

2.1. Composition of Capital Flight. (Uses)

2.1.1. Capital Flight of Firms.

One of the most controversial questions on the Mexican case has to do with the importance of capital flight coming from the treasuries of private firms. The same as in the case of individuals, it is reasonable to think that part of their portfolios would move to dollars in the advent

of a maxidevaluation. The core of the discussion, though, comes from the version of firms also increasing their demand for domestic credit at repressed active rates to buy even more dollars.

Speaking in terms of a simplified balance of sources and uses we could say that firms can employ funds from domestic and foreign credit to either finance productive activities or for capital flight.

$$DOLEMP+PRODUS \equiv CREDEMP+DEXTEMP \qquad (1)$$

DOLEMP : dollar holdings of firms (all concepts are changes with respect to the previous period)

PRODUS : productive uses of total resources

CREDEMP: credits from the banking system

DEXTEMP: external borrowing of private firms

To estimate the size of capital flight originated in additional borrowing we can use a disaggregated version of equation (1) considering some institutional characteristics of the Mexican credit market.

As active rates do not respond fast to changes in supply and demand conditions, it is possible to expect some form of disequilibrium (dynamic) credit rationing in times of dollarization. Consequently, we may have two kinds of firms: those not rationed (N) for which the definition of capital flight is:

$$DOLEMP_N \equiv CREDEMP_N - PRODUSP_N \qquad (1N)$$

PRODUSP : Productive use of credits in pesos.

As this firms are not rationed, there is no reason for them to borrow in dollars for not productive uses. This means that:

$$0 = DEXTEMP_N - PRODUSD_N \qquad (2)$$

PRODUSD : Productive uses of credits in dollars

With respect to rationed firms, they could use additional external borrowing to cover the restrictions in the domestic market.

$$RESEMP = DEXTEMP_R - PORDUSD_R \qquad (1R)$$

RESEMP : Foreign borrowing used to cover domestic credit rationing

We assume that rationed firms use the scarce credit in activities of high productivity, which can be rewritten as:

$$0 \geq CREDEMP_R - PRODUSP_R$$

We finally assume that the initial dollar holdings of rationed firms are small

$$DOLEMP_R = 0 \qquad (3)$$

Substituting (1N), (1R), (2) and (3) in (1) we obtain:

$$DOLEMP = DOLEMP_N = (DEXTEMP_R - PRODUSD_R) + (CREDEMP - PRODUSP)$$

2.1.2. Capital Flight and Resource Capturing of Banks.

In times of dollarization and capital flight banks find, on the assets side, the alternative of lending inside the country or flying their own funds abroad. On the liabilities side, they face financial disintermediation with credit reduction and foreign borrowing. Besides, mex-dollarization implies an additional constraint on their portfolios as dollar

deposits have a much higher reserve requirement. Summarizing this in terms of an accounting identity

we have:

$$EL+DOLBAN+CREDEMP \equiv DISPON+DEXTBAN \quad (4)$$

EL : Reserve requirement -Encaje Legal-
(once again all following concepts are expressed as change with respect to the previous period)
DOLBAN : Dollar assets of commercial banks
DEXTBAN : External borrowing of banks (flow)
DISPON : Liabilities of commercial banks to the public.

2.1.3. Balance Sheet of Individual Agents and the Public Sector

For individual agents, dollarization is simply understood as a change in portfolio composition. The implied identity is:

$$DOLFAM \equiv -DISPON \quad (5)$$

DOLFAM : Dollar assets of individual agents (change with respect to the previous period)

To close this system of identities we will need the government budget.

$$EL+DEXTPUB \equiv PRODUSP_G+PRODUSD_G \quad (6)$$

DEXTPUB : Changes in the stock of foreign public debt.
$PRODUSP_G$: Changes in domestic fiscal deficit.
$PRODUSD_G$: Changes in the external fiscal deficit.

2.2. Financing Capital Flight. (Sources)

Identities (1N) and (4) to (6) provide the scaffolding on which we will build along this essay. Putting them together will allow us to see

capital flight in terms of its sources and composition (uses).

Substituting (4) to (6) on each other we arrive at an expression which shows the six concepts we need to compute to get a complete and integrated picture of the 1981-1982 experience:

$$\begin{aligned} \text{DOLFAM+DOLBAN+DOLEMP} = {} & (\text{DEXTEMP}_R - \text{PRODUSD}_R) + \\ & (\text{DEXTPUB} - \text{PRODUSD}_G) - \text{PRODUSP}_G \\ & (\text{DEXTBAN} - \text{PRODUSP}) \end{aligned} \qquad (7)$$

The right hand side of (7) shows how the burden of capital flight is distributed among sectors.

First, take the private sector which may be forced to borrow to cover for the credit rationing. When they borrow abroad these resources enter the financial system and are converted into pesos. The central bank receives these new dollars and issues more pesos covering the decline in domestic credit. But private firms may not compensate in full the credit reduction. If that is the case both, banks and the government will start having some pressures.

As disintermediation advances the funds fiscal authorities used to get from Encaje Legal begin to shrink and the only way to cover them is either reducing the domestic deficit or borrowing additional funds abroad (other form of domestic borrowing is not well developed before 1982). The second row of expression (7) can be interpreted as the fraction of public foreign debt used to finance capital flight.

Banks could use foreign credit to finance a domestic credit expansion, in which case this extra dollars are reflected in the international reserves of the central bank. The difference between bank external borrowing and credits they give and are used in productive activities represents the fraction of bank borrowing induced by capital flight. In

fact, the term in the third row of expression (7) which is the expansion of bank external borrowing not explained by additions to productive uses, shows the fraction of capital flight financed by banks.

Expression (7), besides giving a global view at the problem, suggests a more analytical methodology for capital flight measuring, besides the common approach of taking simply errors and omissions. Here one looks instead to the credit markets and not only to balance of payments available information.

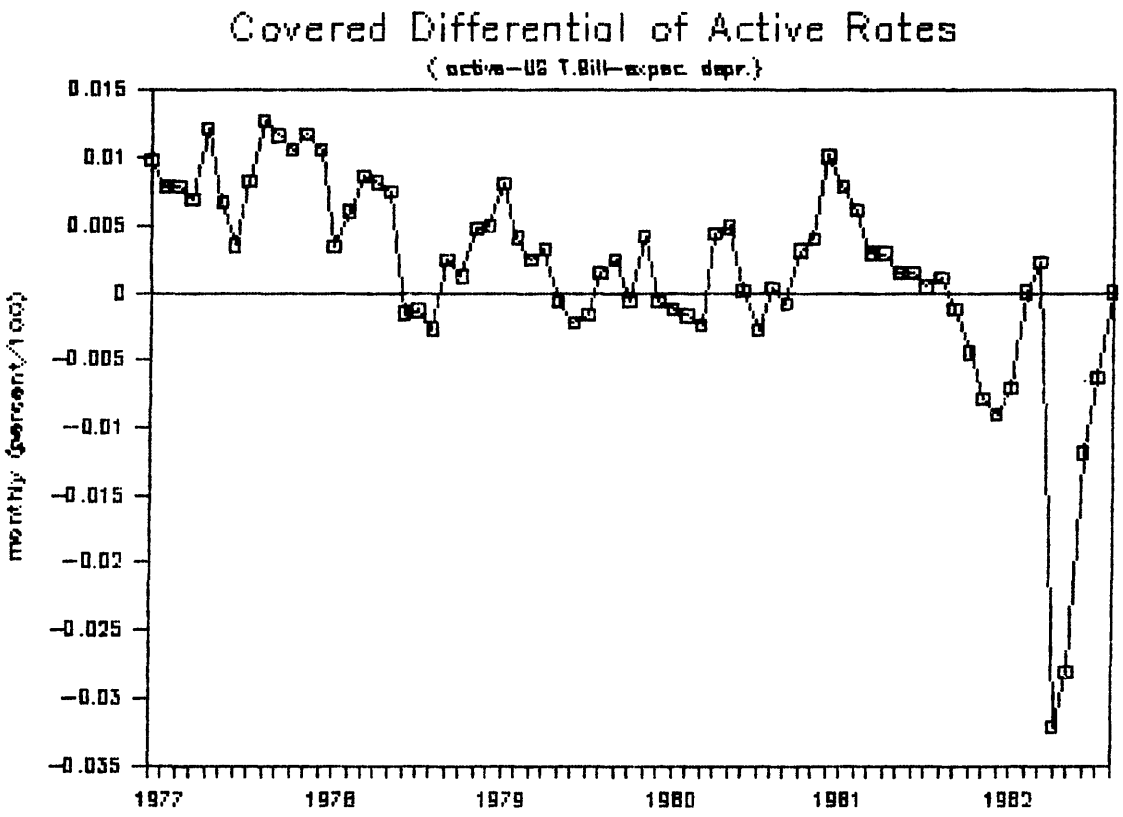
In the next two sections we try to get a series for each one of the three forms of capital flight and each of the three sources of financing, leaving to the last section the analysis of the results and the comparison of these estimates with the numbers one would obtain by simply looking at the balance of payments.

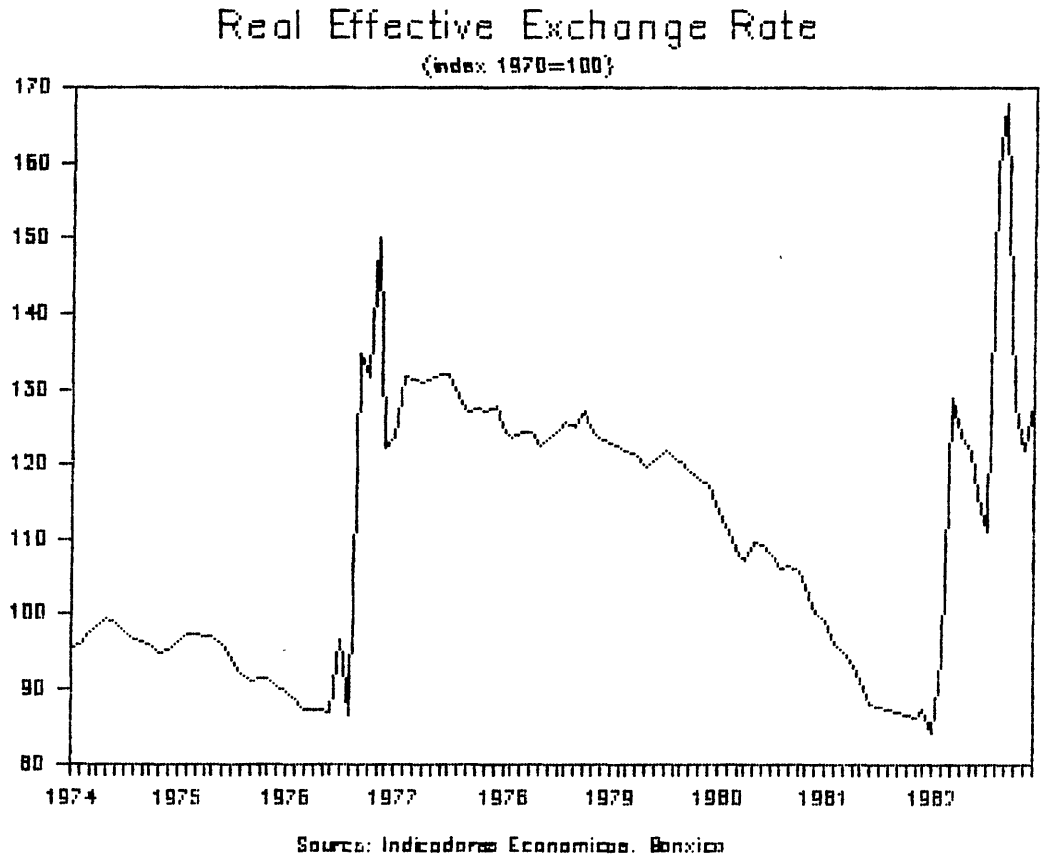
3. Decomposing Capital Flight.

Following section 2 we may consider three forms capital flight depending on the agent who takes action: firms, individual agents and commercial banks.

3.1. Credit Allocation, Credit Rationing and Capital Flight of Firms.

As it has been said, firms could support their capital flight by simply changing the composition of their portfolios or by borrowing at a low active rate in the domestic market and buying dollars with those additional resources. In what follows, when we talk about capital flight of firms we will be referring <u>only</u> to this second form of dollarization, whereas the first will be considered indistinguishable from capital flight


Covered Differential of Active Rates
(active-US T.Bill-expec. depr.)
monthly (percent/100)
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
-0.035
1977
1978
1979
1980
1981
1982


Real Effective Exchange Rate
(Index 1970=100)
170
160
150
140
130
120
110
100
90
80
1974
1975
1976
1977
1978
1979
1980
1981
1982
Source: Indicadores Economicos, Banxico

of individual agents.

Before getting to the numbers, we should think a little about the rationale for why it could be possible for firms to get credits to finance capital flight (or, which is the same, why would banks lend them).

Although we haven yet proved that this actually happened, there are reasons to consider the possibility. As a matter of fact, at the critical times of dollarization and capital flight there was the widespread belief among government officials that important amounts of funds channeled through the credit system were in fact used for capital flight. Some of them, including president Lopez Portillo, even accused commercial banks of inducing their clients to accelerate the capital flight.

A simple model of an optimizing banking system described in appendix A has some of the elements, I think, could determine credit allocation in an environment of capital flight and an expected maxi-devaluation.

This model stands on two basic ideas : banks may ration credit because they can not discriminate completely among credit users; banks do not engage in a massive capital flight of their own funds for institutional and market reasons (The institutional reason I have in mind has to do with the tensions between the government and commercial banks between 1981 and 1982 which ended up with their expropriation: open capital flight of banks had to be limited. A hysterisis reason, which has received some attention in the Mexican debate, has to do with the idea that banks would prefer to keep domestic credit even if they can fly from pesos, in order to keep market shares. (See Ize (1980)).

In this model, which basic notions come from the ideas of credit rationing in Jafee and Modigliani (1969) and Jafee (1971), we imagine a

representative bank which has a given amount of liabilities for which it pays a given passive rate. On the other side, the demand it faces is formed by groups of firms. Each group has a number of firms which projects have a stochastic outcome depending on the state of nature. Each group can be indexed by its expected return, whereas all groups have the same coefficient of variation. Banks can discriminate firms between groups but not within the group. The active rate is regulated and is unique, consequently the decision variable of banks is the quantity of credit they give to each group. A bank gets the regulated active rate in the good state of nature and the minimum of the active rate and the return of the project in the bad state. Banks and firms are risk neutral.

The initial equilibrium has credit rationing because of the usual reasons: as the distribution of returns is truncated at the level of the active rate, the expected return for banks does depend on the variance of returns within each group. Given the structure of the problem banks will lend only to clusters of firms with the highest expected returns and ration groups which, in spite of having firms with expected returns above the active rate mean an expected loss for banks (implicit in the model there is a cost of administering the loan).

The possibility of an exchange rate collapse changes the equilibrium in different ways. Banking intermediation tends to go down as people changes liabilities of the banking system for dollars. Banks may not reduce credit in the same proportion and even borrow or reduce free reserves, to the extent that they see a cost of a lost market share. As the rate of expected depreciation increases, they begin rationing credit and eventually start to fly abroad their own loanable funds.

With respect to credit allocation there is an incentive to lend to groups where there are firms which will buy dollars. The reason is that capital flight is just another project from the standpoint of firms and banks. As the event of a maxi-devaluation is more imminent, capital flight is perceived as a project with higher return and less variance. From the perspective of commercial banks, between two clusters of firms with the same expected return they will prefer those which will dollarize because, reducing the variance for firms increases the expected return for banks. In this way as intermediation happens we can see aggregate rationing but also an important change in the allocation of credit in favor of sectors which will use at least part of the funds to buy dollars. Leaving the rest of the details for the Appendix, we could go ahead looking at the Mexican experience.

First thing to do is to test, based on information of the credit market, for this kind of capital flight.

To know how strong was the incentive on the side of firms to borrow in pesos to buy dollars one needs to know how repressed the active (lending) rate was. A measure of this is given by the difference between the active lending rate and the interest rate of dollar instruments plus the rate of expected depreciation implicit in the futures market.

Figure 3.1 shows the monthly active effective rate and the sum of one month rate of expected depreciation and the monthly return of one month U.S. Treasury Bills. It calls the attention how active rates lagged behind the return of dollars in the second semester of 1981 and the second and third quarters of 1982, opening wide the possibility of firms deviating credit to buy dollars.

Passive rates lagged even more causing capital flight and mex-dollarization which tended to reduce available funds for credit. As will be seen latter, the conjunction of banking disintermediation and inflexible of active rates, provoked intervals of aggregate credit rationing to some segments of the market, as well as financing the capital flight of others.

To get some a sense of the orders of magnitude on how much credit was deviated to capital flight and the extent of rationing, we will need to estimate a model of the credit market. Leaving the details about the techniques to estimate markets in disequilibrium to Appendix B and on the particular specification used, we could start looking at some numbers.

Table 3.1. Supply, Simulated Demand and Excess Demand for Credit to the Private Sector (hundred million of 1978 pesos)

	Credit Supplied	Credit Demanded	Excess Demand (net rationing)
1981			
jan	34 961	35 107	146
feb	34 733	35 060	327
mar	35 403	35 419	16
apr	36 901	36 018	-73
may	36 002	36 120	118
jun	37 046	36 932	-114
jul	37 505	37 434	-71
ago	37 164	37 146	-18
sep	37 196	36 642	-554
oct	37 774	37 079	-661
nov	37 595	36 780	-815
dec	38 740	37 084	-1 656
1982			
jan	37 036	35 818	-1 218
feb	35 089	35 269	180
mar	35 252	36 227	975
apr	33 675	36 521	2 846
may	33 106	36 753	3 647
jun	32 341	37 288	4 947
jul	32 412	36 662	4 250
ago	31 990	36 840	4 850

A positive excess demand means that, looking at aggregated credit there is credit rationing which does not necessarily means that all segments are rationed. On the other hand, finding the negative excess demand can be interpreted also as the difference between total credit and productive credit, which is evidence of resources being diverted to capital flight.

From this exercise we can identify two distinctive periods. The first starting in, April or May of 1981 to January of 1982 when there is a sequence of consecutive negative excess demands, suggesting capital flight of credit in pesos; and the second after the devaluation of February to the date of nationalization of banks and decree of exchange controls on September 1st where credit rationing is very severe. The problem with this aggregate measure is that the numbers for capital flight are underestimated because they do not take into account changes in credit composition.

To get more precise results we have to segment the market based both, on the concepts and definitions given in section 3.1. and the data available.

The best way of segmenting the market is getting groups of agents sharing common characteristics such that it is reasonable to think that when credit rationing affects that group most agents within it are rationed. That is, to work with groups as homogeneous as possible.

Constrained by the available information from Banco de Mexico and the National Commission of Banking and Insurance Institutions, which finest disaggregation is by region and type of credit we can come up with the following five subsets of the credit market.

Table 3.2. Partition of the Mexican Credit Market.

Credit to Enterprises	Industry	(1) Preferential Zones(a) (2) Non-preferential
	Non-Industry	(3) Preferential Zones (4) Non-Preferential
Credit to Individual Agents		(5) Hipotecario and prendario credit

(a) For a description of the content of each sub-group see Appendix B. For now we can say that to generate this series it was done working with data at the finest level of disaggregation available in Mexican Banking Statistics.

Using the same econometric method employed in computing table 3.1. we could estimate the excess demands for credit for each one of the segments.

Table 3.2. Excess Demand for Credit in the Private Sector.

	Segment					
	(1)	(2)	(3)	(4)	(5)	Total
1981						
feb	178.5	-7.8	171.5	7.9	-18.6	331.5
mar	-703.8	392.5	-349.7	96.7	158.8	-305.4
apr	-156.7	143.2	-164.7	-2.4	51.2	-129.4
may	-176.7	140.1	-144.6	55.6	86.7	-38.8
jun	-289.9	119.0	-312.1	90.1	184.3	-209.6
jul	-476.8	253.4	-441.7	200.1	214.5	-250.5
ago	-1456.4	860.7	-1003.2	412.7	497.9	-683.2
sep	-1860.9	1125.4	-1800.1	899.2	855.5	-781.9
oct	-1865.4	1124.3	-1837.1	997.0	996.1	-585.5
nov	-2071.6	1226.2	-1751.6	1044.6	683.2	-869.2
dec	-2689.5	1513.5	-2184.7	1238.3	869.8	-1252.8
1982						
jan	-2249.3	1231.2	-2312.1	928.0	1151.1	-1250.8
feb	-695.0	1157.7	-717.6	895.6	232.0	-227.3
mar	-754.0	1001.2	-499.5	819.1	847.2	1414.0
apr	-410.1	1090.4	-433.2	870.4	912.1	2029.6
may	-234.8	1123.5	-412.5	919.2	1212.5	2608.0
jun	-197.5	1203.4	-174.9	984.6	1337.0	3153.4
jul	-590.3	1623.8	-523.6	1328.6	739.2	3625.5
agu	-612.5	1755.7	-598.7	1512.5	1805.6	3862.6

All numbers are in hundreds of millions of pesos of 1978.

Roughly speaking, these demands are estimated using indicators of economic activity and the real cost of credit as explanatory variables. The sample space for the estimation is integrated with monthly data from 1974.01 to 1980.12, excluding periods of dollarization such as the interval 1976.01 to 1976.10.

In the cases of segments (2), (4) and (5) there is a clear process of rationing starting in the second semester of 1981. Negative excess demands appear in the second quarter of 1981 and diminishes substantially after the February devaluation, to reappear latter on but in a lesser extent before the new exchange rate correction of September.

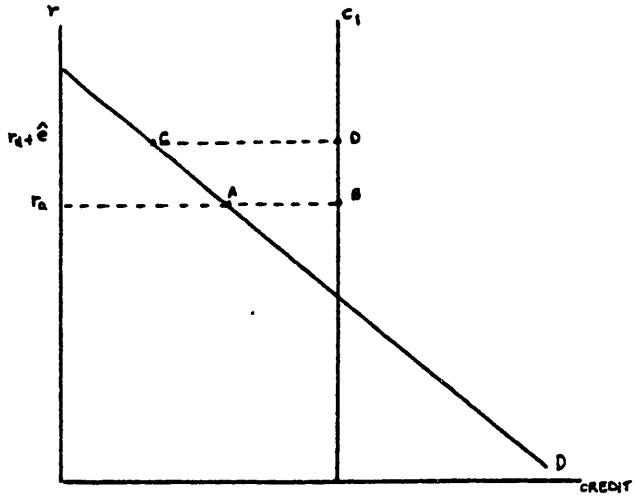


Figure 3.2

The next approximation to capital flight of firms would be given by the addition of columns (1) and (3) of table 3.2. This result can be refined a little more, given the data we have. In terms of figure 3.2. what has been done so far is to estimate the segment AB, but what we are looking for is the distance DC, for which we correct the estimates of excess demand for segments (1) and (3) at the level of the return of dollar denominated financial instruments (see again Appendix B for details).

Table 3.3. Capital Flight of Firms.

	(1)+(3) from table 3.2.	Correction	Total (a)	Total (b)
1981				
jun	602.0	24.2	626.2	0.485
jul	918.5	26.8	945.3	0.739
ago	2 454.6	37.7	2 492.3	1.974
set	3 661.0	46.1	3 707.1	2.942
oct	3 702.5	159.4	3 861.4	3.106
nov	3 823.2	281.1	4 104.3	3.324
dec	4 873.7	327.0	5 200.8	4.266
1982 (c)				
jan	4 561.4	255.8	4 816.8	4.089
may	647.3	325.7	973.0	0.555
jun	372.1	222.9	595.0	0.353
jul	1 113.9	312.6	1 426.5	0.875
ago	1 215.1	257.2	1 472.3	0.787

(a) in hundreds of millions of pesos of 1978.
(b) billion dollars of the U.S.
(c) results from February to April are omitted because the effects of the maxi-devaluation on the predicted values and the correction are too large. The model is used again once the foreign exchange market has stabilized.

3.3. Capital Flight of Individual Agents.

It is a fact that there are not precise measures of aggregate private capital flight of families and firms because most of these operations are

not documented. As a result one has to rely on approximations.

The most commonly used consists on taking total errors and omissions in the balance of payments. Zedillo (1986) has proposed some improved versions of this particular datum to eliminate some sources of overestimation. For example, it is necessary to subtract imputed interests earned by Mexican Nationals from their assets abroad because, in the Balance of Payments accounting, they are considered to enter and then leave the country as capital flight.

In this section we will present as capital flight of individuals the difference between corrected errors and omissions and capital flight of firms (from table 3.3). This is the fraction of capital flight which comes as a result of a change in composition of an initially given portfolio.

Table 3.4. Capital Flight of Individual Agents.

	Capital Flight of Firms	Corrected Errors and Omissions	Difference
1981			
jun	0.485	2.798	2.313
jul	0.379	3.868	3.139
ago	1.974	3.630	1.656
sep	2.942	4.367	1.425
oct	3.106	5.104	1.998
nov	3.324	5.816	2.492
dec	4.266	8.421	4.155
1982			
jan	4.089	8.536	4.447
may	0.555	9.516	8.961
jun	0.353	10.025	9.672
jul	0.875	10.561	9.686
ago	0.787	13.368	12.581

In billion dollars of the U.S.

3.4. Capital Flight of Banks.

Banks also diversified their portfolio moving part of their resources to buy foreign exchange denominated assets. As it was suggested before, banks could not engage in open and massive capital flight due both, to regulation and the willingness of the Lopez Portillo Administration to impose a close supervision of all bank activities, maybe for political reasons.

Fortunately we do not need to do econometrics to get exact figures of capital flight of banks as this type of operations are fully documented.

Table 3.5. Capital Flight of Banks. (a)

1981		
	jun	0.011 (b)
	jul	-0.002
	ago	0.041
	sep	-0.012
	oct	0.022
	nov	0.110
	dec	0.227
1982		
	jan	0.279
	feb	0.410
	mar	0.210
	apr	0.165
	may	0.078
	jun	0.054
	jul	0.082
	ago	0.002

(a) Differences with respect to bank balances in foreign assets in December 31, 1980. (Change in "disponibilidades" in foreign currency). Source:Banco de Mexico

(b) In billions of U.S. dollars.

4. Financing Capital Flight.

There have been few and very simplistic descriptions of what happened on the financing side of capital flight, even though it plays a crucial

role in understanding the origins of the debt crisis in Mexico.

Looking at the international reserves one concludes that a great deal of the financing of the 1981 capital flight was supported with external borrowing, whereas the 1982 experience was supported by a combination of borrowing and declining reserves.

Table 4. Cumulative Change in Gross Reserves. (a)

1981		
	jan	0.096 (b)
	feb	0.154
	mar	0.884
	apr	1.000
	may	1.139
	jun	0.337
	jul	0.662
	ago	1.370
	sep	0.537
	oct	0.388
	nov	0.748
	dec	1.667
1982		
	jan	0.345
	feb	-0.167
	mar	0.209
	apr	-0.820
	may	0.326
	jun	-1.393
	jul	-1.310
	ago	-1.605

(a) Cumulative Change of Gross Reserves. December 1980=0.0.
(b) Billions of U.S. dollars.

It is not that surprising to see public sector external borrowing growing in times of capital flight as it can be puzzling to see that the private sector debt grew very substantially in 1981 and 1982. Then, it interesting to see, if the paradox of a private sector recycling through a very distorted financial sector, actually took place.

The same as in section 3 we will proceed disaggregating the information to get a more complete sense of what happened.

4.1. Government Financing of Capital Flight.

Following the definitions in section 2., this series can be obtained by simply looking at the uses of foreign public borrowing.

Here we will use a little more precise and operative definition:

Public Financing of Capital Flight =

Increase in Flow of External Borrowing of the Government (includes national banks) Increase in Fiscal Deficit - Increase in International Reserves (net) -Increase in Foreign Assets of the Parastate Sector. (8)

Table 4.1. Government Financing of Capital Flight. (a)

1981		
	jun	0.274
	jul	0.894
	ago	0.553
	sep	1.405
	oct	1.027
	nov	1.007
	dec	1.547
1982		
	jan	2.034
	feb	0.954
	mar	3.091
	apr	2.361
	may	1.971
	jun	2.381
	jul	4.071
	ago	4.581

(a) Cumulative increases of expression (8) starting on December 1980=0.0.
(b) In billion U.S. dollars.

4.2. External Borrowing of Rationed Firms.

Another possible source of capital flight financing could come from

the private sector itself; either form commercial banks or private enterprises.

A rationale for private firms borrowing could be found in the presence of rationing of domestic credit: if they see external borrowing as substitute for domestic credit they could go outside and get loans to cover for scarce domestic credit, even if there are prospects for a devaluation.

Appendix C explains the details on how this component is computed, but, in general terms what is done consists on defining an equation for external credit demand in the private non-banking sector, using observations only in times where there was not credit rationing. The component to finance capital flight is the difference between the observed flows of external credit and the demand for foreign credit simulated using the observed values of the explanatory variables.

Table 4.2. Private Firm Financing of Capital Flight.(a)

1981		
	jun	0.015
	jul	-0.145
	ago	0.159
	sep	0.345
	oct	0.945
	nov	2.143
	dec	2.509
1982		
	jan	2.614
	feb	1.950
	mar	0.479
	apr	0.432
	may	0.618
	jun	1.337
	jul	1.583
	ago	1.713

(a) In billions of U.S. dollars.

4.3. Commercial Bank Financing of Capital Flight.

Banks could also respond to financial disintermediation borrowing abroad. A reason for this could be given for the impossibility for them to adjust their portfolios as fast as other agents do: banks had to face the reduction in deposits without being able to reduce credit at the same speed. This meant that, at least for some time free reserves had to go down and additional foreign credit used to cover this gap.

This last component can be estimated by differences taking total external borrowing of banks and subtracting from it the amount of productive credit banks give to firms. The details are also in Appendix C.

Table 4.3. Commercial Bank Financing of Capital Flight (a).

1981		
	may	-0.045
	jun	0.450
	jul	0.590
	ago	0.670
	sep	1.638
	oct	2.250
	nov	3.253
	dec	4.453
1982		
	jan	4.218
	feb	4.338
	mar	4.590
	apr	4.987
	may	5.591
	jun	5.617
	jul	5.923
	ago	6.095

(a) In billion dollars of the U.S.

5. A Global View at the Capital Flight Experience of Mexico (1981--1982)

and some concluding remarks.

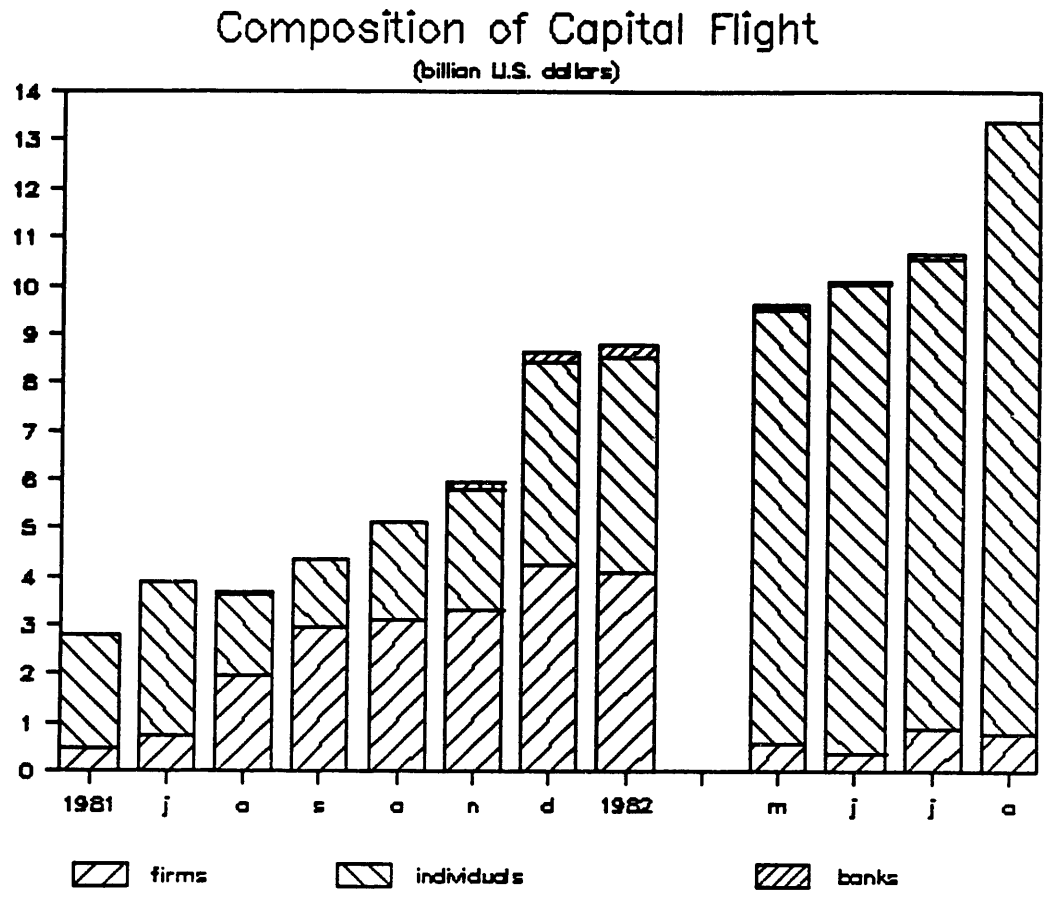
The intention of this section is to comment in and try to give an interpretation to the results we got in the last two sections.

As we obtained the financing of capital flight and each one of its components (uses) independently, it would be interesting to compare both results.

Table 5.1 and 5.2 show both totals (sources and uses). The sum in the uses side coincides (net of the capital flight of banks) with the usual measures of capital flight based on balance of payments information, whereas the results on the sources side use basically information of the credit market.

We can see that the difference between these two approaches is not very large. The cause for this discrepancy could come from measurement errors as well as from differences in methodologies used in the elaboration of balance of payments statistics versus credit statistics: for example, the component of errors and omissions has all kinds of measurement errors on it which do may not have a counterpart in the statistics of the banking sector. Another cause is in the error terms in the regression used for the simulations.

Focusing our attention on the periods immediately before the maxi-devaluations (which took place in the third week of February and last week of August) we get the next two columns, the first is the sum of the three components computed in section 3. and the second column is the addition of the three sources of financing calculated in section 4.


Composition of Capital Flight
(billion U.S. dollars)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1981
j
a
s
o
n
d
1982
m
j
j
a
firms
individuals
banks

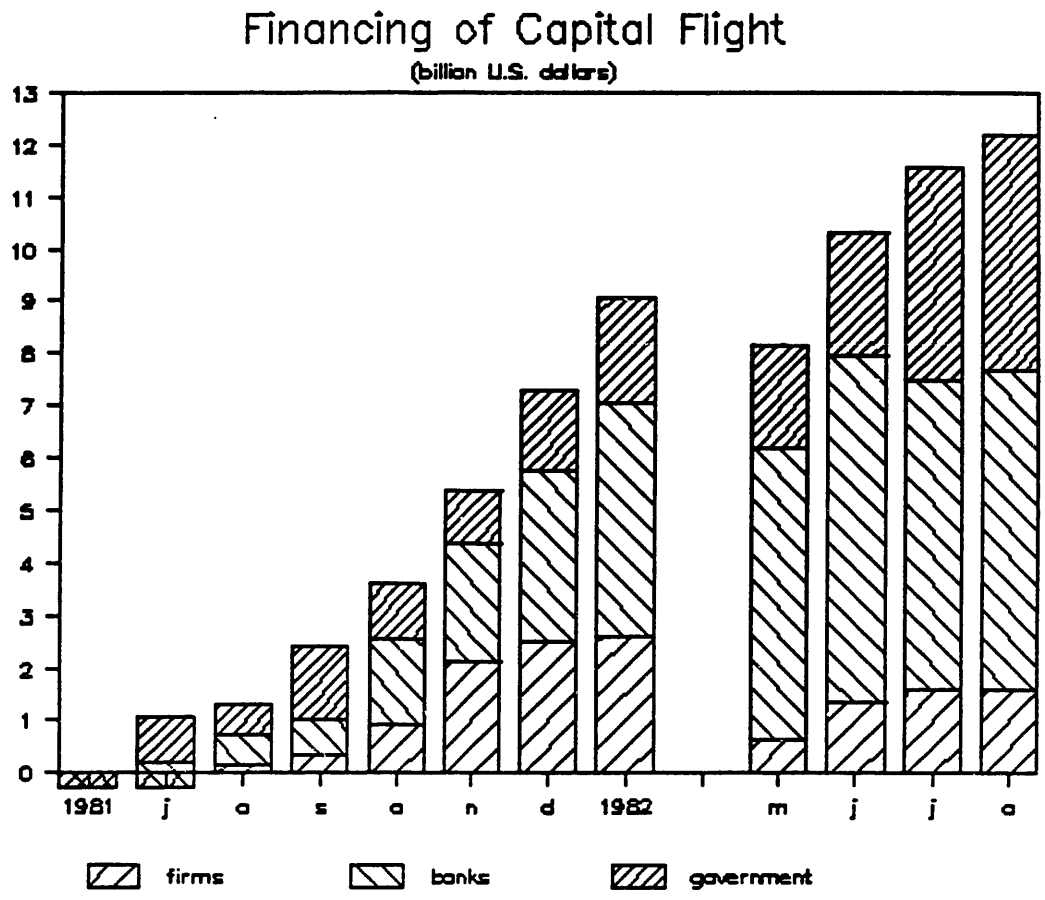

Financing of Capital Flight
(billion U.S. dollars)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1981
j
a
s
o
n
d
1982
m
j
j
a
firms
banks
government

Table 5.1. Capital Flight from the Balance of Payments and the Credit Market. Period sep. 1981-jan. 1982.- (a)

	Uses	Sources	Difference.
1981			
sep	4.367	3.382	0.985
oct	5.126	4.224	0.902
nov	5.926	6.398	-0.472
dec	8.698	8.855	0.157
1982 jan	8.810	8.862	-0.052

Table 5.2. Capital Flight (cont.) -Period may-ago 1982

1982 may	9.039	8.179	0.860
jun	10.070	9.329	0.741
jul	9.762	11.565	-1.803
ago	13.362	12.386	0.976

(a) In billions of dollars of the U.S.

With all this information at hand, we can now tell the Mexican capital flight experience from the perspective of the credit market.

We could divide the period in two parts, separated by the devaluation of February 1982.

The 1981 capital flight took off by the end of the first semester. Half of it is explained by what we called capital flight of individuals, which was no other thing but portfolio shifts of individual agents and firms. The other half is the result of the deviation of inexpensive credit in pesos to buy dollars.

During this first phase, private firm borrowing represented an important source of dollars. Commercial banks also borrowed heavily, but not when the capital flight of firms increased (October and November), but

when the capital flight of individuals strengthened (when disintermediation started).

The next phase has some clear differences. First, portfolio capital flight is the main source of dollarization. Second, this disintermediation causes a credit rationing that affects uniformly all segments of the market, and consequently there is no further capital flight of firms. Third, the burden of capital flight goes to the government (loss in reserves included) and to commercial banks. Fourth, there is no distress borrowing in a large scale: rationed firms do not borrow large amounts abroad.

These results help us to put together many of the stories that have been told about capital flight: from the hypothesis of having capital flight financed by distress borrowing, to the version that the repression of active and passive interest rates and missing markets for CD's. The answer would be that all these phenomena did occur, but, their importance and dynamics changed with the conditions in the credit and foreign exchange markets along this very interesting time in the recent Mexican economic history.

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Appendix A. A Model of Credit Allocation and Capital Flight.

As it is said in the text, this model rests on some of the original ideas in models of credit rationing by Jafee and Modigliani (1969) and Jafee (1971).

1. The Model

Consider a continuum of clusters of firms. Each cluster has an index z in the interval $[2r_a, z]$.

Each cluster has two firms. In cluster z one firm has a project which pays an expected return z and the other pays z/2. Actual returns are contingent on the state of nature. For simplicity one can take only two equally likely states of nature.

Banks can identify clusters but can not distinguish the client within the cluster, then, when a credit is given they do not know exactly to which project the resources are being channeled.

For each project, a firm needs 1 peso. They obtain 1.25z and .625z in the good state of nature and .75z and (3/8)z in the bad state depending if they are the firm with the high expected return or the one with the low return within the cluster.

The decision of the bank is weather or not lend to a given cluster of firms 0,.5 or 1 peso. The revenue that comes from each decision in expected value is:

$$R(0,Z) = 0 \qquad ER(0,Z) = 0$$

$$R(1,Z) = \begin{cases} r_a & ER(1,z) = r_a \quad z > - r_a \\ .5 \min (r_a, \frac{3}{8}z) + .5r_a & ER(1.z) = .75r_a + \frac{3}{32}z \quad z \leq \frac{8}{3}r_a \end{cases}$$

$$R(2,Z) = \begin{cases} 2r_a & \\ \min (r_a, \frac{3}{8}z) & ER(2,z) = 2ER \end{cases}$$

R is the revenue function in both states of nature, with the upper row referring to the good state. Banks are indifferent between lending one half or one peso. Then, the marginal revenue function for banks is given by E R(2,z) (marginal in z). With respect to the cost of lending we will assume a constant marginal cost c(z)=c.

Each bank takes total resource capturing as given, consequently the payments they make for interest are given and treated as a fixed cost.

The solution of the equilibrium is illustrated in figure A.1. in the horizontal axis and reading from left to right we have all clusters in the interval $[2r_a, Z]$. This means that for an active rate r_a all agents in the market will want credit but not all of them will get it, even if there are enough resources for them.

The marginal revenue function is interpreted moving from right to left, as banks will start lending to those clusters which have the highest expected return. For some range this function is flat at the level of the active rate until reaching cluster $z'=3/8\ r_a$ From then on the marginal revenue declines. The solution is given (in the case where total loanable funds are larger than total demand) by kinks lending to firms in the interval $[z',Z]$, where z' corresponds to the point where expected marginal revenue and marginal cost are equalized.

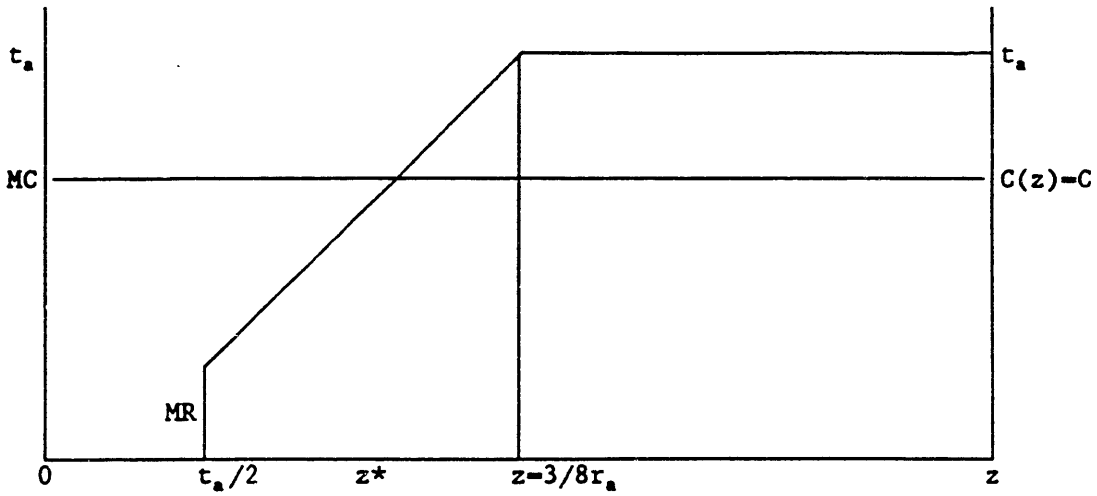


Figure A.1.

Dollarization changes the setting of the problem to the extent that buying dollars represents an additional project available to firms. This implies not only changes in the expected value but also in the average variance of returns perceived by firms and, consequently the expected return for banks.

The point we want to remember is that in this kind of models, variability is important. Here we will think that capital flight takes place when the expected depreciation is becomes more imminent (less uncertain) as time passes. Assuming this is the case that the project of buying dollars has a sure outcome, we now have, from the perspective of banks the expected return will be (when the return on dollars $r_d > r_a$) r_a not only for $z > 3/8\ r_a$ but for $z < r_d/2$.

In terms of figure A.2., with the possibility of dollarization the marginal revenue schedule presents now a discontinuity. Firms with expected return less than r_d (return on buying dollars) will use their credit in pesos to buy dollars.

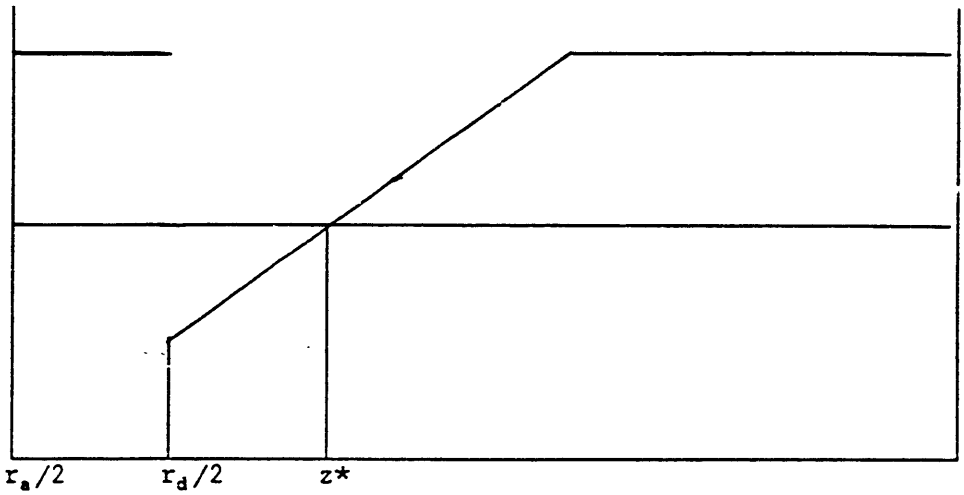


Figure A.2.

If total loanable funds are enough to satisfy total demand there will be some rationing, but less than in the case of no-dollarization. Only firms in clusters $(r_d/2, z')$ will not receive funds.

If there is financial disintermediation, and consequently less funds for bank lending, there will be not only a drop in financing but also a change in composition. If the initial supply was enough to give resources to firms in the interval [z*,Z] and goes down to [z**,Z], all firms in the interval [z*,z'] will be rationed; [z',z**] of them due to disintermediation and [z**,z'], as banks give preferential treatment to those clusters where there will be capital flight to those where there are projects with higher returns but more variability.

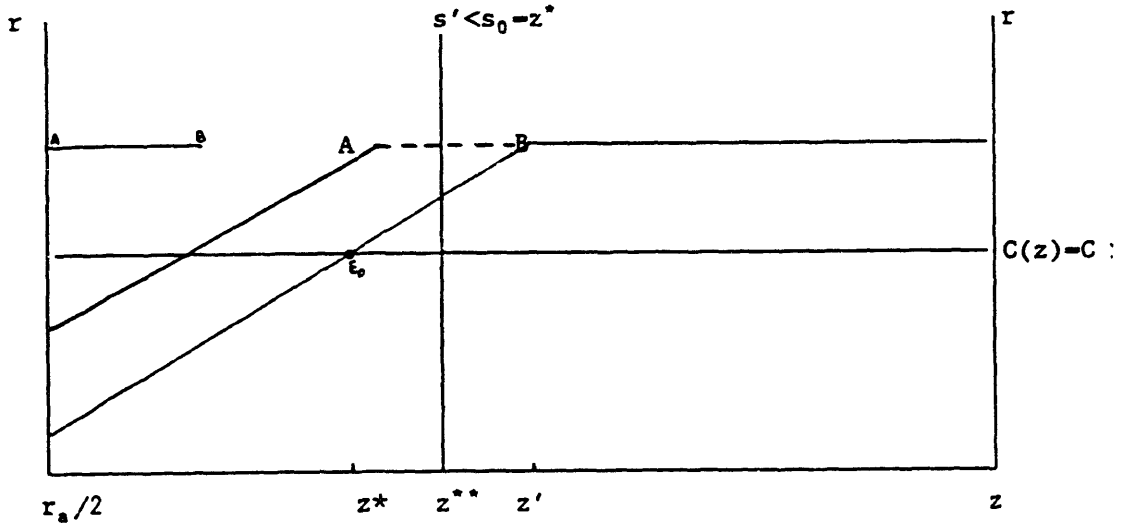


Figure A.3.

To have a complete story we have to tell why, at least for some time, banks do not engage in capital flight themselves.

The answer is further explored in Appendix C in a dynamic context, but up to here we could speculate that market structure and lending technology could so have something to do with the results. Namely, what we are trying to say here is that banks may want to keep market share, and if for some reason reduce lending today, they may find that it recovering that presence is costly. In other words, the marginal benefit that banks find from buying dollars may look like r_d-g where g is the cost of reducing their presence in the market.

If this is the case, the marginal revenue function for banks will show another kink, now at the return r_d-g. In the equilibrium it is likely to fin banks lending at the same time for productive uses, to firms buying dollars and flying dollars themselves.

Figure A.4. shows how this happens. First, as dollarization is possible the flat portion of the marginal revenue function is extended

including all firms in clusters in intervals [$2r_a$, $r_d/2$] and [3/8 r_a,Z], then comes the downward sloping segment which will include only firms in the interval [z',z'''] where z''' is the cluster which offers banks an expected return r_d-g-c (as buying dollar is not assumed to imply a significant transaction cost). The upper diagram shows the firms that receive credit, assuming that there are just enough resources to lend to all firms [$2r_a$,Z]. The lower diagram shows the allocation of funds by banks between credit, capital flight financing and direct dollar buying.

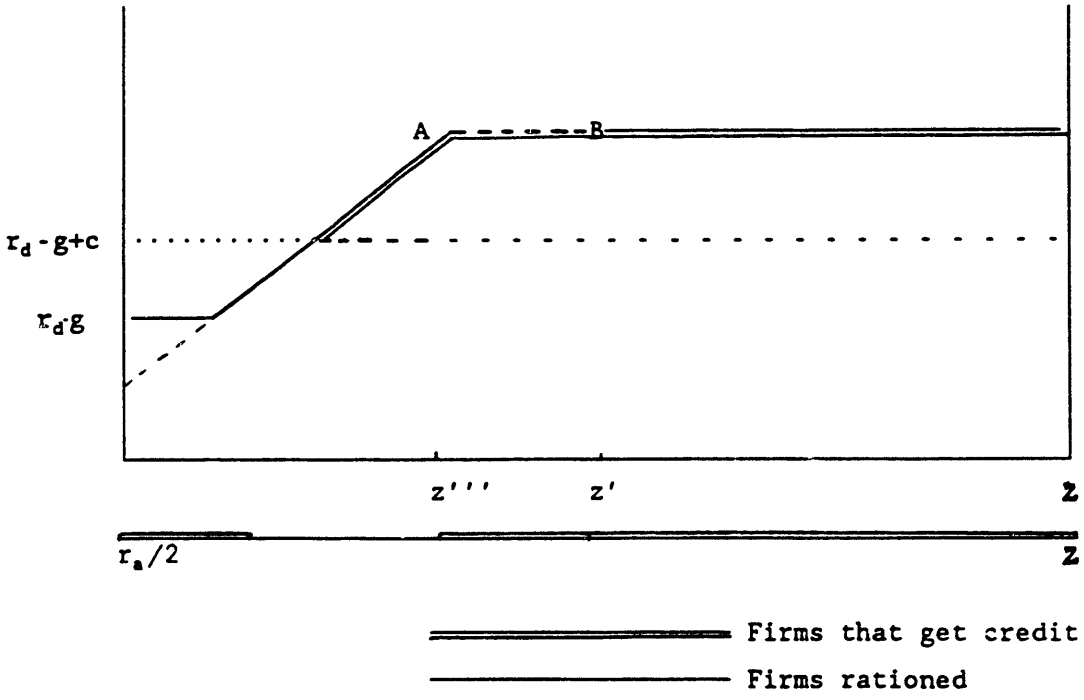


Figure A.4.

Appendix B. Estimation of Markets in Disequilibrium. An Application to the Mexican Credit Market.

When we have markets in disequilibrium the usual methods of equation system estimation fail. To solve this problem there have been different approaches which are variants of regression methods widely used and available in most statistical packages.

For instance, Amemiya (1973) interprets the disequilibrium issue in terms of a regression analysis of truncated normal dependent variables and suggests the use of Tobit estimation techniques. Hartley (1976) explores more in detail the situation in which the supply is exogenously determined and presents a version of WLS to obtain efficient estimators of demand functions in markets in disequilibrium. Fair and Jafee (1972) and Fair and Kelejian (1973) explain the basic intuition behind the method used in this essay to get consistent estimates for the credit demand used for the simulations in this essay.

1. A Simple Method of Estimation.

The demand equations estimated were obtained using a Maximum Likelihood method.

We started from the idea of a credit market where the active rate is determined exogenously (by Banco de Mexico). The system is formed by a supply and demand equations where X^d is a vector of predetermined and exogenous variables for the credit demand.

$$D_t = \alpha_0 X_t^D + \alpha_1 r_{at} + \epsilon_t^D \qquad (B1)$$

$$S_t = \beta_0 X_t^S + \beta_1 r_{at} \epsilon_t^S \qquad (B2)$$

X^s the corresponding vector for the supply equation. Variable r_a is the active (lending) rate.

As the interest rate is not adjusted instantaneously, supply and demand are not the same in most of the cases. Being C_t the actual quantity observed we could write

$$C_t = k_t(\alpha_0 X_t^D + \alpha_1 r_{at} + \epsilon_t^D) + (1-k_t)(\beta_0 X_t^S + \beta_1 r_{at} + \epsilon_t^S) \qquad (B3)$$

where

$$k_t = \begin{cases} 0 & \text{if } C_t = S_t \\ 1 & \text{if } C_t = D_t \end{cases}$$

If we have an idea of where the switching point is, that is, in which sub-sample there is excess demand and in which other there is excess supply the method of MLE is reduced to OLS. The reason is simple: lets suppose that the sample space of T observations can be partitioned in two subsets. The first with t_d observations where of excess supply and the second with t_s for the case of excess demand. Assuming normality the likelihoods for supply and demand are respectively:

$$(2\pi\sigma^2_s)^{-ts/2}\exp\left[-\frac{1}{2\sigma^2_{ts}}\sum(S_t - \beta_0 X_{0t}^S - \beta_1 r_{at})^2\right] \qquad (B4)$$

$$(2\pi\sigma^2_d)^{-td/2}\exp\left[-\frac{1}{2\sigma^2_{td}}\sum(D_t - \alpha_0 X_{0t}^D - \alpha_1 r_{at})^2\right] \qquad (B5)$$

For the entire sample the likelihood function is

$$L = (2\pi\sigma^2_s)^{-ts/2}(2\pi\sigma^2_d)^{-td/2}\exp\left[-\frac{1}{2\sigma^2_{td}}\sum(D_t - \alpha_0 X_t^D - \alpha_1 r_{at}) - \right.$$

$$\left.\frac{1}{2\sigma^2_s}\sum_{td}(S_t - \beta_0 X_t^S - \beta_1 r_{at})^2\right]$$

For a given sample separation, the derivatives of the log-likelihood function give the normal equations which correspond to the OLS estimators.

Then, the problem adds up to find the partition which maximizes the likelihood function evaluated at the OLS estimates at each partition.

This is the same as estimating supply and demand with OLS, using the observations with excess supply to get the demand and viceversa. Then, take the logarithm of the standard error of regression of supply and demand and compute the weighted average of both, using as factors the number of observations corresponding to each one. The best partition will be the one which maximizes this weighted average.

As our sample size for estimation (observations for simulation are not included) uses about 90 data points this makes a total of 1.2×10^{27} possible partitions. Obviously it is intractable to try all of them and it makes necessary to find some criterion for the partition.

2. A Criterion for Sample Partition.

A reasonable way of attacking the problem is first to set some partitions which may sound plausible and select the best one among them. The method suggested by Fair and Jafee relies on price data, that is, considers times of excess demand those where the sluggish price rises above some trend and times of excess supply where it declines. The problem with this procedure is that is suited more for situations where the cause for disequilibria comes from adjustment costs. What I prefer doing was to look at free reserves, and took as periods of excess demand those where free reserves of the commercial banks decline below some trend.

As an exact series for free reserves is not available it was necessary to construct a series for total reserves and required reserves. To construct this series I first computed total reserves using information on deposits in current account of commercial banks in Banco de Mexico and other liquid peso denominated assets under the row of 'disponibilidades'. To get free reserves one subtracts total and required reserves. The required reserves information had to be calculates using information on liabilities of the banking sector and the rates of 'encaje legal' applicable to each one of them. Figure B.1. shows the series of deviations of total real seasonally adjusted free reserves from a trend.

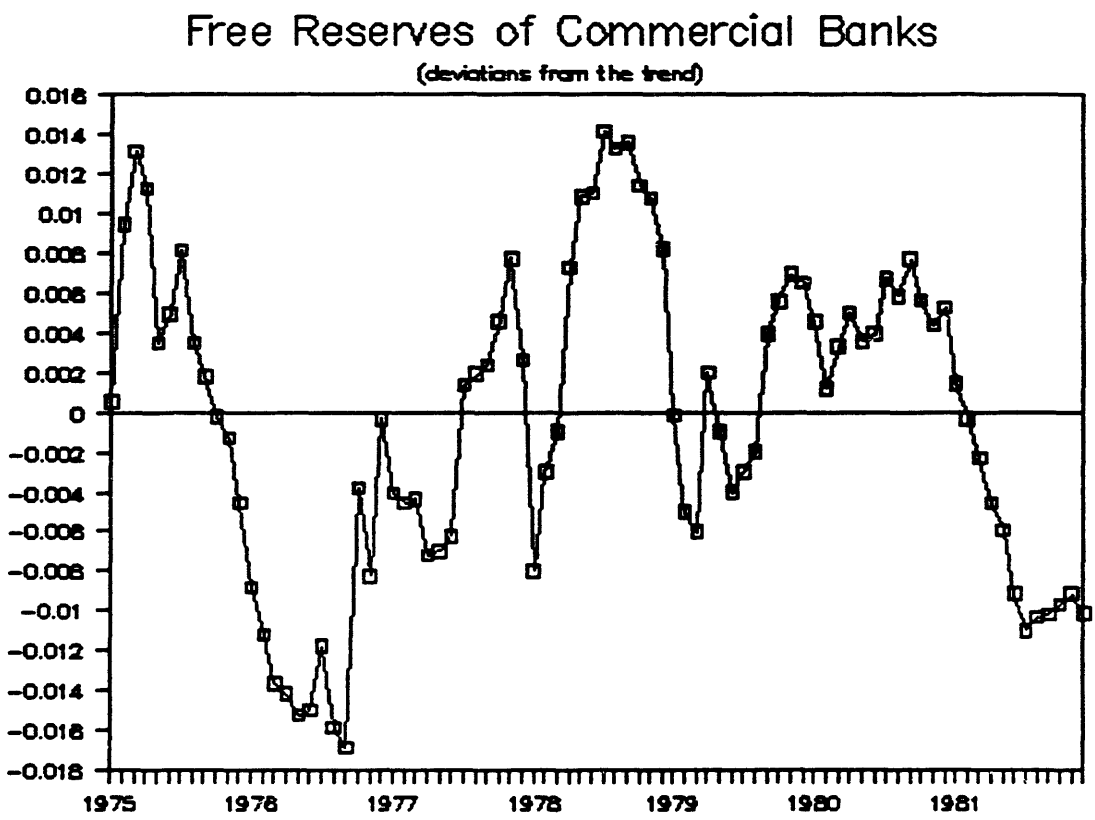
Were considered plausible periods of excess demand all intervals where these deviations were negative. The partition which gave the best results identified as periods of excess demand: 1974.08-1974.12; 1975.10--1976.08; 1977.01-1977.06; 1978.02-1978.03; 1979.02-1979.04. The sample period for estimation was 1974.01-1981.01.

3. The Data. Market Segmentation.

Most, if not all, consistent information on banking statistics, is contained in Indicadores de Moneda y Banca of Banco de Mexico and Boletin Estadistico of the National Commission of Banking and Insurance Institutions.

As it is shown in the text, we classified productive sectors in preferential and non-preferential. This following the available disaggregation of total financing.

Information is available for use and geographic region to which it is assigned. We considered preferential all credit assigned to activities in


Free Reserves of Commercial Banks
(deviations from the trend)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
-0.016
-0.018
1975
1976
1977
1978
1979
1980
1981

those areas within region IIIA and IIIB in the Global Development Plan 1977-1982, which are basically urban and developed areas (Metropolitan Mexico City, Jalisco, Nuevo Leon, Puebla and Northern Baja California).

The explanatory variables used in the regression are a smoothed indicator of the index of economic activity, a trend and the real active effective interest rate.

The activity variable (SIVOL) comes from the Index of Manufacturing Activity generated by Banco de Mexico. It was seasonally adjusted and besides, it was passed through a filter consisting of centered moving averages of amplitude six.

The real interest rate (RTIRA) corresponds to the active effective interest rate or lending rate. It is expressed in (percent/100 per month.)

The dependent variable is in hundreds of billions of Mexican pesos of 1978. Finally, specially in the case of credit to individuals, it was found that there is a significant trend component.

A last thing to consider has to do with the presence of first order auto-correlation, which could be expected in this exercise.

To solve the problem we could go modifying a little the method suggested above. The first is that for each sub-interval of excess demand and excess supply we lose one observation.

Assuming that the coefficient for auto-correlation is stable we estimate it first for the longest sub-interval and proceed by generalized differences to estimate the parameters of intercept, slope and the variance of the error term.

It is this corrected variance what we use to set the best partition of the sample.

Table B. Estimation of the Credit Demand Equations.

Segment	C	T	SIVOL	RTIRA	R^2	rho
Total	6 194		1 398.7	-36 001	.934	.967
	(1.59)		(5.94)	(-2.02)		
(1)	29 046		656.6	-28 403	.887	.803
	(0.64)		(4.72)	(-1.79)		
(2)	-14 291		1 735.1	-52 525	.958	.409
	(-6.36)		(14.8)	(-1.91)		
(3)	11 028		2 081.1	-17 093	.841	.711
	(0.22)		(2.50)	(-1.82)		
(4)	-2 778		4 285.5	-38 350	.966	.957
	(0.02)		(2.16)	(-3.13)		
(5)	58 474	-48.12	43.2	-47 667	.688	.580
	(1.87)	(-1.79)	(1.91)	(-1.35)		

Appendix C. Estimation of Excess Demand for Foreign Credit and Productive Uses of Commercial Bank Credit.

This appendix describes some of the details on how excess foreign borrowing of the private sector and commercial banks was computed indicating in each case the kind of data used.

1. External Borrowing of Private Firms.

To determine the excess borrowing of private firms during 1981 and 1982 first it was necessary to estimate an equation for foreign borrowing in times of excess supply of domestic funds and with this simulate the demand that would have happened if no rationing had taken place in 1981 and 1982. The difference between observed and simulated values is attributed to the effects of the contraction and allocation of domestic credit.

1.1. The Data.

In the regression equation we have as dependent variable the stock of net private external borrowing in the non-banking sector (DEXTEMP) from SIE-Banxico data bank. Data are in billion dollars.

The explanatory variables are the volume of activity in the economy (SIVOL) for which we use the Index of Manufacturing Activity (1978=100) ; the real active effective interest rate (RTIRA) (units are in per cent per month -in decimal notation 1%=.01- the same units are used everywhere we refer to rates such as in RPRIME below), the real exchange rate (REALEX) all of them from the same SIE-Banxico (1978=100.0). The cost of foreign

funds (RPRIME) results from subtracting from the prime rate the rate of domestic inflation, the expected depreciation (from the quoting of the one month futures of the mexican peso). The prime rate comes from various numbers of the Survey of Current Business of the Bureau of Labor Statistics and the quotations of futures from Indicadores de Sector Externo of Banco de Mexico.

1.2. The Estimation.

The same as in the estimation of the credit market where the sample is partitioned in several non-contiguous intervals the problem of autocorrelation is faced computing the regressions with the method of generalized differences estimating the parameter rho in the longest sub-interval.

DEXTPR = -53 125 + 230.75 SIVOL + 74 962 RTIRA + 142.88 REALEX

t-statistic (-3.39) (3.94) (2.67) (2.59)

-44 937 RPRIME

(-1.86)

RHO= .924 R^2=.987

2. Productive Lending of the Banking System.

Banks in Mexico were allowed to lend in pesos and in dollars. The credit demand equations estimated in Appendix B. refer to financing in pesos.

To compute productive lending we start from the idea that all financing in dollars through the financial system does not go to capital flight.

Then, to simulate all productive credit we take the estimated demand for peso financing obtained in Appendix B for each segment, when that segment is not rationed and actual credit when the segment is rationed. To the sum of these amounts, one adds financing in dollars. Then to derive the flow we simply take first differences and compare it with the flows of external borrowing of commercial banks. (it includes the corrections of table 3.3).

The gap between this simulated flow and the flows of foreign borrowing are computed and accumulated starting on 1980.12 = 0.0 and reported in section 4.3.

Part V

DOMESTIC STABILITY AND EXTERNAL SHOCKS

A Review of the Causes of the Mexican Stabilizing Development (1955-1971)

DOMESTIC STABILITY AND EXTERNAL SHOCKS

A Review of the Causes of the Mexican Stabilizing Development (1955-1971)

Introduction

The Mexican economic history of the first fifty years of post-Revolutionary experience is usually divided in three stages: economic reconstruction (1917-1940)), growth with inflation (1940-1954) and the stabilizing development (1955-1971).

The literature is abundant in descriptions and details of what happened in each one of these periods (some references which summarize most of the different views and facts on this part of the Mexican Economic experience are Fernandez Hurtado, 1976; Gil Diaz, 1983; Solis, 1968, 1980, 1981; Solis and Brothers, 1967; Mancilla, 1978; Vernon 1965; Ibarra, 1970; Reyna and Pellicer de Brody, 1978 and Urquidi, 1951 among others). Nevertheless there has been very little discussion on the transition between one stage and the next which is usually where one can find the most enriching lessons.

This sense that something important is missing is specially evident when one tries to explain how Mexico was able to go from inflation to stability in the mid-fifties while there was so little change in institutions.

The years of fast growth and price stability of the 'desarrollo estabilizador' leave policy makers with a puzzle and a challenge. On the one hand one wants to know what were the essential features of the insti-

tutional arrangements in the labor, financial and goods markets that collaborated in making it possible as well as to understand to what extent it was the result of fiscal discipline and to what extent it was simply the consequence of a more stable world economy and less severe exogenous shocks. If it is the case that policy and/or institutional changes were at the center of the transition from inflation to economic stability, then the challenge for policy makers is to try to adjust current arrangements following the lessons from the past, and in this way reproduce the 'desarrollo estabilizador'. On the other hand, it may very well be the case that the 'desarrollo estabilizador' is mainly the result of less variability of the international business cycle and of other shocks. If the latter is true one has to put the story of the 'desarrollo estabilizador' in perspective trying to avoid exaggeration of the stylized facts of this period, being more aware of the constraints that external shocks impose on macroeconomic goals and focusing the efforts of policy making in innovation rather than imitation if the idea is to go back to price and exchange rate stability with fast income growth. Although, as I mentioned before, the literature says very little about this transition, there is a commonly accepted view, held mostly by policy makers and many times presented as the most logical explanation to students of Mexican Economic History. It claims that there had to be a significant change in the style of policy making, going from inflationary finance of growth to fiscal and monetary conservatisim. The new style is usually identified with the personalities of Ortiz-Mena and Gomez in Hacienda and Banco de Mexico.

This paper challenges this conventional view as it tries to identify the role of changes in institutional policy and external conditions in the

transition to de 'desarrollo establizador'. Section 2 gives a brief description of the characteristics and performance of the Mexican Economy after the Revolution, paying special attention to the period from 1940 to 1971 and focusing on institutional and policy aspects of the transition to the 'desarrollo estabilizador'. Section 3 decomposes, with the help of optimal control techniques, the sources of stability in what is due to external and exogenous fluctuations and what is due to changes in the direction of economic policy. Section 4 has some concluding remarks.

Besides the intention of this piece to contribute to the debate of Mexican history it also suggests a methodology to the more broader discussion on the role of external factors in the stability of less developed countries.

2. A Panoramic View of the Economic History of Post-Revolutionary Mexico.

After something more than thirty years of modernization and expansion of the 'Porfirian Peace', Mexico is devastated by a Revolution that cost more than one million lives, and inflicted heavy losses in infrastructure affecting very seriously key sectors such as agriculture and mining. By some accounts (Reynolds, 1973) the opportunity cost of the destructive phase of the Revolution (1910-1917) was something close to 37% of the potential income.

The reconstructive period (1917-1940) is marked by the creation of some basic institutions which role would be to provide a minimal physical and financial foundation for future economic expansion. Some examples of this are Banco de Mexico, Nacional Financiera and other Development Banks,

the National Commission of Roads and the National Commission of Irrigation, the National Commission of the Minimum Wage, the National Commission of Electricity etc. During this years large fractions of the federal budgets (between 40 and 60%) were directed to economic promotion in agriculture, some basic industries, public works, etc. By 1940 all basic institutions were in place and with the characteristics that were going to prevail until the mid and late seventies. There are very few reforms in the fourties and fifties that could justify thinking of them as crucial factors in the stabilization. The basic shape of the credit and labor markets was given by pre-1940 legislation.

For example, with respect to the financial system it was constituted by a Central Bank (Banco de Mexico), National Development Banks and private institutions (commercial banks in charge of issuing short term instruments and giving short term credit, and financieras in charge of long term savings and lending). There is no money market, and there are no money market operations; the government finances its deficit mainly via 'encaje legal' or direct credits from Banco de Mexico. The interest rate on deposits, financiera bonds and credits is given by Banco de Mexico and remains practically constant for thirty years. (General Law of Banking Institutions and Auxiliary Credit Institutions, 1940).

With respect to the labor market regulation, it followed the basic principles of article 123 of the Constitution (1917). The amendments of 1929, 1933, 1938 and 1942 create the Social Security system and the Labor Tribunals (Junta de Conciliacion y Arbitraje), set the procedures and conditions for the legal use of the right to a strike and institute the biannual revision of the minimum wages and wages in the so called law

contracts and collective contracts. No other significant change is introduced to the labor legislation until the passing of the Federal Law of Labor in 1970.

The decade of the 1930s is also characterized by important events such as the nationalization of the oil industry (1938), the rapid advance of the agrarian reform and the definitive reassumption of service payments on the external public debt (1941).

From 1940 on Mexico has a period of fast expansion and industrialization which will continue uninterrupted until 1976. Between 1940 and 1970 the per-capita GDP grows at 3.2% per year, industrial production at 8.0% per year and while agriculture and services averaged an annual expansion of 4.4% and 6.4% respectively.

Table 1. Basic Indicators.(a) (annual rates)

	GDP Growth	Per Capita GDP	Inflation
1900-1910	3.0%	2.1%	5.5%
1910-1921	0.5	1.0	4.8
1921-1940	1.7	0.0	1.2
1940-1955	6.0	3.2	11.0
1955-1970	6.7	3.3	3.3

(a) Elaborated from Estadisticas Historicas de Mexico, SPP

The detonator of the Mexican expansion is usually linked to the growth of exports caused by the war as well as from the additional liquidity generated by capital flight from economies at war which found refuge in the country.

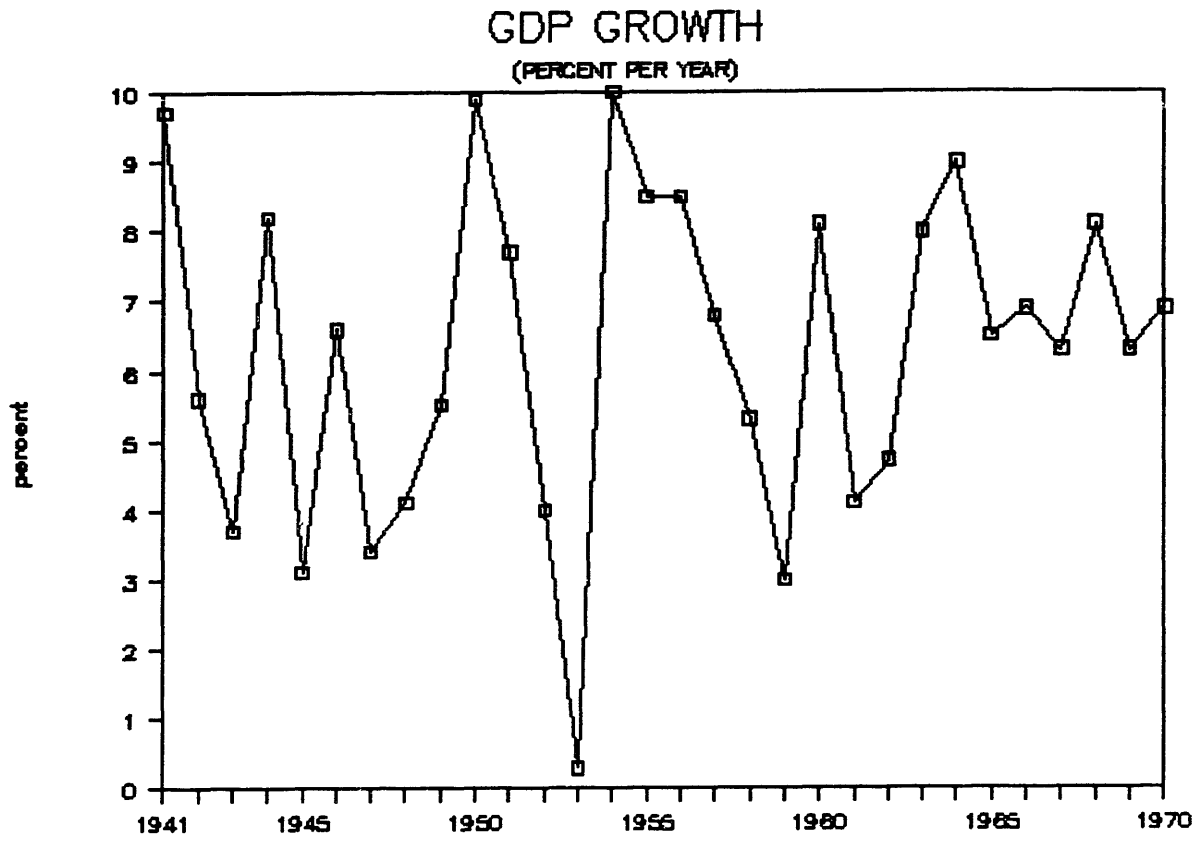
The basic difference with the pre-war period is that once the initial impulse disappeared (with the slowdown of the U.S. economy and the return

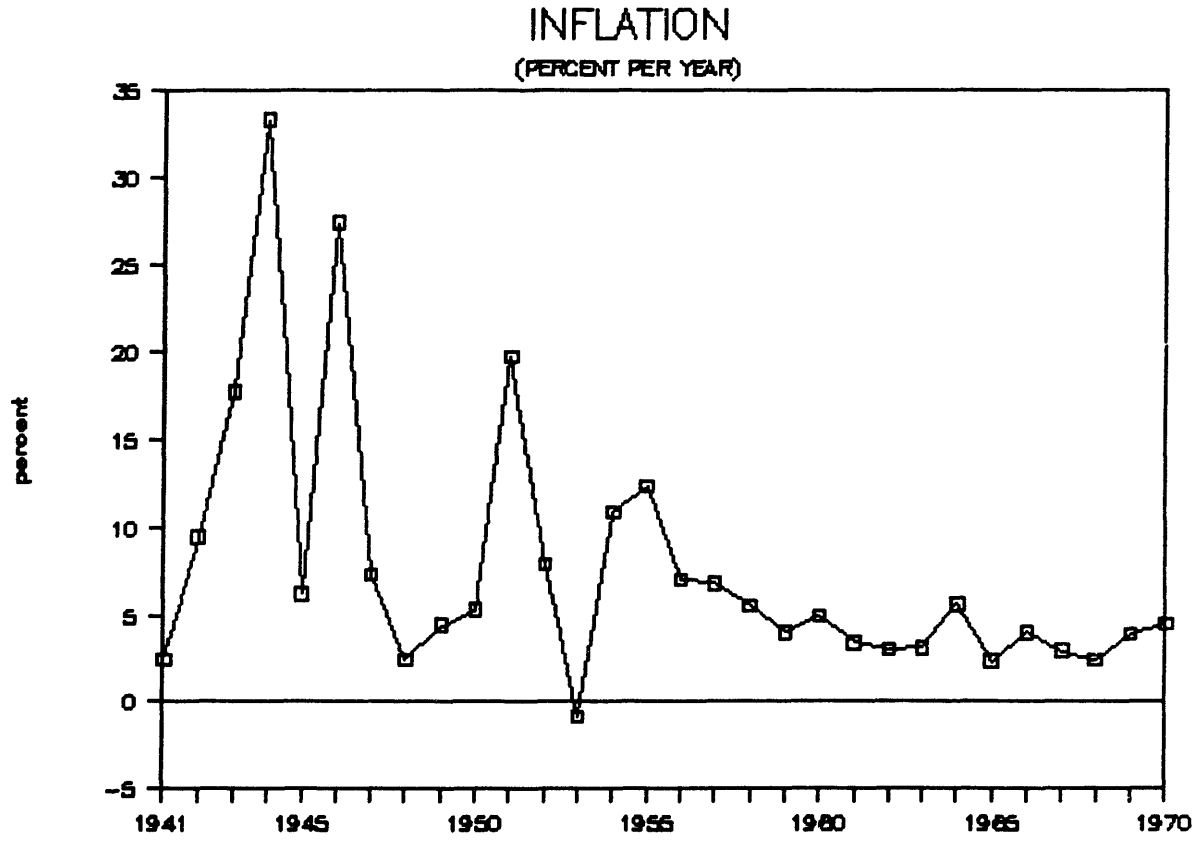
of the European capital flight) the expansion is sustained by a combination of real exchange rate devaluations and an activist fiscal and monetary policy. The civilian governments that came after the war, having realized the benefits of the industrialization of the early forties tried to continue the process using fiscal and exchange rate policies to compensate external shocks.

The period of inflation and growth can be described as a sequence of external shocks, devaluation and inflation and an accommodating aggregate demand policy. In turn, during the 'desarrollo estabilizador', the same emphasis for growth prevailed but, the stability of the external conditions made possible to combine growth with low inflation.

Figures 1 and 2 give a good picture of the transition from inflation to stability. The claim here is that the change is not the result of a shift in policy preferences in favor of inflation stabilization instead of growth to the extent that is attributed to the styles of Ortiz-Mena and Rodrigo Gomez, but rather the consequence of steady growth and low inflation in the rest of the industrialized world, particularly in the U.S. Although the next section suggests this same conclusion more formally, we can motivate this idea by looking at some external events that constrained the capacity of the government to keep inflation down and continue the industrialization.

The first of these external shocks is the expansion during the years of World War II as well as the consequences of the peace which is reflected in a rapid deterioration of the current account during 1946 and 1947. In 1948 and 1949 the country is forced to abandon the fixed exchange rate regime. The second episode is the Korean War. The same as in the previous


GDP GROWTH
(PERCENT PER YEAR)
percent
10
9
8
7
6
5
4
3
2
1
0
1941
1945
1950
1955
1960
1965
1970


INFLATION
(PERCENT PER YEAR)
percent
35
30
25
20
15
10
5
0
-5
1941
1945
1950
1955
1960
1965
1970

case there were the years of prosperity (1950-1951) and the years of recession and post-war adjustment (1952-1953) ending with the devaluation of 1954.

In both cases the expansionary and contractionary effects of the external shocks have a sizeable impact on the Mexican Economy. Table 2 shows that the changes in exports from one year to the next can be of the order of 2.5 to 3.5 points of GDP. These fluctuations are explained to a large extent by the cycle of the US economy.

Table 2. Export Shocks and Economic Performance (1940-1955).

	GDP	Inflation	Exports/GDP
1941	9.7	2.4	9.0
1942	5.6	9.4	9.9
1943	3.7	17.7	9.2
1944	8.2	33.3	5.9
1945	3.1	6.2	6.4
1946	6.6	27.4	7.2
1947	3.4	7.3	7.4
1948	4.1	2.4	8.5
1949	5.5	4.4	10.5
1950	9.9	5.3	10.9
1951	7.7	19.7	10.6
1952	4.0	7.9	8.9
1953	0.3	-0.8	8.4
1954	10.0	10.8	9.9
1955	8.5	12.3	11.1
1956	8.5	7.0	11.0

Source: Estadisticas Historicas de Mexico, SPP.

During the years of the 'desarrollo estabilizador' the situation looks much different. The year to year variability of the export-output ratio is significantly smaller.

Table 3. Export Shocks and Economic Performance (1956-1970)

	GDP	Inflation	Export/GDP
1957	6.8	6.8	7.8
1958	5.3	5.5	7.1
1959	3.0	4.0	6.8
1960	8.1	4.9	6.0
1961	4.1	3.4	6.2
1962	4.7	3.0	6.1
1963	8.0	3.1	5.9
1964	9.0	5.6	6.1
1965	6.5	2.3	5.9
1966	6.9	4.0	5.4
1967	6.3	2.9	5.2
1968	8.1	2.4	4.9
1969	6.3	3.9	5.2
1970	6.9	4.5	4.9

Source: Estadisticas Historicas de Mexico, SPP.

It was also the case that the decade of the forties and fifties had several episodes of bad agricultural production and sharp terms of trade shocks which also added to the variability of total production and exports. Table 3 shows that the frequency and amplitude of agricultural shocks is much higher in the years of growth with inflation than in the years of the 'desarrollo estabilizador'. This, added to the fact that agriculture decreases participation in total production as the modernization of the fifties and sixties goes on in the following decades makes this kind of exogenous shock have much more impact in the years of inflation and growth.

To have a complete picture of the transition we have to talk about the preferences of the policy makers, and try to see to what extent a policy shift is also responsible for the stabilization.

Table 3. Agricultural Production (annual growth rates).

1940	-11.5
1941	23.9
1942	12.2
1943	-9.3
1944	10.3
1945	-4.6
1946	1.6
1947	10.3
1948	10.9
1950	10.3
1951	5.2
1952	-3.9
1953	0.6
1954	22.9
1955	12.5
1956	-5.9
1957	9.4
1958	8.6
1959	-7.2
1960	5.7
1961	2.3
1962	6.9
1963	4.3
1964	10.6
1965	2.6
1966	5.2
1967	0.1
1968	0.9
1969	1.0
1970	3.8

Source: Estadisticas Historicas, SPP.

We start in the 1940's and 1950's with a government with a strong commitment in favor of growth rather than inflation control. This is quite apparent when one reviews the 'State of the Union ' addresses of presidents Avila-Camacho, Aleman-Valdes, and Ruiz-Cortines and by simply looking at the facts. Negative shocks (external or internal) are met with expansionary fiscal and credit policies and an exchange rate correction.

Table 4. Fiscal and Exchange Rate Policies. (1940-1955).

	Deficit/GDP (a)	Exchange Rate (b) (pesos per dollar)
1941	0.19%	4.85
1942	0.85	4.85
1943	0.52	4.85
1944	0.89	4.85
1945	1.15	4.85
1946	0.60	4.85
1947	0.68	4.85
1948	1.29	5.74
1949	0.71	8.01
1950	0.48	8.65
1951	-0.73	8.65
1952	0.46	8.65
1953	0.44	8.65
1954	0.76	11.34
1955	-0.03	12.50
1956	0.53	12.50

(a) Source: Anuario Estadistico, SPP. several issues.
(b) Period average.

In every case it is clear that the size of the fiscal deficit is very small and that fiscal expansions have little persistence, which was determined mostly by the persistence of the external and supply shocks themselves.

During the years of the 'desarrollo estabilizador', Mexico continues running small deficits and its variability is clearly less than in the period of inflation and growth. This does not necessarily mean that there was a shift in policy direction or of better economics. It may also be the consequence of external stability. For example, an economy where policy preferences are biased in favor of GDP stability rather than inflation stability will accommodate all supply shocks making fiscal policy look volatile, but the cause of the inflation variability is not

fiscal undiscipline but the exogenous shocks. Once they have lower frequency and/or amplitude the optimal aggregate demand will also be less volatile for the same policy preferences.

Table 5. Fiscal Deficit during the 'Desarrollo Estabilizador' (1956-1970).

	Deficit/GDP
1957	0.7
1958	0.7
1959	0.8
1960	0.5
1961	1.0
1962	0.9
1963	0.8
1964	1.1
1965	0.8
1966	1.2
1967	2.2
1968	2.0
1969	2.1
1970	3.6

Source: Anuario Estadistico, SPP, several issues.

The next section looks in more detail at the role of external factors in the transition to stability, but before doing so it is important to mention that there are some other factors which may also have contributed to the good economic performance of the sixties. As stability came about, productive investment and saving increased, the financial institutions consolidated and the modernization of the country continued with further labor mobility, better communications and transport infrastructure, higher level of education and the strengthening of the middle and entrepreneurial class.

3. The Transition to the Desarrollo Estabilizador from the Perspective of an Optimization Exercise.

This section presents an exercise based on optimal control techniques to identify the sources of price and growth stability from the mid-fifties until 1971. The idea here is to start estimating a simple structural model of the Mexican Economy. This model is the basis to compute an optimal control solution which is used as a benchmark to evaluate the economic policy of the inflation and 'desarrollo estabilizador' periods. The outcome of the control exercise also provides a framework which can help to get a sense of the constraints that external, and other exogenous shocks imposed on macroeconomic stability.

3.1. A Simple Model.

To solve the optimization problem one first needs to now the structural constraints which are given by the institutional arrangements of the Mexican Economy. A minimal description is given by a simple macroeconometric model with an aggregate demand. an aggregate supply and a real exchange rate equation.

$$GDP_t = \beta_0 + \beta_1\ GDP_{t-1} + \beta_2\ G_t + \beta_3\ \sigma_{t-1} + \beta_4\ GNPUS_{t-1} + e_t \qquad (1)$$

$$\pi_t = \alpha_0 + \alpha_1\ \pi_{t-1} + \alpha_2\ DEPR_t + \alpha_3\ GDP_t + u_t \qquad (2)$$

$$\sigma_t = \sigma_{t-1} + depr_t + \pi us_{t-1} + \pi us^* - \pi_{t-1} \qquad (3)$$

Where

GDP — Natural logarithm of the ratio GDP/trend GDP

G — Annual growth rate of real government spending in domestically produced goods.

σ — Natural Logarithm of the real exchange rate. 1960=0.0

π Annual rate of inflation of the consumer price index (December to December)

πus Annual rate of inflation of the US consumer price index (expressed as difference from the 1955-1971 average πus*)

GNPUS Annual rate of growth of GNP in the U.S. (deviations from 1955-1971 average)

3.2. The Data.

These three equations are estimated for the sample period 1939-1971 with annual data. All data for the Mexican series comes from Estadisticas Historicas de Mexico, SPP. For the U.S. all data comes from the Appendix of Gordon (1981).

3.3. The Results

The system of simultaneous equations (1) and (2) has the property of being recursive which allows us to estimate them using single equation methods. The method chosen was OLS which gives consistent estimates.

Dependent Variable :	GDP	t-statistic
c	-.070	-3.136
GDP(t-1)	.440	3.102
G	.042	2.077
GNPUS(t-1)	.129	2.150
σ(t-1)	.057	2.873
R-squared:	.651	DW: 1.77

Dependent Variable	π	
c	.016	1.395
π(t-1)	.631	4.412
GDP	1.364	2.981
DEPR	.380	2.075
R-squared:	.508	DW: 1.89

3.4. The Control Exercise

To get an idea of how much of the variability of inflation and growth can be attributed to external shocks rather than to policy bias in favor of growth stability versus inflation stability. One begins estimating a set of optimal combinations of inflation and growth that could be reached given the variability of external and other exogenous shocks.

Here we will follow closely the methodology presented by Chow (1973) to solve an optimal control problem for stochastic models. One starts with a loss function of the form:

$$L = E_0 \sum_{1}^{T} (\hat{Y}_t - \bar{Y})' \; D_t \; (\hat{Y}_t - \bar{Y}) \qquad (4)$$

where E_0 is the expectation conditional to the initial condition vector Y_0. The $\hat{Y}_t$ vector is defined as

$$\hat{Y} = \begin{bmatrix} 1 \\ GDP_t \\ \pi_t \\ \sigma_t \\ GNPUS_t \\ \pi us_t \end{bmatrix}$$

and $\bar{Y}$ is the vector of 'preferred' values of the state variables. Somewhat arbitrarily we take as reasonable target values a domestic inflation of 3% per year, a cyclical GDP of zero and the real exchange rate of 1960 ($\pi = .03$, $\sigma = 0.0$ and GDP = 0.0).

The loss function can be simplified defining $\bar{Y} = 0$ and correcting the intercept of the inflation and real exchange rate equation. In the inflation equation it is originally given by β_0 and now is given by $\beta_0' = \beta_0 + (1-\beta_1)\pi$. For the real exchange rate the intercept given initially by πus^* is now $\pi us - \pi$. With these changes considered while defining

the constraints to which the optimization problem will be subject, the minimization will be on:

$$L = E_0 \sum_{1}^{T} Y'_t \; D \; Y_t \qquad (4')$$

Matrix D is assumed constant during the exercise. Each one of the elements in the diagonal shows the relative preferences of the authorities with respect to the stabilization of nominal versus real variables. One simplification that helps to keep the dimensionality of the problem and still allows to capture the essence of the tradeoff between stability of nominal versus real variables would be to specify.

$$D = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \delta/2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1-\delta & 0 & 0 & 0 \\ 0 & 0 & 0 & \delta/2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Before minimizing (4') using as control variables government spending and the nominal exchange rate depreciation one has to rewrite the dynamic system (1) to (3) as

$$Y_t = B \; Y_{t-1} + c \; A_t + \mu_t \qquad (6)$$

where

$$B = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \beta 0' & \beta_1 & 0 & \beta_4 & \beta_5 & 0 \\ \alpha_0+\alpha_3\beta_0' & \alpha_3\beta_1 & \alpha_1 & \alpha_3\beta_4 & \alpha_3\beta_5 & 0 \\ \pi us^*+\pi & 0 & -1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$c = \begin{bmatrix} 0 & 0 \\ \beta_2 & 0 \\ \alpha_3\beta_2 & \alpha_2 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \qquad A_t = \begin{bmatrix} G_t \\ DEPR_t \end{bmatrix}$$

and the μ vector which is treated as a vector of not autocorrelated zero mean random variables. This is is already proved for the supply and demand shocks. For the other exogenous variables what is required is that the production and price processes in the US be random walks with a trend.

$$e_t = \begin{bmatrix} 0 \\ e_t \\ \alpha_3 e_t + u_t \\ 0 \\ GNPUS_t \\ \pi us^t \end{bmatrix}$$

A_t is the vector of policy instruments. For this problem what we have is a situation with two instruments (fiscal and exchange rate policy) and three objectives: production, inflation and real exchange rate.

The solution of (4') subject to (6) gives an optimal rule of the form : (see Chow, 1971 for the proof)

$$A_t = Y_{t-1}\, g \qquad (7)$$

where g is the matrix of coefficient of the optimal response of the corresponding policy variable to the exogenous shocks. A first order approximation of the solution for g, (which will be used here) is suggested by Anderson (1971) (see also Chow (1973) and Taylor (1979)).

$$g = -\,(c'D\,c)^{-1}\, c'\, D\, B \qquad (8)$$

3.4.1. The Optimal Policy Response.

The next step is to use the values we already have for the Mexican Economy to compute the optimal policy matrix 'g' for different values of δ. Tables 6.1 and 6.2 show the resulting vectors for the fiscal and exchange rate policies.

Table 6.1. Coefficients of the Optimal Response Rule (G_t)

δ	c	GDP(t-1)	$\pi(-1)-\pi$	σ(t-1)	GNPUS(t-1)	πus(t-1)
.01	3.164	-11.730	-18.458	5.354	-3.386	6.936
.10	3.124	-11.709	-17.926	5.149	-3.382	6.737
.25	3.040	-11.667	-16.862	4.754	-3.375	6.338
.50	2.814	-11.566	-14.316	3.810	-3.356	5.380
.75	2.505	-11.389	- 9.851	2.154	-3.323	3.702
.90	2.140	-11.201	- 5.090	0.388	-3.287	1.913
.99	1.790	-11.021	- 0/616	-1.271	-3.254	0.231

Table 6.2. Coefficients of the Optimal Response Rule ($DEPR_t$)

δ	c	GDP(t-1)	$\pi(-1)-\pi$	σ(-1)	GNPUS(t-1)	πus(t-1)
.01	.0173	-.00878	.775	-.916	-.00166	-.915
.10	.0161	-.00862	.782	-.919	-.00161	-.918
.25	.0151	-.00811	.794	-.923	-.00152	-.922
.50	.0133	-.00687	.825	-.935	-.00129	-.934
.75	.0091	-.00473	.880	-.955	-.00088	-.955
.90	.0047	-.00244	.938	-.977	-.00046	-.976
.99	.0005	-.00296	.992	-.997	-.00005	-.997

Tables 6.1 and 6.2 give, for each value of δ the coefficients in equations

$$G_t = g_1 + g_2 GDP_{t-1} + g_1(\pi_{t-1}-\pi) + g_3\sigma_{t-1} + g_4 GNPUS_{t-1} + g_5 \pi us^{t-1} \quad (9)$$

$$DEPR = d_1 + d_2 GDP_{t-1} + g_3(\pi_{t-1}-\pi) + d_4\sigma_{t-1} + d_4 GNPUS_{t-1} + d_5 \pi us_{t-1} \quad (10)$$

being and DEPR the values of the optimal fiscal and exchange rate policy rules.

3.4.2. The Second Order Phillips Curve.

Knowing the values of the optimal response rule it is possible to simulate the optimal inflation and GDP performance. Lets define

$$s^2(t) = Y^*(t)\, Y^*(t)' \quad (11)$$

where

$$Y^* = \begin{bmatrix} 1 \\ GDP^* \\ \pi^* \\ \sigma^* \\ GNPUS \\ \pi us \end{bmatrix}$$

The elements in the diagonal of $Y^*Y^{*\prime}$ give us the variability of inflation, real exchange rate and income that could be achieved at time t if the optimal response rule had been applied. At each time t, s^2 will be the result of solving

$$s^2(t) = (B+cg)\, s^2(t-1)\, (B+cg)' + \mu(t)\, (\mu(t)(B+cg)^t\, Y_0 + \sum_0^t (B+cg)^i\, \mu_{t-i})' \quad (12)$$

It can be seen that the characteristic roots of (B+cg) are less than one in absolute value, having the elements of μ not autocorrelated and from the fact that we will be interested in the elements in the diagonal to compute what which be called second order Phillips curve (defined bellow), we can approximate (12) by (13)

$$s^2(t) = (B+cg)\, s^2(t-1)\, (B+cg)' + \mu(t)\mu(t)' \qquad (13)$$

and

$$s^2(0) = Y(0)Y(0)'$$

Taylor (1979) introduced this concept of a second order Phillips curve. This function shows the trade-off between the variance of inflation and the variance of income in an optimal control exercise. This trade-off, for a given period (0,t) can be summarized comparing the elements the diagonal terms of

$$(1/t) \sum_{o}^{t} s^2(t) \qquad (14)$$

Using this idea to review the basic performance of the Mexican Economy during the years of inflation and 'desarrollo estabilizador' can help to understand the nature of the transition.

3.4.2. The Second Order Phillips Curve.

3.4.2.1. The Mexican Economy during the inflation and growth period.

Computing equation (14) for the 1942-1954 period gives the results shown in table 7 and figure 4.

Table 7. Minimum Average Variability of Income and Inflation (1942- 1954)

δ	s^2 (GDP)	s^2 (Inflation)
.01	.027	.011
.10	.023	.012
.25	.020	.014
.50	.017	.018
.75	.010	.030
.90	.006	.052
.99	.005	.109
Observed	.013	.026

Curve PP in figure 4 is the second order Phillips curve. It shows the combination of the minimum feasible variance of GDP and inflation. All points to the left and bellow PP cannot be reached. The position of the curve is determined by the variability of the external and other exogenous shocks. Comparing actual and optimal performance we see that the observed data are very close to the PP schedule for a value of δ between .50 and .75. This fact has two meanings: on the one hand this helps to discard the possible argument that the variability of inflation and growth is the result of poor policy making and can be rationalized by an optimization exercise; on the other hand one could say that the performance of the economy reveals the preferences of the authorities with a δ value between .5 and .75.

Figure 4 also has the combination of variance of income and inflation for the years of the 'desarrollo estabilizador'. It is clear that the variability of exogenous and external shocks made it unfeasible. If there had been a policy more biased against inflation (say, δ=.01), the recession would have been huge. In other words, any change in the tone of

policy making would not have been sufficient to reproduce the 'desarrollo estabilizador'. To complete the study of the role of policy changes and external factors in the transition from inflation to stability we need to see the second order Phillips curve for the 1955-1971 period.

3.4.2.2. The Mexican Economy during the Desarrollo Estabilizador.

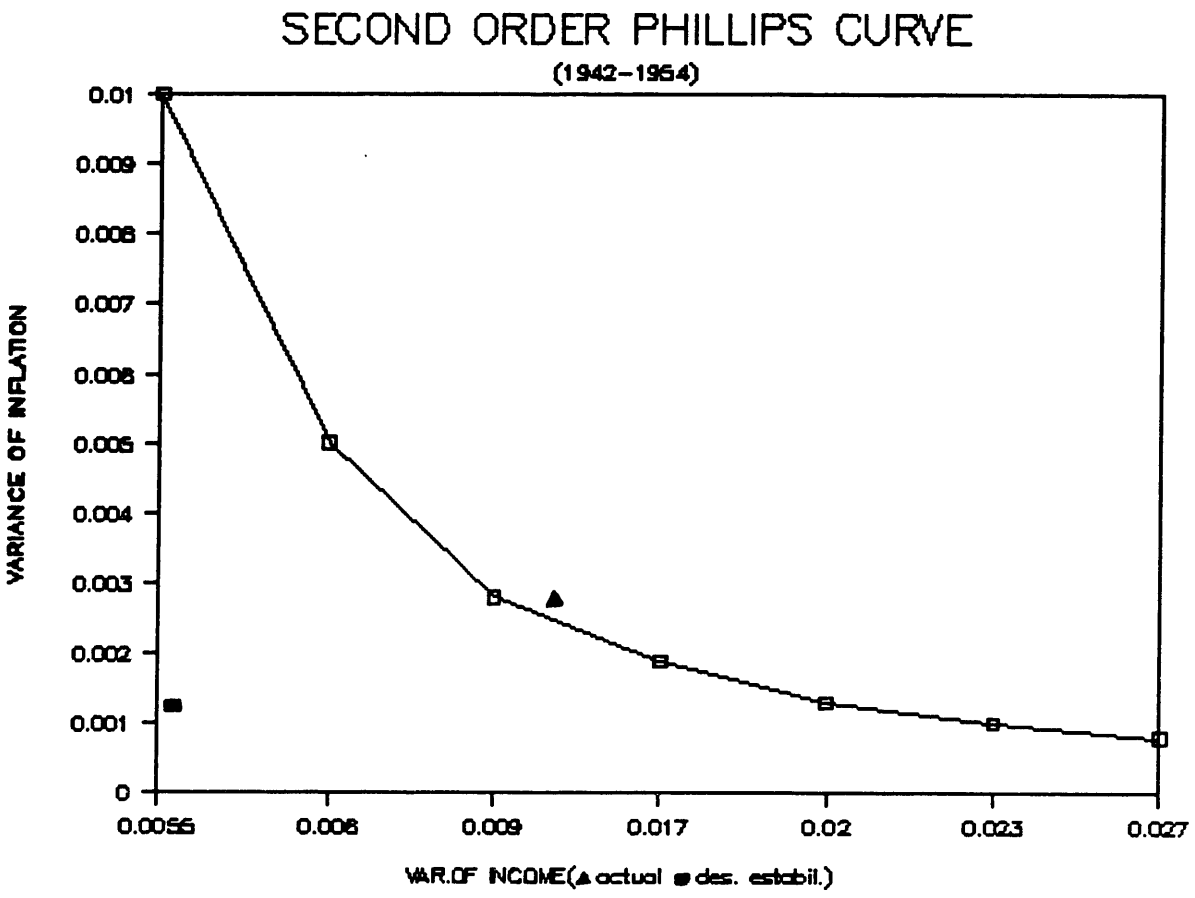
Here we simply repeat the exercise for the 1955-1971 period. The results are shown in table 8 and figure 5.

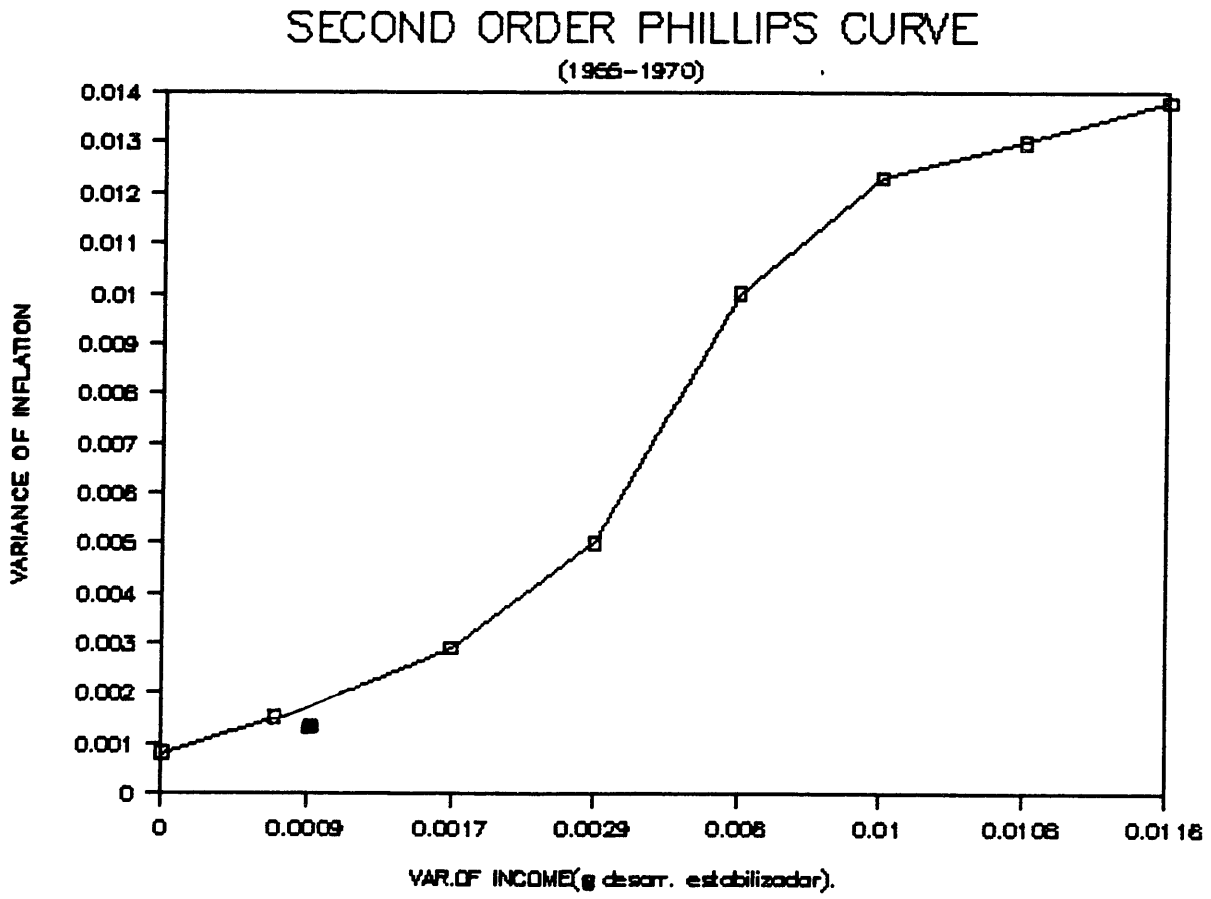
Table 8. Minimum Average Variability of Income and Inflation (1955-1971)

δ	s^2 (GDP)	s^2 (Inflation)
.01	.0111	.0138
.10	.0105	.0132
.25	.0097	.0128
.50	.0066	.0098
.75	.0026	.0048
.90	.0011	.0029
.99	.0006	.0014
1.00	.0000	.0009
Observed	.0009	.0015

Figure 8 shows the corresponding second order Phillips curve. It is immediately apparent that it is upward slopping which means that, during this period, either supply and demand shocks were negatively correlated or that supply shocks were significantly less important.

Talking about variances has a lot to do with the second order conditions. If agents realize or learn that there has been a change in the variance-covariance matrix, that information will also affect the


SECOND ORDER PHILLIPS CURVE
(1942-1964)
VARIANCE OF INFLATION
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0.0056
0.006
0.009
0.017
0.02
0.023
0.027
VAR.OF INCOME(▲actual ■des. estabil.)


SECOND ORDER PHILLIPS CURVE
(1966-1970)
VARIANCE OF INFLATION
0.014
0.013
0.012
0.011
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
0.0009
0.0017
0.0029
0.006
0.01
0.0106
0.0116
VAR.OF INCOME(■ desarr. estabilizador).

optimal response. For instance, if agents realize that the second order Phillips curve is now vertical with the characteristics of PP in figure 5, it is clear that the only rule that will maximize equation (14') will be the one corresponding to $\delta = 1.00$ for any possible preference coefficient δ. Comparing the optimal performance with the observed performance it can be seen that actual values are proportionally farther from optimal values during the 'desarrollo estabilizador' years than during the inflation years. On the other hand it is also clear that the change in the relative variance of external and exogenous shocks modifies substantially the set of minimum inflation and exchange rate variability, from a downward sloping relation to a single point. This shows the role of external variability in the capacity of the country to reduce inflation.

The following tables based on the numbers of tables 6 and 7 can summarize some interesting features of the Mexican stabilization.

Table 9. Sources of inflation and growth variability in Mexico.

Inflation and Growth Period (1942-1954)

	Variance	Proportion
Inflation		
External Factors	.022	84.6%
Policy Mistakes	.004	15.4%
Total	.026	100.0%
GDP		
External Factors	.011	84.6%
Policy Mistakes	.002	15.4%
Total	.013	100.0%

Table 9 (continued)

Desarrollo Estabilizador (1955-1971)		
Inflation		
External Factors	.0009	60.0%
Policy Mistakes	.0006	40.0%
Total	.0015	100.0%
GDP		
External Factors	.0000	0.0%
Policy Mistakes	.0009	100.0%
Total	.0009	100.0%

Table 10. Transition from Inflation to Stability.

		Inflation		GDP	
(1)	Variance (1942-1954)	.0260		.0132	
(2)	Variance (1955-1971)	.0015		.0009	
(3)	Difference (1)-(2)	.0245		.0123	
		Total	%	Total	%
(4)	Difference in External Factors	.0210	85.7	.0109	88.6
(5)	Difference in Policy Mistakes	.0035	14.2	.0014	11.3
(6)	Change in Policy Preferences	n.s.	n.s.	n.s.	n.s.
	(4)+(5)+(6)=(3)	.0245	100.0	.0123	100.0

n.s.: non-significant. See text bellow for an interpretation of this result.

Table 9 views the variability of GDP and of Inflation as having two components. The first given by the distance from the origin to the second Order Phillips curve (in the case of period 1942-1954 the point selected on the PP schedule was the closest to the actual observation). This distance, for a given loss function, is explained by the variability of external and other exogenous shocks. The second component corresponds to

the distance from PP to the observed values. This difference is presented under the heading of policy mistakes because they represent deviations from the optimal policy frontier. They can actually be the result of 'honest' policy mistakes or may come from some conscious attempt of the authorities to depart persistently from the inflation or GDP targets, which may also be interpreted as the result of a loss function different from (14').

Table 10 uses the numbers in Table 9 to decompose the transition from the inflation and growth period to the 'desarrollo estabilizador'.

The change in observed economic performance can be understood as the result of three factors. First, the lower variability of external and exogenous shocks, which is represented by the shift of the second order Phillips curve. A second factor is the change in policy mistakes or efficiency of the policy makers to optimize the loss function, which means the change in the distance between the observed and the optimal values of inflation and growth. A third possible factor is the change in preferences of the government, namely a change in the weights given to the loss function.

It is suggested that something like 85 to 90% of the improvement in inflation and growth performance is due to the reduction in external and other exogenous shocks. A possible change in policy preferences, which means having authorities placing different emphasis to the state variables, although possible does not make any difference in the choice of optimal policy as the second order Phillips curve is now upward sloping meaning that the second order Phillips curve has degenerated into a point. The remaining component refers to 'better policy management' in the sense

of a performance closer to the optimal one. This factor is responsible for the 10 to 15% improved performance.

4. Concluding Remarks

This piece goes back to the origins of the Mexican Stabilizing Development looking for the causes for the outstanding performance of the economy which was often referred to as the Mexican Miracle.

Using a methodology based on an optimal control exercise it is suggested that almost 90% of the stabilization is due to the stability of external conditions while little more than 10% was due to better policy management. This contrasts with the traditional view which claims that the advent of the management 'styles' of legendary officials such as Rodrigo Gomez and Ortiz Mena made most of the difference.

This result puts the 'desarrollo estabilizador' and the Mexican Miracle in a different perspective which, while recognizing the role of good economics, also suggests that circumstances had a lot to do with it. The 'desarrollo estabilizador' is then, an even more exceptional period.

Understanding this carries an important policy message to contemporary economists, who look back at the institutions of the sixties wondering what should be copied and what is right for today's Mexico. The answer is perhaps very little should be copied. Current conditions, complicated by the external debt problem means that there is no way back and that any sensible solution will require a combination of imagination and innovation coupled with the practice of disciplined economics.

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