Private savings and financial modernization in Mexico, 1988-95 [*]

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The evolution of private savings, and especially the decline they went through in the 1988-94 period, has attracted a lot of attention in the controversy about the origins of Mexico's 1995 crisis. In this paper we shall be analyzing the evolution of private savings in Mexico with the theory of effective demand as a framework and making use of econometric estimates. On this basis, our analysis will extend to the impact of the financial reforms, and in particular the effect of liberalization and deregulation of the financial system on private savings in Mexico. This set of reforms will hereinafter be called the 'strategy of financial modernization'.

The paper is set out in two sections. In the first section we formulate our explanation of the determinants of private savings and the impact of the strategy of 'financial modernization' on private savings, by specifying a short-run macroeconomic model. In the second section we carry out econometric estimates that lend empirical support to the main conclusions of the first section.

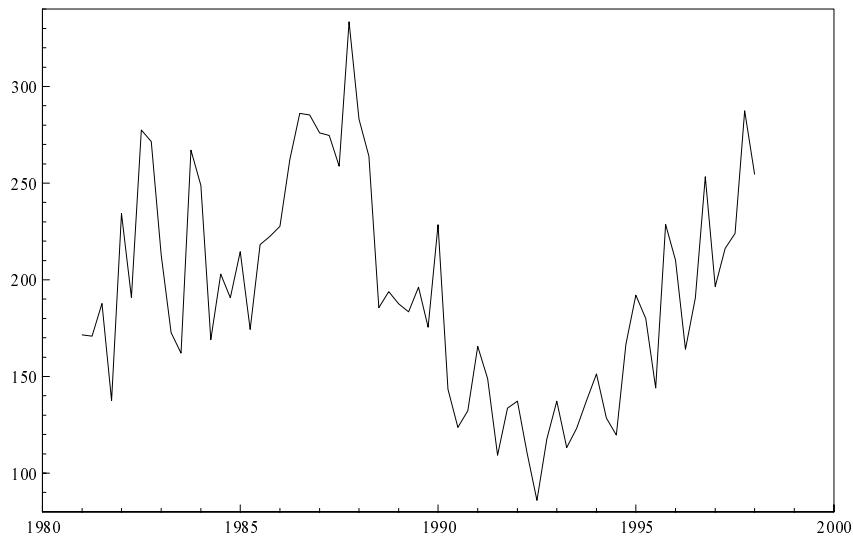## 1. Private savings in Mexico and the role of financial modernization

1.1. Introduction

As a preliminary step, we show in Graph 1 the evolution of private savings in Mexico.

GRAPH 1

PRIVATE SECTOR SAVINGS, 1980-98
(Billions of pesos in 1993 prices)

As can be seen, private savings fluctuated, but on average remained stable between 1980 and 1988, but declined dramatically from 20.7% of GDP in 1988 to only 10% of GDP in 1993.[1] This severe drop in private savings coincides with implementation of the 'strategy of financial modernization'.

In order to explain the behavior of private savings in Mexico and the effects of the financial modernization strategy on private savings we shall, in this section, outline a simple general model based on the theory of effective demand. The model enables us to determine the principal mechanisms by which private savings and aggregate demand are modified when the exogenous variables – and in particular the volume of credit, the interest rate and the exchange rate – vary.

Our model is characterized by the following assumptions. First, we assume that output is governed by aggregate demand, and we posit that demand is affected by autonomous expenditure as well as income

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[1] Figures taken from Poder Ejecutivo Federal (1997).

distribution. Secondly, we assume that the Mexican financial sector rations credit.

The first assumption follows from the theory of effective demand. We need not emphasize here the role of autonomous expenditure, but it may be worth recalling that income distribution depends on the relationship between prices and prime costs. We posit that the prices of industrial goods are set by firms in an industrial sector characterized by oligopolies, which add a mark-up over prime costs, the latter consisting basically of wages and imported inputs (Sylos Labini 1979). As for the second assumption, by assuming the existence of 'credit rationing' we imply in the first place that the volume of credit, and thus the quantity of money, is determined by supply, and concretely by the supply from banks, and not by demand. Although we share the usual assumption of the post-Keynesian school that credit and money are endogenous for the private sector as a whole, we take a distance from the so-called 'horizontalist approach'.

In our view, credit and money are endogenous, but only within certain limits, which are set by the norms and regulations determined by the monetary authorities. In addition, supply tends to adapt to demand, but will not always equal latent demand, since there will normally be a "fringe of unsatisfied borrowers" (Keynes 1971, p. 326). The degree of credit rationing is determined by the banks, which take into consideration the norms and regulations in effect at any given moment (Wolfson 1996). A second consequence of our assumption of 'credit rationing' is that the interest rate is not the only variable through which the financial side affects the real side of the economy: the amount of credit granted also has an influence.

Now, liberalization and deregulation of the financial system in Mexico modified the norms and regulations of the financial sector. This led to an increase in the interest rate, and a greater capacity and willingness of the banking sector to grant credit. Interest rates and credit are the two variables that will be subject to variations ('shocks') in our model, in order to establish the effect of financial modernization on private savings.

We shall now establish the basic theoretical relationships regarding how an economy based on the previous assumptions works, and explain the mechanism for determining the equilibrium between savings and aggregate demand.

1.2. *A short-term model for private savings*

[1] The model is expressed as follows:

  (1) $Y = I + Ck + Cw + X - M + B$

  (2) $B \equiv G - T$

  (3) $S_p = I + X - M + B$

  (4) $I = I(P, r, c, \theta, Z); \quad I_{P,c} > 0, \quad I_{r,\theta} < 0$

  (5) $P = P(Y, w, S_W); \quad P_Y > 0, \quad P_{w,S_W} < 0$

  (6) $Ck = Ck(Y, w, r); \quad Ck_Y > 0, \quad Ck_{w,r} < 0$

  (7) $Cw = Cw(Y, w, S_W); \quad Cw_{Y,w} > 0, \quad Cw_{S_W} < 0$

  (8) $S_W = S_W(r, c); \quad S_{W_r} > 0, \quad S_{W_c} < 0$

  (9) $X = X(y^e, \theta); \quad X^e_{y,\theta} > 0$

  (10) $M = M(Y, \theta); \quad M_Y > 0, \quad M_\theta < 0$

  (11) $B = B(r, \theta); \quad B_r < 0, \quad B_\theta > 0$

  (12) $\theta \equiv E(p^*/p)$

  (13) $E = E(r), \quad E_r < 0$

  (14) $w = w(\theta), \quad w_\theta < 0$

where: $Y \equiv$ Private income; $I \equiv$ Gross investment; $Ck \equiv$ Capitalist consumption; $Cw \equiv$ Workers' consumption; $X \equiv$ Exports; $M \equiv$ Imports (excluding government imports); $B \equiv$ Government internal deficit (excluding expenditures on imports, payment of foreign interest and oil revenues); $G \equiv$ Public expenditure; $T \equiv$ Taxes; $S_p \equiv$ Private savings; $P \equiv$ Gross profits; $S_W \equiv$ Workers' propensity to save; $r \equiv$ Real interest rate; $c \equiv$ Credit; $\theta \equiv$ Real exchange rate; $w \equiv$ Share of wages in output; $y^e \equiv$ External demand; $E \equiv$ Nominal exchange rate; $p^* \equiv$ Index of external prices; $p \equiv$ Index of internal prices; $Z \equiv$ Vector of exogenous variables not explicitly modeled.

Equation 1 describes the factors that determine private income in an open capitalist economy with a non-negligible government (Kalecki 1954). The internal deficit of the public sector is defined by equation 2, as the difference between expenditure and taxes. Note that we are referring to the internal deficit, so that expenditures exclude government imports and the payment of foreign interest, and taxes exclude all those obtained from oil exports (López 1998b).

Subtracting from the income equation capitalist consumption and workers' consumption, we obtain equation 3 for private savings. From 1 and 3 it follows that private savings depend on investment demand from the private sector, the budget deficit and the surplus of exports over imports, given a certain level of capitalist and workers' consumption. As Kalecki (1954, p. 57) pointed out, "the equality between savings and investment plus export surplus plus budget deficit [...] will be valid under any circumstances. In particular, it will be independent of the level of the rate of interest".

Equation 4 specifies the investment function; the explanatory variables are defined between parentheses, and the assumed effects on the dependent variable are given by the signs of their partial first derivatives,[2] written to one side of the equation (here and in the remaining equations we abstract from the lags in order to simplify the model). Investment is a positive function of profits (Sylos Labini 1956, Kalecki 1954, Minsky 1986), and is negatively associated with the real interest rate (since the analysis is made in real terms, we assume a positive relation between nominal and real rates). Credit availability also influences investment, as follows from our assumption that 'credit rationing' prevails: if loosened, it would have positive effects on the desired rate of accumulation. Investment also depends inversely on the real exchange rate, since a hike in the exchange rate increases both the debt of firms in foreign currency and the prices of imported capital goods (López 1998a), thus dampening the entrepreneurs' willingness to undertake new investments in capital equipment. The last argument of the function is a vector (Z) of variables not explicitly modeled.

Profits are a positive function of income and a negative function of the share of wages in output, as per equation 5. Therefore a rise in income, assuming income distribution to be constant, will translate into greater profits and private savings. In addition, in an open economy a shift to wages will have a negative effect on profits since a part of the increase in the workers' consumption will raise imports. The workers' savings depress profits because they reduce domestic demand.

Equation 6 states that capitalist consumption depends directly on income, and negatively on the share of wages in output and on the interest rate. According to equation 7, the workers' consumption de-

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[2] We assume that the functions defined have continuous partial derivatives.

pends directly on wages (and thus on private income and the share of wages in output). Equation 8 describes the determinants of the workers' propensity to save, which rises when the interest rate increases and falls when the amount of credit rises (unlike the capitalists' consumption, the workers' is credit rationed).

Equations 9 and 10 are the typical equations for exports and imports.

As previously mentioned, the internal deficit of the public sector also affects aggregate demand. In this connection, two factors are to be taken into account. First, we are using the concept of the internal deficit, already defined. Secondly, one of the objectives of fiscal policy in Mexico in the past few years has been to maintain fiscal equilibrium, i.e., the authorities seek to maintain an equilibrium in all fiscal accounts, and this restriction should be considered in our analysis.

To account for the influence of the internal public deficit on savings, we have specified equation 11, where we assumed that an increase in the interest rate will have a negative impact on the level of government expenditure on goods and services. In reality, the increase will translate into greater payment of government interest, although in Mexico's particular conditions it will tend to be accompanied by diminished expenditure on goods and services. Although, rigorously speaking, the volume of the deficit will not change (given our assumption that the intended volume is set beforehand by the authorities), the composition of expenditure will change in favor of the payment of interest even as purchases of goods and services drop. Due to the change in its composition, the impact of the deficit on aggregate demand (its multiplier) will be lower when interest rates rise, given that the rentiers' propensity to spend is small. In equation 11 we try to reflect this effect concisely by simply assuming that the deficit falls when the interest rates rise.

A second explicative variable of the deficit equation is the real exchange rate. We assume that an increase in the exchange rate raises the internal deficit because it brings about a rise in government income (in Mexico the oil sector is government owned) and brings about greater public expenditure. The total deficit does not rise (because expenditures rise due to the increase in oil income), but the internal deficit, which does not include this income, will in fact rise.

Equation 12 defines the real exchange rate, or competitiveness, as the product of the nominal exchange rate times the ratio of external prices to domestic prices.

Equation 13 establishes the determinants of the nominal exchange rate. According to this equation the real interest rate has an inverse effect on the nominal exchange rate, since an increase in the interest rate allows the domestic currency to appreciate.

The last equation (14) negatively relates the share of wages in income and the real exchange rate. The reason is as follows. The share of wages in income depends on the degree of monopoly and on the relationship between the unit costs of raw materials and unit wage costs (Kalecki 1954). Now, a drop in the real exchange rate means that relative import prices are reduced. In this situation, the domestic firms tend to reduce their profit margins in order to be able to compete, which brings about a shift to wages. In addition, the appreciation of the exchange rate makes imported raw materials cheaper, and the relative share of raw material cost to wage cost drops, thus raising the share of wages in income.

Our model is characterized by a broad specification of functions, therefore it is not possible to find precise equilibrium solutions for the endogenous variables. However, we can undertake exercises in comparative statics to evaluate the direction of the changes in the equilibrium value of private saving as the exogenous variables change, as given by the partial derivatives. In order to obtain the changes that interest us, we re-write our model in compact form as follows:

$$F^1 (Y, S_p, P, w, \theta \; ; r, c, y^e) = Y - I - Cw - C_K - B - X + M = 0$$

$$F^2 (Y, S_p, P, w, \theta \; ; r, c, y^e) = S_p - I - B - X + M = 0$$

[2] $$F^3 (Y, S_p, P, w, \theta \; ; r, c, y^e) = P - P (Y, w) = 0$$

$$F^4 (Y, S_p, P, w, \theta \; ; r, c, y^e) = w - w (\theta) = 0$$

$$F^5 (Y, S_p, P, w, \theta \; ; r, c, y^e) = \theta - \theta (r) = 0$$

We now apply the theorem of the implicit function[3] which allows us to write the equilibrium values of the five endogenous vari-

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[3] The theorem of the implicit function allows us to write the equilibrium values of the system's endogenous variables 2 as implicit functions of the values of the exogenous variables around the equilibrium solution of the system and then find the partial derivatives. To do this, functions F^i must have continuous partial derivatives

ables: income (Y), private savings (S_p), profits (P), the share of wages in income (w), and the real exchange rate (θ) as implicit functions of the two exogenous variables, i.e., the interest rate (r) and credit (c). We can then find the partial derivatives that interest us. Now, in this paper we are interested in only one of the endogenous variables, namely private savings, since we are seeking to answer the following question: how will the equilibrium value of private savings change with changes in the exogenous variables that have been stimulated by the strategy of financial modernization?

To find the answer, we can write private savings as an implicit function of the exogenous variables and find the partial derivatives[4] that respond to our question (Chiang 1984). In symbols:

$$S_p = f(r, c, y^e); \quad \text{with} \quad (\partial S_p\, \partial i) = |J_{Sp}|/|J|$$

$$(\partial S_p/\partial c)$$

Before calculating these effects, it is worth to recall that, according to equation 3, changes in private savings are explained, directly, by changes in the private sector's investment demand, the budget deficit and the foreign trade balance and, indirectly, by the variables that explain these latter variables.

1.3. *Exercises in comparative statics*

The aim in this section is to carry out a series of exercises in comparative statics with the model specified in the previous section. We must begin by assuming a state of initial equilibrium for our endogenous variables: income (Y), private savings (S_p), profits (P), the share of profits in the product (w) and the real exchange rate (θ). This point of initial equilibrium, i.e. the vector (Y^*, S_p^*, P^*, w^*, θ^*), is associated with certain values of the two exogenous variables of the model: the interest rate (r) and credit (c). We will try to find how the equilibrium value for private savings changes when these exogenous variables

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with respect to all variables and the Jacobian determinate $|J|$ of the endogenous variable must not be null at the point of initial equilibrium.

[4] The partial derivatives are calculated by obtaining the Jacobian determinate $|J|$ of the system's endogenous variables [2] and a vector of partial derivatives of each one of the exogenous variables and then Cramer's rule is applied to find the comparative statics derivatives that interest us $(\partial S_p/\partial i) = |J_S|/|J|$.

change. For this reason we assume that exogenous shocks to the model occur, associated with the deregulation and financial liberalization processes, such as an increase in the real interest rate and an expansion of credit.

This type of exogenous disturbances, which modifies the equilibrium $(Y^*, S_p^*, P^*, w^*, \theta^*)$, will be discussed in order to discern what consequences these changes will have in the equilibrium of private savings (S_p) in the short run in an economy characterized by our assumptions.

1.3.1. A change in the real interest rate

Let us now posit our initial scenario, which sees the interest rate rising. The change in the real interest rate will have various direct and indirect effects on the aggregate demand and private savings, given by the partial derivative $(\partial S_p/\partial r)$ of the system's implicit functions [2]. Capital letters denote endogenous variables and the subindex next to each variable indicates the variable being derived:[5]

$$[2.1] \quad (\partial S_p/\partial r) = |J_{S_p}|/|J| =$$

$$\frac{[I_r + B_r + 2\theta_r\,(I_\theta + B_\theta + X_\theta - M_\theta + 4w_\theta\,P_w\,I_p) + 2\,s_{w_r}\,P_{S_w}\,I_p]\,[1 - Cw_Y - Ck_Y]}{[1 - Cw_Y - Ck_Y - 2I_p\,P_Y + M_Y]} +$$

$$\frac{[4\theta_r\,W_\theta\,(C_{K_w} + C_{W_w}) + C_{W_r} + C_{W_{sw}} + C_{K_r}]\,[2I_p\,P_y - M_Y]}{[1 - C_{W_Y} - C_{k_Y} - 2I_p\,P_y + M_Y]}$$

According to this exercise, the final effect on private savings from an increase in the interest rate is ambiguous. We shall now, without any pretense of being exhaustive, go on to describe some of the principal effects on savings resulting from an increase in the interest rate, as shown in expression 2.1:

1) First, as the interest rate rises, the cost of capital goes up, generating a drop in investment (equation 4). *Ceteris paribus* this tends to depress private savings.

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[5] All our calculations were done with MAPLE.

2) If the interest rate goes up, government expenditure on goods and services will be reduced since the interest payments will rise, as shown by equation 11. The drop in the internal deficit and in demand, *ceteris paribus*, will lower the equilibrium value of private savings.

3) A rise in the interest rate leads to a drop in the workers' consumption. The drop in consumption (the rise in workers' savings) lowers profits and private investment and reduces imports, improving the external balance. The total effect on private savings is ambiguous.

4) Now, it is also important to emphasize *the indirect impacts* that a policy of increasing interest rates will have on demand and private savings. One of the principal channels of influence through which indirect impacts will be felt on aggregate demand and private savings will be the real exchange rate. As previously explained, the rise in interest rates increases the inflow of foreign capital, which in turn stimulates a rise in the nominal exchange rate and appreciation of the domestic currency. A higher exchange rate has both positive and negative effects on savings. We here list some of the indirect effects:

a) The appreciation of the domestic currency worsens the foreign trade balance (assuming the Marshall-Lerner condition holds), tending to reduce private savings.

b) This drop in exports generates a drop in public sector revenues from taxes on exports and leads to a reduction of government expenditure, which will tend to depress demand and private savings.

c) The appreciation of the domestic currency will also stimulate private investment because it reduces both the firms' debt in foreign currency and the cost of imported inputs.

d) The increase in the share of wages in income when the real exchange rate appreciates will stimulate the workers' consumption and dampen capitalist consumption. If we assume that the workers' propensity to consume is greater than the capitalists', then the overall effect on demand is positive. Yet we should state that greater consumption demand generates greater income, which stimulates private investment in the light of heightened expectations of profits, and prompts greater expenditures in the public sector as its income rises. This latter factor generates a higher equilibrium level of imports, but

does not allow us to state unequivocally the final effect that a rise in consumption will have on private savings.

From the above it follows that we cannot state precisely what the overall impact of a rise in the interest rate will be on savings, since it will depend on the magnitude or the real values that the exogenous variables or model parameters take on.

Nonetheless, the exercise undertaken has been helpful insofar as it has helped us to distinguish the channels through which the interest rate acts on demand and savings. Furthermore, we have been able to show that since savings are, *ex definitione*, the difference between private income and private consumption, which means they are an endogenous variable of our model, there exists an interrelationship between saving and the interest rate, even though this relationship is not univocal. Hence, the claim made in neoclassical economics that a rise in the interest rate will always and necessarily bring about a rise in private savings, or in the saving rate, cannot be logically demonstrated.

1.3.2. A lowering of 'credit rationing'

We can also determine what happens if we assume that the so-called 'credit rationing' is reduced along with liberalization and financial deregulation. If a part of the fringe of unsatisfied borrowers has access to credit, the level of investment will increase along with the workers' consumption. Applying the procedures used in the previous section, we can deduce that an exogenous rise in credit granted to potential borrowers will have the following direct and indirect effects on private savings:

$$[2.2] \quad (\partial SP/\partial c) = |JS_p|/|J| =$$

$$\frac{I_c + I_P\,P_{Sw}\,Sw_c\,[1 - Cw_Y - Ck_Y] + Cw_{Sw}\,Sw_c\,[2I_P\,P_Y - M_Y]}{[1 - Cw_Y - Ck_Y - 2I_P\,P_Y + M_Y]}$$

We now go on to analyze the most important effects that appear in equation 2.2.

A greater availability of credit allows projects to be financed for additional investment and the workers' consumption to rise, which raises the level of income. In turn, the rise in income generates posi-

tive effects in demand and yet, in an open economy, the likely posi-
tive effect of an expansion of credit on aggregate demand and savings
in the short run could be more than offset by an increase in imports.
The overall result of greater availability of credit for private savings
will be positive if, and only if, the increased demand does not leak
abroad in the form of excessive imports, generating a deficit in the
trade balance with the ensuing drop in private savings. This is pre-
cisely what happened in Mexico from 1990 to 1994.

1.4. *Conclusions*

The comparative statistics exercises we have carried out assume that
the strategy of financial modernization implied exogenous changes
('shocks') in the parameters. The overall result of these exercises leads
us to the following general conclusion: the process of financial mod-
ernization can lead to an expansion in demand, insofar as the positive
effect of a rise in credit exceeds the negative effect of a rise in the in-
terest rate. But if the final outcome is an increase in demand, this will
bring about a disequilibrium in the foreign accounts. If the increase in
investment exceeds the deterioration of the trade balance and the fall
in the government deficit, private savings will rise. Yet the opposite
could also occur, and private savings could drop. In conclusion, for
the purposes of a firmer response regarding the influence from a rise
in interest rates and a reduction of credit rationing on private savings,
we shall in the following section examine the real performance of pri-
vate savings during implementation of the financial modernization
strategy in Mexico.

2. The empirical evidence

In this section we carry out some econometric estimates for Mexico
that will lend greater empirical support to the analysis and the basic
conclusions in the previous section. Here we shall confine analysis to
equation (3), which summarizes our model. Let us take another look
at the, somewhat modified, equation of private saving:

$$S_p = I + SCC + B$$

This expression tells us that private savings (S_p) are equal to the sum of private investment (I), plus the balance of the current account of the balance of payments (SCC), plus the deficit of the public sector (B). For reasons of information availability, we shall, for our econometric estimates, use the balance in the current account of the balance of payments (SCC), instead of the balance in the trade account; for the same reason the government deficit includes government imports and payment of foreign interest, i.e., it equals difference between the expenditure and income of the public sector. As we shall see further on, this will change the expected signs of the partial derivatives of the equation estimated for the deficit. In the first place we shall model for Mexico equations for each of the determinants of savings, namely investment, the public deficit and the balance in the current account, after which we shall go on to estimate the equation for private savings.

As a preliminary step let us consider some of the properties of the set of variables we shall be utilizing. We use quarterly series from 1981(1) to 1997(4) of private real private savings (S_p), real GDP (Y), private investment (I), governmental deficit (B), the current account surplus (SCC), total real credit (c), in billions of 1993 pesos. We also utilize the real interest rate (r),[6] the real exchange rate (θ) and the GDP of the United States (y^e), as a proxy for world demand. All variables are in levels. The graphs of the series are shown below.

Graphic analysis of the variables shows in the first place that as from 1988 – the year financial liberalization reforms began – significant changes began to mark their behavior. Private savings (S_p) fell sharply, even as private investment (I) recovered from its previous slump and started growing, and the government deficit fell (B), as did the current account surplus (SCC). This demand behavior can be attributed to certain changes (induced by financial reforms) in variables such as credit (c), real interest rate (r) and the real exchange rate (θ). In other words, the changes in savings and their determinants are a consequence of credit expansion, a rise in the real interest rate and the appreciation of the real exchange rate as from 1988, as can readily be seen in the three graphs below.

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[6] The real interest rate is the CETES rate for 91-day bonds (Mexico's government bonds) and was calculated based on the following formula: Real interest rate = (Nominal interest rate – Inflation rate) / [1 + (Inflation rate/100)].

GRAPH 2

It is also important to characterize our series from a statistical standpoint (Cuthbertson, Hall and Taylor 1992) since it is evident that all variables seem to be non-stationary. Augmented Dickey-Fuller test (ADF) were carried out in order to determine the order of integration of the series (with four lags in each case), revealing that the series are integrated of order one, I~(1), i.e. they are non-stationary, with the exception of the interest rate and credit which are I~(0) and I~(2) respectively.[7]

For the econometric analysis,[8] in each case we first estimated a VAR (the number of lags was chosen on statistical adequacy grounds). In the second place, we tested each model for misspecification in order to ensure statistical congruency, utilizing the appropriate equation and system tests.[9] We then went on to carry out cointegration analy-

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[7] The results of the ADF tests can be consulted from the authors.

[8] We follow closely the overall vision of the econometric approach advocated by Spanos (1986, 1999) and by Hendry (1995). All the econometric work was carried out with PcFiml 9.1 (see Doornik and Hendry 1997 or Ericsson and Campos 1990).

[9] According to Hendry (1995, p. 365), models that satisfy the following information sets are said to be congruent: *i*) homoscedastic, innovation errors; *ii*) weakly exogenous conditioning variables for the parameters of interest; *iii*) constant, invariant parameters of interest; *iv*) theory-consistent, identifiable structures; *v*) data admis-

sis of each VAR utilizing the Johansen (1988) procedure to see if cointegration vectors – i.e. long-run associations between the variables of the VAR (Engle and Granger 1987) – could be found.

Let us now model the private investment function for Mexico. We have already established, *a priori*, the determinants of investment with the following specification:

$$I = I\,(P, r, c, \theta); \quad I_{P,\,c} > 0, \quad I_{r,\,\theta} < 0,$$

where I is private investment that is positively linked to profits (P) and credit (c) and negatively with the interest rate (r) and the real exchange rate (θ). The variable that represents profits can be proxied with the GDP (Y), assuming that profits move in the same direction as the latter variable. The estimate will be from 1982(2) to 1994(1) with the series in levels for private investment, real income, credit, real exchange rate, real interest rate and a dummy variable.

We estimated a VAR with five lags for the above mentioned variables. The results of the misspecification tests on the model indicate that it has satisfactory statistical properties. Furthermore, the Johansen matrix trace procedure test indicates the existence of at least three cointegration vectors (see Tables 1a and 1b in the Appendix). By normalizing the first cointegration vector, which can be interpreted as the private investment equation, we obtain:

$$I = 1189 + 2.24Y + 7.55c - 62.11\theta - 3.8r + 162.57q$$

The vector obtained establishes that, in the long run, output (Y) and real total credit (c) positively influence private investment (I). It also indicates that both the real exchange rate (θ) and the real interest rate (r) have an inverse effect on investment. The variable (q) is a binary variable (dummy) that takes on the value of zero before 1998(3) and one afterwards. It is useful to introduce this latter variable in our model because with it we can take into account effects of the changes brought about by financial reforms other than those associated with the variables that we explicitly considered here. In fact, the cointegration vector obtained, where the dummy variable is included, suggests that the reforms launched in 1988 produced a positive impact that

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sible formulations on accurate observations. The results of the tests can be obtained from the authors.

went further than that brought about by credit and the interest rate on private investment.

This result confirms our assumptions on the behavior of investment. In other words, investment is positively conditioned by credit and negatively affected by the interest rate and, therefore, the changes induced by financial liberalization will have an uncertain effect on investment.

On the basis of these results we can explain the role of investment *vis à vis* savings and the effects the financial reforms have had on them. As already mentioned, in Mexico from 1988 to 1995 private investment had a positive influence on the generation of savings, although its contribution was somewhat weak. This state of affairs was due to the fact that, starting with the financial reforms in 1988, investment was stimulated by the rise in the volume of credit in the economy even as the increase in the interest rate dampened investment.

We next specify a function for the surplus in current account:

$$SCC = SCC\ (Y,\ \theta,\ y^e);\ \ SCC_Y < 0,\ \ \ SCC_{\theta,y^e} > 0,$$

where *SCC* is the current account surplus, which we assume *a priori* depends inversely on real income (Y) and positively on the real exchange rate (θ) and external demand (y^e). The variable we use to approximate foreign demand is the US GDP.

We were able to find a statistically congruent VAR for the period from 1982(3) to 1994(2), with 6 lags for the endogenous variables. Furthermore, the Johansen matrix trace procedure test indicates the existence of one and possibly two cointegration vectors (see Tables 2a and 2b in the Appendix). The first vector can be interpreted as the equation of the current account surplus, which appears below and confirms the signs expected in Section 2:

$$SCC = -156.19Y + 35763\theta + 0.75y^e$$

This vector confirms, for the Mexican economy, a negative association between the output and the current account surplus, and a positive association between the surplus, the real exchange rate and external demand.

As we have seen, the financial reforms in Mexico had a negative effect on private savings despite the fact that they probably stimulated demand. Our estimate suggests that the negative effect occurred be-

cause the financial reforms were accompanied by other indiscriminate trade opening measures, as well as a significant appreciation in the real exchange rate. All this finally translated into an external disequilibrium that contributed to shrinking private savings.

The public sector deficit is the final component of demand that determines how private savings evolve, for which we posit *a priori* the following equation:

$$B = B(Y, r, \theta); \quad B_Y < 0, \quad B_{r,\theta} > 0$$

where *B* is the government deficit that is negatively associated with real income (*Y*) and positively with the real exchange rate (*θ*) and the interest rate (*r*). A rise in the real interest rate should increase the deficit because, government being a net debtor, it sets the associated expenditure climbing with the payment of interest. Likewise, a greater real exchange rate raises the service of the debt more than it increases oil revenues (expressed in local currency).

We were able to find a statistically congruent VAR, with 6 lags for the endogenous variables, for the period 1982(4) to 1994(3). Further, the Johansen matrix trace procedure test indicates the existence of one cointegration vector with economic significance for the public deficit (see Tables 3a and 3b in the Appendix). This vector confirms our hypotheses on the expected signs.

$$B = -23.8Y + 2047r + 31890\theta$$

According to this estimate, the public sector deficit is explained inversely by the evolution of real income, and directly by the real exchange rate and the interest rate.

Here it is worth stressing that the drop in private savings in Mexico is largely explained by the decline in the budget deficit, the budget deficit having a significant reduction since the Eighties due to balanced-budget policies. In addition, on the basis of empirical results we can state that the government budget deficit was ambiguously affected by financial liberalization. The rising interest rates meant higher interest payments on the debt, which tended to raise the total deficit, but at the same time the drop in the real exchange rate accompanying the rising interest rates tended to reduce the deficit. In addition given the strategy geared to balanced public finances, the greater interest payments were offset by curtailing expenditure on other items, which depressed aggregate demand.

Finally, and to conclude the econometric exercises, we estimate an equation for private savings, using an Autoregressive Distributed Lags model (ADL), which will allow us to distinguish the effects of the current and lagged variables on real private savings.[10] We start from the following general specification of the savings function:

$$S_p = S_p\,(Y, c, r)$$

where S_p is real private savings, associated with the income level (Y), credit (c) and the interest rate (r). We obtained the following ADL model for the period 1981(4) to 1998(1):[11]

$$S_p = 0.78\,S_{P_{t-1}} - 0.42Y_{t-1} + 0.46\,Y_{t-3}$$
$$\quad\quad (0.07)\quad\quad (0.14)\quad\quad (0.14)$$

$R^2 = 0.967;\ \sigma = 38.82$

For 3 variables and 46 observations

Tests of parameter consistency from 1993 (2) to 1998(1)

Forecast $\chi^2(20) = 18.396\ [0.5613]$

Chow $F(20, 43) = 0.812\ [0.6856]$

This model gives the following long-run solution ($S_{P_t} = S_{P_{t-1}};$ $Y_t = Y_{t-1} = Y_{t-3}$):

$$S_p = 0.18Y$$

In other words private savings are on average 18% of the GDP.

In general we can say that the model is capable of reproducing the behavior of real private savings in Mexico. Indeed, no problems were detected with the misspecification tests, nor are there any structural change problems (see Table 4 in the Appendix). In addition, the model is an approximate simulation of the real values of private savings, as shown in Graph 3, where real values and estimated values for private savings are shown, a vertical line indicating the projected period of the values.

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[10] The statistical properties of our series and, in particular, the normality of the different estimated autoregressive vectors allow us to posit a single-equation estimate for private savings, since normality implies that the conditioning variables are weakly exogenous with respect to the conditioned variable (Spanos 1986).

[11] Standard errors of the estimated parameters are set between parentheses below the parameters.

GRAPH 3

ACTUAL AND FITTED VALUES OF REAL PRIVATE SAVINGS 1981-97
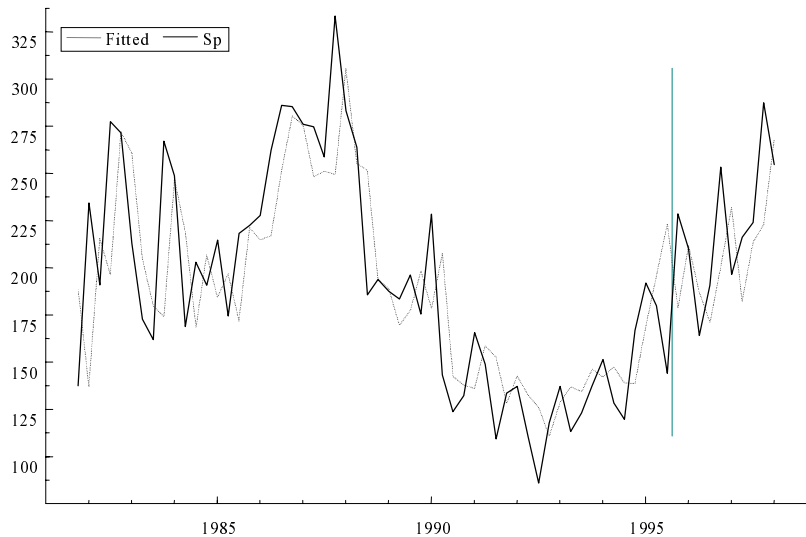
From our estimates it follows that the interest rate and credit are not relevant in explaining savings. Rather, savings depend on their own past value (with one lag), and on the past levels of income (with one and three lags). This result is consistent with our previous contention that the impacts of the interest rate and credit on private savings are ambiguous.

In addition, in reference to the regression coefficients, it is important to note that income with one lag has a negative impact on savings, while income with three lags has a positive impact; and in the long run the impact of income on savings is positive. How can this result be explained? The short-term negative impact of income could be explained as follows: a higher level of economic activity brings about a rise in imports in the short run, as well as a rise in tax income, thus leading to a drop in the current account surplus and government deficit; at the same time, this greater income does not affect private investment in the short run. All this leads to a drop in private savings which, as we know, are reduced when the surplus in the current account of the balance of payments and the government deficit drops. Now the positive effect of income lagged three periods on savings can

be explained because the increase in profits, which goes together with the rise in GDP, has a positive, but lagged, effect on private investment and therefore has a positive effect on private savings. Obviously the positive long-term effect due to the increase in income in savings can be explained because the rise the latter induces in private investment exceeds the drop induced in the current account balance and budget deficit.

Conclusions

In conclusion, the exercises we have carried out confirm that in Mexico's post-reforms period private savings declined due to a series of changes in monetary policy that led to contraction in private demand and greater foreign indebtedness.

The empirical evidence presented here confirms the hypotheses we stated at the beginning of this paper. On the basis of Mexico's recent experience, which saw private savings fall considerably between 1988 and 1995 following, in fact, on the financial reforms, we can categorically state that financial reforms leading to an increase in the interest rate, credit expansion and appreciation of the domestic currency do not necessarily stimulate private savings. If the worst comes to the worst, the strategy of financial modernization can open up a scenario where declining private demand is accompanied by mounting foreign indebtedness, as Mexico's recent economic evolution dramatically shows.

APPENDIX

TEST OF THE COINTEGRATION RANK FOR THE PRIVATE INVESTMENT DATA
(1982:2-1994:1)

H0:rank = p	−Tlog(1−mu)	usingT−nm	95%	−TSum log(.)	usingT−nm	95%
p = 0	63.02**	30.2	34.4	172**	82.42*	76.1
p ≤ 0	53.39**	25.58	28.1	109**	52.22	53.1
P ≤ 1	28.43**	13.62	22.0	55.59**	26.64	34.9
p ≤ 2	14.4	6.9	15.7	27.16**	13.01	20.0
p ≤ 3	12.76**	6.114	9.2	12.76*	6.114	9.2

* Denotes rejection at the 10% significance level.
** Denotes rejection at the 5% significance level.

COINTEGRATION VECTORS

I	Y	c	ter	r	Constant	dummy
1.000	−2.241	−7.556	62.116	3.8600	1188.8	−162.57
0.465	1.000	−9.213	98.016	6.5178	−1657.0	−292.14
−0.953	2.690	1.000	−660.31	29.532	1947.1	−305.65
0.010	−0.013	−0.091	1.0000	0.0332	0.9587	−1.3481
−0.086	−0.511	7.862	5.2972	1.0000	330.66	71.054

TEST OF THE COINTEGRATION RANK FOR THE CURRENT ACCOUNT
SURPLUS DATA (1982:3-1994:3)

H0:rank = p	−Tlog(1−mu)	usingT−nm	95%	−TSum log(.)	usingT−nm	95%
p = 0	63.65**	32.47**	23.8	88.29**	45.05*	39.9
p ≤ 0	15.44	7.88	17.9	24.64*	12.57	24.3
P ≤ 1	8.535	4.355	11.4	9.198	4.693	12.5
p ≤ 2	0.6627	0.3381	3.8	0.6627	0.3381	3.8

* Denotes rejection at the 10% significance level.
** Denotes rejection at the 5% significance level.

TABLE 2B

COINTEGRATION VECTORS

SCC	Y	ter	y e
1.0000	156.19	–35763.	–0.74989
0.024480	1.0000	–753.10	0.18527
0.00029107	0.49878	1.0000	–0.096135
0.011424	8.6884	–3987.7	1.0000

TABLE 3A

TEST OF THE COINTEGRATION RANK FOR THE PUBLIC DEFIC DATA
(1982:4-1994:3)

H0:rank =p	–Tlog(1–mu)	usingT–nm	95%	–TSum log(.)	usingT–nm	95%
p = 0	40.88**	20.44	23.8	81.93**	40.96*	30.9
p ≤ 0	25.35**	12.67	17.9	41.05**	20.52	24.3
P ≤ 1	13.34**	6.672	11.4	15.7*	7.85	12.5
p ≤ 2	2.356	1.178	3.8	2.356	1.178	3.8

 * Denotes rejection at the 5% significance level.
** Denotes rejection at the 10% significance level.

TABLE 3B

COINTEGRATION VECTORS

B	Y	r	ter
1.0000	23.836	–20.47	–31890.
0.0059512	1.0000	5.42	–286.05
7.8890e-005	–0.011036	1.0000	1.9214
–2.5073e-006	–0.0036142	–0.0057	1.0000

TABLE 4

PRIVATE SAVINGS MODEL EVALUATION DIAGNOSTICS 1981(4) TO 1998(1) (ADL)

Autocorrelation	AR[1-4]	$F(4, 39) = 2.5825 [0.0520]$
Heteroscedasticity	ARCH [4]	$F(4, 35) = 0.9370 [0.4540]$
Normality		$Chi^2 (2) = 2.6628 [0.2641]$
Xi^		$F(6, 36) = 0.6408 [0.6968]$
Xi*		$F(9, 33) = 0.9058 [0.5316]$
Linearity: RESET		$F(1, 42) = 2.0248 [0.1621]$

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