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# The Monetary Approach to Official Reserves and the Foreign Exchange Rate in France, 1962–74: Some Structural Estimates

*By* JACQUES MELITZ AND HENRI STERDYNIAK*

Any test of the monetary approach centered on the period of fixed exchange rates would now be predominantly of historical interest. At the time of this study, however, experience with flexible exchange rates was still too short to permit concentrating econometric analysis exclusively on this more recent system. Caught in this net, we have attempted an analysis of official reserves and the foreign exchange rate in France covering both fixed and flexible exchange rates, that is, thirty-nine quarters of fixed rates, 1962.1–1971.3, and thirteen quarters of flexible rates, 1971.4–1974.4. The cost is the presence of errors in our simultaneous equation estimates of the exchange rate during the period of fixed rates. But the benefit is an econometric analysis founded on fifty-two observations, and yet covering three years of flexible rates. Since the errors in the estimates of the exchange rate under fixed rates are quite moderate, the cost would seem to be worth the benefit.

The most important characteristic of our work is the use of a detailed structural model of bank credit and money in testing the monetary approach. The early tests of this approach simplified the structure of the monetary system to the utmost and considered the domestic source component of the reserve base (or the total base minus official foreign reserves) and the money multiplier as exogenous.[1] But there is really no logical basis for these restrictive assumptions. The monetary approach states that the demand and supply of money in a "small" country together determine 1) money, and 2) official reserves or the foreign exchange rate or the attainable combinations of the two, depending upon fixed, floating, or managed exchange rates. Nothing but a correct specification of the conditions for monetary equilibrium can provide a basis for testing this proposition.

We also deviate from the tendency in the literature on the monetary approach to suppose that any convenient measure of money will do. Based on this attitude, there have been many tests of the monetary approach using simply the reserve base as the measure of money, even though this aggregate, consisting of currency plus an arbitrary fraction of deposits, is inappropriate in analyzing the monetary behavior of firms and households.[2] In justifying this measure in a well-known econometric work, Pentti Kouri and Michael Porter merely say: "The essential features of the model [would not be] substantially changed by incorporating a more complete banking system" (p. 448). But not only does this fail to meet the criticism, it also neglects the fact that the monetary approach can give rise to conflicting estimates of changes in official reserves and the exchange rate depending on the money measure.[3] There is no way of assessing the seriousness of this last objection without testing. In this work we shall examine the extent to which varying and tenable money measures in France yield convergent results.

In spite of these deviations from the literature, we may be said to adhere to a strict

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[1]See, for example, the works of J. Richard Zecher, Hans Genberg, and Donna Bean.

[2]Harry Johnson showed the way in his seminal article.

[3]Nonetheless, Kouri and Porter invite us to take seriously their point estimates of the extent to which changes in official reserves neutralize domestic monetary policy actions in four different countries under fixed exchange rates. With respect to the issue of choice of money aggregate, see Rudiger Dornbusch, p. 257, fn. 1. One important article anticipating Kouri and Porter's work about one decade earlier is by Jürg Niehans.



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version of the monetary approach. Only monetary influences enter into our analysis. We take real income as given and ignore the balance of trade and the terms of trade. Any use of the trade balance as a datum in determining the flow of official reserves would limit the analysis to the explanation of movements in reserves corresponding to foreign capital movements. By eschewing information about absorption or the terms of trade—anything to do with imports or exports of *commodities* as such—we avoid this restriction and examine a particularly strong version of the monetary approach, in accordance with Harry Johnson's influential paper.

Following Kouri and Porter, our effort might also be expected to show the extent to which movements in official reserves offset the impact of policy changes in the reserve base. However, there are no open market operations in France; the basic monetary instrument is bank rate, or more precisely, the daily price of refinancing at the Bank of France (*le taux de l'argent au jour le jour*). Thus the only question we can investigate which corresponds to Kouri and Porter's problem is the extent to which a fiscal deficit is offset by an outflow of official reserves. In fact, we find this offset to be very high, on the order of 70 percent within a year (a reasonable figure since practically all fiscal deficits were financed directly through the central bank during most of the study period). The offset also has only diminished slightly—by about 4 percent—since the abandonment of fixed rates in late 1971. In general, the regime of flexible rates has brought little change in the magnitude of the influences on money and official reserves in France. There is simply a new and high sensitivity to the dollar-deutschmark exchange rate. We shall conclude, on the basis of the analysis, that the monetary approach is quite useful, but does not explain enough to warrant exclusive reliance upon it.

## I. The Model

The general underlying conception of money-stock determination in this work has important links to Karl Brunner and Allan Meltzer (1966, 1968). On the one side, commercial banks demand earning assets; on the other, firms and households supply such assets to the banks. There results a quantity of earning assets and a price. The quantity of commercial bank earning assets, together with the banks' desired excess legal reserves, their desired borrowing from the central bank, the legal reserve requirement, and an accounting identity yield commercial bank deposits. An equilibrium relationship between bank deposits on the one side and government monetary debt on the other, then permits deriving the money stock if money is viewed as the sum of commercial bank deposits and the monetary liabilities of the government (or as the sum of these deposits plus currency, postal checking deposits, and state savings deposits). If money should be understood differently, then some other deposit ratios would enter the analysis.

Adapting this fundamental framework to France is easy in one respect, complicated in another. What makes it simple is that the earning assets of French commercial banks consist entirely of loans, and not securities. The banks demand no securities since they can use eligible paper for discount at the central bank (*effets mobilisables*) to satisfy all of their demand for interest-yielding liquidity.[4] Consequently, there is no need first to determine the supply and demand for bank loans, then separately to determine the demand for securities by the banks and the supply of securities to them, and finally to aggregate in order to obtain the demand and supply of bank earning assets. The complication in France is that the demand for commercial bank loans cannot be distinguished from the demand for loans from other financial institutions in the sphere of the Treasury.[5]

[4]Prior to 1967, commercial banks were required to hold some government securities. We have taken this into account in the econometric analysis, though we shall ignore it in the discussion.

[5]The most important public credit institutions under Treasury control include the Bank of Deposits and Consignations, which administers all of the funds collected through the savings banks, the Fund for Economic and Social Development, and the Land Bank or Crédit Foncier. It should be carefully noted, however, that there are some publicly owned banks in France that

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Our precise formulation of money-stock determination in France is easily understood in view of these considerations. Our model is shown in the following equations. (The symbols are defined in Appendix A.)

Commercial bank reserves

(1) $R = R_r + R_e$

Bank credit

(2) $C = C_b + C_t + RD$

Commercial bank net assets

(3) $A = C_b + R_e$

Commercial bank accounting identity

(4) $C_b = D_b - R$

Reserve base

(5) $B = D_{po} + D_{sb} + N + R$

Base money

(6) $B_m = B - R$

Money in the sense $M_4$

(7) $M_4 = D_b + B_m$

Demand for bank credit

(8) $$\frac{C}{P} = \frac{C}{P}(\overset{-}{i}, \overset{+}{i^*}, \overset{+}{dP_a}, \overset{+}{Y_p}, \overset{-}{Y_{tr}})$$

Supply of bank credit

(9) $$C = C(\overset{+}{i}, \overset{-}{i_1}, \overset{-}{\lambda}, \overset{-}{r}, \overset{+}{F}, \overset{+}{CFD}, \overset{\pm}{Y_p}) + C_t$$

Commercial bank demand for net assets

(10) $$A = A(\overset{+}{i}, \overset{-}{i_1}, \overset{-}{\lambda}, \overset{-}{r}, \overset{+}{F}, \overset{+}{CFD}, \overset{\pm}{Y_p})$$

Equation of the ratio of money to net assets

(11) $$\frac{M_4}{A} = \frac{1}{1-r} + \psi_4(\overset{-}{i}, \overset{+}{i_1}, \overset{+}{\lambda}, \overset{+}{r}, \overset{\pm}{Y_p})\frac{1}{1-r}$$

where $\psi_4 = B_m / D_b$

Demand for money

(12) $$\frac{M_4}{P} = \frac{M_4}{P}(\overset{+}{Y_p}, \overset{-}{dP_a})$$

Reaction function of the monetary authorities

(13) $$\frac{FF}{\$} = \frac{FF}{\$}(\overset{-}{FX}, \overset{+}{\frac{DM}{\$}} X, X) + TAR$$

Price level equation

(14) $$P = P(\overset{+}{\frac{FF}{\$}}) + P_x$$

Exogenous variables: $C_t$, $CFD$, $DM/\$$, $i^*$, $i_1$, $P_x$, $dP_a$, $r$, $TAR$, $X$, $Y_p$, $Y_{tr}$, $\lambda$.

Endogenous variables: $A$, $C$, $F$, $FF/\$$, $i$, $M_4$, $P$.

As can be seen from this system of equations, we introduce a demand and supply of bank loans inclusive of the loans of the financial institutions in the Treasury sphere as well as those of the commercial banks (see equation (2)). These represent the aggregate demand and supply of bank credit in the analysis (equations (8) and (9)). Then we use a separate behavioral relation (equation (10)) to determine the commercial banks' contribution to this supply of bank credit, minus their rediscounts and plus their demand for excess legal reserves, or the banks' "demand for net assets." A fourth equation, (11), reflecting the joint behavior of commercial banks, households, and firms, sets the ratio of money to commercial bank net assets, or equivalently, given the legal reserve requirement, the ratio of money to commercial bank deposits. Money is a very broad concept here, inclusive of all privately held government debts with a fixed nominal price (previously referred to as government monetary liabilities), that is, postal checking accounts and deposits at the savings banks as well as currency plus all commercial bank deposits. The advantage of this broad measure of money, $M_4$, is that the function $\psi_4$ ( ) of equation (11) consequently refers to the competitive position of the commercial banks relative to the government in the issue of deposits and currency. The previous four behavioral equations together determine bank credit, the interest rate on bank credit, commercial bank net assets, and money in the sense $M_4$.

In line with the monetary approach, the additional presence of a demand for money (equation (12)) serves to determine official

should be viewed as ordinary members of the commercial banking system. As all students of the French monetary system agree, these are the three nationalized commercial banks (Crédit Lyonnais, Banque Nationale de Paris, and Société Générale), the branch system of Agricultural Banks, and the branch system of Popular Banks. For a few other prominent studies of the French system, see the works of Antoine Coutière and Jacques-Henri David reprinted in the Commissariat Général au Plan. Also see André Fourçans, and Patrick Artus.

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reserves under fixed rates or the foreign exchange rate under floating rates. Equation (13), the official reaction function, permits us to view official reserves and the foreign exchange rate as simultaneously determined. The final equation, (14), ties the price level to the foreign exchange rate, and thereby admits the influence of the foreign exchange rate on the demand for money and the demand for credit. Without this last influence, the impact of the foreign exchange rate in the model would depend solely on the preoccupation of the authorities with the value of the franc in setting their net foreign reserves.

The signs above the variables of the fundamental equations (8)–(14) relate to the partial derivatives. A few points in the formulation of these equations may be clarified. The cost of foreign borrowing in the demand for credit, equation (8), is simply the foreign interest rate $i^*$, and not the sum of this rate and the forward premium on the franc, because earlier tests indicated that this forward premium is statistically insignificant. In equation (9), the cumulative fiscal deficit ($CFD$) is an argument, rather than the Treasury source component of the base, because the Treasury source component implicitly depends on the amount of base money, $M_4 - D_b$ (or $B - R$), and cannot be viewed as exogenous. For instance, the Bank of Deposits and Consignations in the Treasury sphere holds a large volume of securities which, based on the model and all evidence, varies with the demand for base money. Permanent real income $Y_p$ is also an argument in equation (9) because it may affect $\psi_4$ in equation (11). If $Y_p$ should lower this ratio, for example, thus raising the commercial banks' share of the market for issues of deposits, it would obviously raise the supply of credit. Equation (9) thus is a partially reduced form. This is also true of equation (10), which equals $C(\;)$ in the supply of credit minus the desired value of net borrowed reserves $RD - R_e$.[6]

The signs of $i$, $i_1$, and $r$ in the functional relation $\psi_4(\;)$ of equation (11) rest on the hypothesis that any rise in the profitability of asset expansion will induce the commercial banks to offer more services to their depositors. A rise in $\lambda$, on the other hand, will raise $\psi_4$, even though necessitating more commercial bank services ($\lambda$ being a certain legal disadvantage of the commercial banks relative to the savings banks with respect to the amount of interest they can pay and certain tax regulations). Permanent income $Y_p$ possibly affects $\psi_4$ because the income elasticity of the private demand for commercial bank deposits may differ from the income elasticity of the private demand for base money.

There are two fundamental omissions in equation (12), the demand for money: the foreign interest rate $i^*$ (with or without the forward premium on the franc); and the money rate on domestic bonds. Both omissions rest on econometric considerations. We were unable to find a significant negative coefficient of $i^*$ in the simultaneous equation estimates of the demand for money (though we succeeded in doing so in the single equation estimates), and we also found that anticipated inflation dominated the money rate on domestic bonds in the estimates of the demand for money (see Melitz, 1976a).

Equation (13) says that the foreign exchange rate $FF/\$$ is equal to the target rate under fixed exchange rates, prior to 1971.4, and since then equal to

$$\frac{FF}{\$} = \frac{FF}{\$}\left(F, \frac{DM}{\$}, 1\right)$$

The hypothetical negative sign of $F$ in the function means that in case of a downward pressure on the franc, the French authorities prefer a combination of a rise in $FF/\$$ and a fall in $F$ to merely one or the other. The $DM/\$$ in the reaction function refers to the influence of the Common Market "snake." The separate presence of $F$ implies the possible French absence from the snake. If the fit of the equation is good, the official presence or absence of France in the snake can be explained by the equation.

As regards the price level equation, (14), the exogenous component $P_x$ refers partly to the influence of foreign prices of traded goods, partly to the influence of French prices of nontraded goods (since these prices may be

[6]For a detailed discussion of the relation between $C(\;)$ and $A(\;)$, see Melitz (1976b, Part I, pp. 56–58), which contains an econometric study of the same model of the French monetary system with $F$ and $FF/\$$ as exogenous.

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independent of the foreign exchange rate to some extent), and partly to changes in the relative weights of the two.

The only uncomfortable aspect of the system is the view that anticipated inflation $dP_a$ is exogenous. But a very delicate problem confronted us in this respect. To have treated $dP_a$ differently, or as dependent on $P$, thus $FF/\$$, would have been to allow the errors in the fitted values of $FF/\$$ to distort the fitted values for anticipated inflation as well as those of $P$ during the period of fixed exchange rates, covering three-quarters of our observations. The distortion then would have persisted during the early part of the period of flexible rates because of distributed lag effects of $P$ on $dP_a$. It seemed to us wiser, therefore, to accept the element of simultaneous equation bias (affecting only the tail end of the period) which is inherent in the treatment of anticipated inflation as exogenous.

We studied three other measures of money besides $M_4$, namely, $M_1$, $M_2$, and $M_3$; but space limitations will confine the discussion of the econometric results to one, $M_1$. Therefore we shall specify the adaptation of the model only to this one other money measure (though the adaptation to the other two, $M_2$ and $M_3$, will become apparent).[7]

Let $M_1$ be privately held currency plus demand deposits, or

$$(7') \qquad M_1 = M_4 - D_{sb} - D_{bs}$$

where $D_{sb}$ are the savings deposits with the savings banks, $D_{bs}$ those with the commercial banks, and $D_{sb} + D_{bs}$ total savings deposits. Instead of equation (11), we then have

$$(11') \qquad \frac{M_1}{A} = \frac{1}{1-r} + \psi_1(\quad)\frac{1}{1-r}$$

$$\text{where} \qquad \psi_1 = \frac{D_{po} + N - D_{bs}}{D_b}$$

The problem then is to show, in line with $\psi_4(\quad)$:

$$\psi_1 = \psi_1(\overset{-}{i}, \overset{+}{i_1}, \overset{+}{\lambda}, \overset{+}{r}, \overset{\pm}{Y_p})$$

A rise in $i$ will lead commercial banks to try to attract deposits on previous grounds, thus lowering the ratio of currency plus postal checking accounts to their deposits. Since law permits these banks to increase the interest they pay on certain types of savings deposits, but not to pay any interest on checking accounts, their efforts to raise their deposits will partly provoke a rise in the ratio of their savings deposits, $D_{bs}/D_b$, which will then reinforce the fall in $\psi_1$. The positive signs of $i_1$ and $r$ in $\psi_1(\quad)$ follow on the same ground. As regards the sign of $\lambda$, deposits at the savings banks are closer substitutes for savings deposits at the commercial banks than they are for either currency or checking accounts. Consequently a rise in $\lambda$ will raise $(D_{po} + N)/D_b$, lower $D_{bs}/D_b$, and therefore raise $\psi_1$.

The demand for money in the sense $M_1$ may be stated as

$$(12') \qquad \frac{M_1}{P} = \frac{M_1}{P}(\overset{+}{Y_p}, d\overset{-}{P_a}, \overset{-}{i_d})$$

where $i_d$ is the interest rate on savings deposits. Equations (11′) and (12′) then can substitute for (11) and (12) in the case of $M_1$.

## II. The Method of Estimation

There are three basic problems in estimating the system of equations (8)–(14). The first concerns the missing series $P_x$ in the price level equation. We handled this difficulty by identifying $P_x$ with the sum of the constant and the disturbance term $(a_o + \mu)$ in the equation

$$(14') \qquad P = a_o + a_1 \frac{FF}{\$} + \mu$$

In other words, we broke up $P$ between $P_x$ and $a_1 FF/\$$ on the basis of a one-stage least squares estimate of equation (14′), and next substituted $P_x + a_1 FF/\$$ for $P$ in equations (8) and (12). In this way, we reduced the system to six equations before engaging in simultaneous equation estimation. This poses an obvious risk of simultaneous equation bias

[7] $M_2$ is currency plus total commercial bank deposits, and $M_3$ is currency plus demand deposits plus savings deposits with either the commercial banks or the savings banks that are low-interest yielding and without any maturity date.

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in the estimate of $a_1$. But the procedure has the fundamental merit of assuring that the differences between the observed and estimated values of $P$ in the simultaneous equation estimates derive strictly from differences between the observed and estimated values of $FF/\$$. There would be no point in admitting errors in the estimates of $P$ stemming from any other source in a test of the monetary approach as such. Our single equation estimate of equation (14′) involves a highly significant coefficient $a_1$ (with a $t$-statistic of 4.7).

Our second estimation problem is that several of our equations are not linear with respect to all of the endogenous variables. This is true for equation (8) because of the expression $C/(P_x + a_1 FF/\$)$, for equation (12) because of the expression $M/(P_x + a_l FF/\$)$, and for equation (11) because of the expressions $M/A$ and $i/(1 - r)$. The problem could not be resolved by stating all of the equations in *log*-linear form, since the effects of $F$ and $CFD$ in the supply of credit and the demand for net assets (equations (9) and (10)) are genuinely linear rather than *log*-linear. Moreover, the linear form of the demand for credit in France happens to yield substantially better fits than the *log*-linear form. We therefore formulated all of the equations linearly, using linear approximations to the four previous expressions.

Our third problem involves the difficulty of treating official reserves in the reaction function (equation (13)) as endogenous for only part of the observation period. Using $FX$ instead of $F$ in the reaction function does not resolve this problem fully, as it may seem to, since we cannot consider $FX$ (which is zero until 1971.4 and then becomes equal to official reserves) as an endogenous variable as distinct from $F$. Hence, we were compelled to substitute $F - F(1 - X)$ for $FX$ in equation (13), interpret $F$ as endogenous, $-F(1 - X)$ as exogenous, and constrain both $F$ and $-F(1 - X)$ to have the same coefficient. This procedure works perfectly with flexible exchange rates when $X = 1$ and therefore $-F(1 - X)$ is zero. But under fixed rates when $X = 0$, the sum of $F$ and $-F(1 - X)$ does not yield zero as we would like, since $F$ is the estimate of official reserves, $-F(1 - X)$ the negative of the observed value of official reserves, and $F - F(1 - X)$ therefore the error in the estimate. This error then becomes a factor distorting our estimates of the exchange rate in the period of fixed rates. We found this distortion impossible to avoid; in other words, we found no way to suppress the simultaneity of the estimates of $F$ and $FF/\$$ for any subsection of the study period. Fortunately, however, the errors in the estimates of $FF/\$$ are only moderate under fixed rates. Two-thirds of them are within 2 percent and with only one close exception all of the rest are within 5 percent.

As regards the structure of the distributed lags, we admitted a fairly short adaptation period in all of the equations except for the demand for credit. Earlier experiments with Almon lags showed that there was no point in deviating from a simple Fisherine assumption of a linear decay in influence. Accordingly, we imposed a linearly declining pattern of distributed lags everywhere lasting four quarters, except in the demand for credit where they last twelve, and of course, in the reaction function where the adjustment supposedly takes place in a single quarter. There are a few exceptions: $Y_{tr}$ in the demand for credit and $r$ in equations (25) and (26) are all supposed to exert their full effect in a single quarter.

We also introduced a dummy variable in all six equations for the third quarter of 1969, when France devalued by 10 percent under fixed rates. The relevant theory of the determination of $F$ does not apply in that quarter. Further, it proved useful to inject the dummy variable $X$ in all of the equations, not only (13). The variable $X$ always has a highly significant coefficient and its presence diminishes the standard errors of some of the other coefficients without much affecting their levels. The simplest interpretation is that $X$ compensates for a bias issuing from the errors in our estimates of $FF/\$$ under fixed exchange rates.

The computer program at our disposal (Clifford Wymer's well-known *RESIMUL*) enabled us to estimate the system with full-information maximum likelihood (*FIML*)

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subject to all of the desired linear restrictions.

## III. The Econometric Analysis

The *FIML* estimates are shown in Appendix B, together with explanatory material relating to measures, data, statistical magnitudes, and the meaning of test statistics. We simplify to the utmost by ignoring the dummy variable for 1963.3 (which proved utterly insignificant), the dummy variable for flexible exchange rates in the first five equations of the Appendix, and the insignificant coefficient of $r$ (more precisely $r/(1 - r)$) in the $\psi$ function (which we set at zero in the estimates). The Appendix shows the predetermined coefficient of the influence of the exchange rate on the price level to be 0.06 (with a $t$-statistic of 4.7 in the single equation estimate, as we mentioned before). This corresponds to an exchange rate elasticity of the price level of 0.2 at the means, which is not as small as it may seem, since the effect is over a single quarter.[8]

The coefficient of the influence of $Y_p$ on $M_4/A$ (in equation (11)) is negative and significant, which theoretically implies a positive effect of $Y_p$ in the supply of bank credit and the demand for net assets. However, we encountered a considerable problem of multicollinearity between $Y_p$, $F$, and $CFD$ in these two equations. With $Y_p$ as a factor in both equations, the coefficients of $F$ vary greatly from one measure of money to the next, they are generally unreliable, and the reduced form is largely shorn of interest. Thus, we report only on the *FIML* estimates without $Y_p$ in equations (9) and (10).

These estimates, or the ones in Appendix B, are quite satisfactory on the whole. The only major exception is the coefficient of the interest rate $i$ in the demand for bank credit in the model with $M_1$, which is insignificant and of the wrong sign. The coefficient is negative and significant, however, in all of the estimates with the other money measures ($M_2$ and $M_3$ as well as $M_4$). Another bothersome result is the insignificance of the legal reserve requirement $r$ (which first appeared in France only in 1971) in the supply of credit. But this is less embarrassing than it may seem, since a rise in $r$ necessitates more refinancing ($RD$) at any given level of deposits and in this respect tends toward a positive sign of $r$ in this equation. On the other hand, the negative effect of $r$ in the demand for net assets, about which there is no theoretical ambiguity, is amply confirmed in the estimates.

The enormous $t$-value of $DM/\$$ in the reaction function is not surprising because of the occasional official French presence in the European Economic Community (*EEC*) snake. The real mark of the success of the equation, therefore, is the equally high $t$-value of the coefficient of $F$. Since the coefficient of $DM/\$$ does not differ significantly from one, the conclusion is that, *ceteris paribus*, the French authorities try to keep the $DM/FF$ exchange rate about the same. However, being that $F$ clearly is another official consideration, the periods when France is in the *EEC* snake evidently correspond to those when keeping the franc moving in perfect step with the *DM* relative to the dollar requires little change in reserves.

We do not provide the $R^2$ for $FF/\$$ in Appendix B since, as explained there, this statistic would have no interest: three-quarters of the observations in the study period concern fixed exchange rates. Instead, we have constructed a special $R^2$ relating to $FF/\$$ and $F$ during the period of flexible exchange rates (see Appendix B). These $R^2$s, in combination with the others in the appendix, yield two basic conclusions: first, that the model explains $F$ and $FF/\$$ less well than the other four endogenous variables;[9] second, that

[8]With only thirteen quarterly observations at our disposal, we tried but could not find any statistically significant pattern of distributed lags in the influence of $FF/\$$ on $P$. Our 0.2 estimate of the exchange rate elasticity is in line with the estimates of Dornbusch and Paul Krugman, pp. 568–73, for various countries, including France.

[9]There may be some hesitation about this conclusion on the ground that all of our estimates are interdependent; therefore the estimates of $F$ and $FF/\$$ could even be the source of the high $R^2$s for the other variables. But we know from *FIML* estimates of equations (8)–(11) alone for the same study period (see Melitz, 1976b, 1977) that the quality of our estimates of $C$, $i$, $A$, and $M_4$ or $M_1$ owes nothing to the fitted values of $P$, $F$, and $FF/\$$. This would then support the statement in the text.

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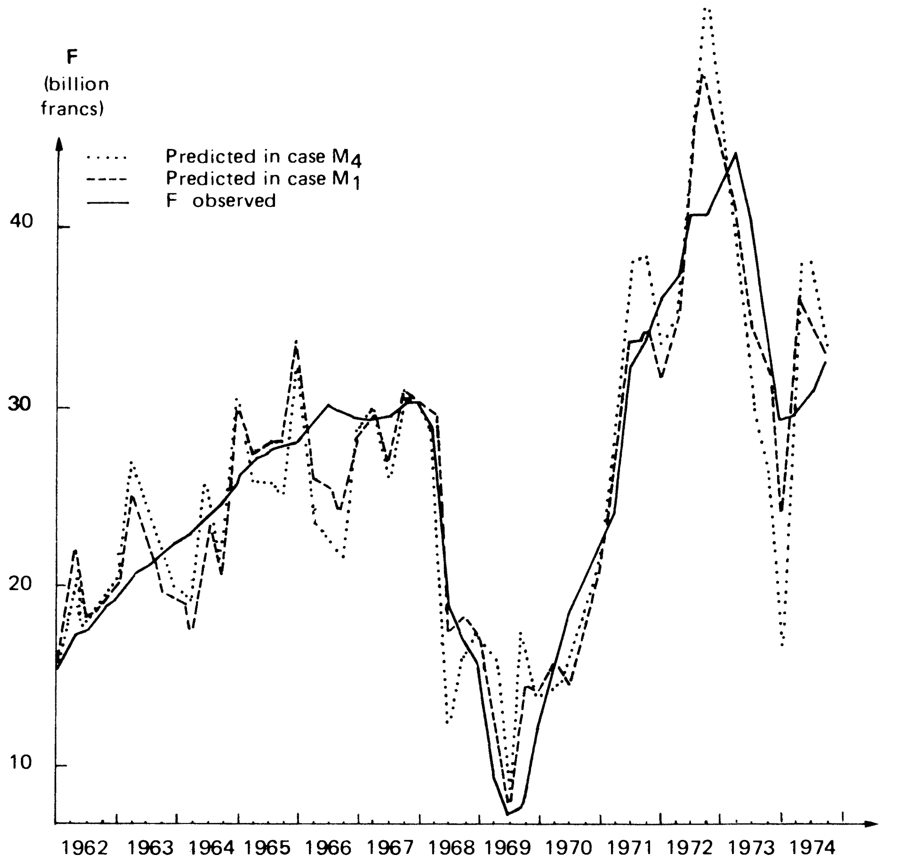


Coefficient of correlation in 1971,4-1974,4 (r)= 0,57
in the case of $M_4$ and 0,74 in the case of $M_1$

FIGURE 1

the model explains these two variables better in the case of $M_1$ than $M_4$.

It may be seen from Figures 1 and 2 that the profiles of the errors in the estimates of $F$ and $FF/\$$ are basically the same for $M_1$ and $M_4$. The model does not explain $F$ particularly well in either case during the calm of 1962.1–1968.1 when $F$ grew steadily under fixed exchange rates (see Figure 1). The fitted values define some fictitious, sharp, tooth-edged movements around the basic upward trend during this time. The model is very successful, however, in tracking the sharp downswing in $F$ starting with the political disturbances of May–June 1968 and the subsequent sharp upswing in $F$ following the devaluation of the franc in 1969.3. It also anticipates the downswing of $F$ of 1973.3 by one quarter and captures the timing of the upswing after the oil crisis in mid-1974. With respect to $FF/\$$, the model traces the appreciation of the franc from 1971.4 to 1973.2 with a certain lack of precision (see Figure 2). But it captures the timing of the depreciation of 1973.3 and the timing of the subsequent appreciation of 1974.1. The performance of the model therefore is reasonable at the turning points and during the turbulent episodes.

Table 1 provides the reduced-form coefficients of the influences on $F$, $FF/\$$, and $M$. These coefficients, like the structural ones of

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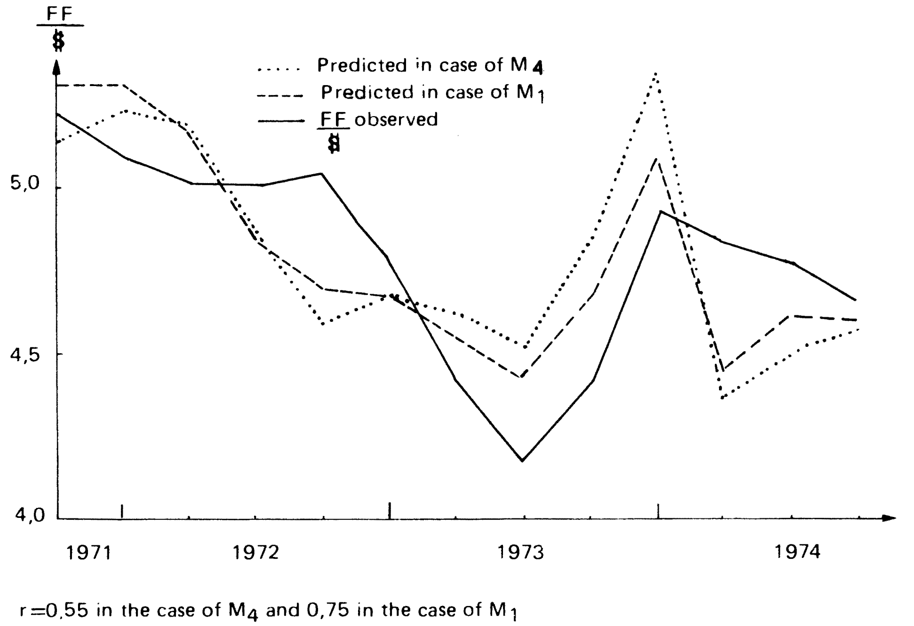


FIGURE 2

Appendix B, refer to cumulative impacts over time. All of the effects are distributed over three years, but attain 85 percent of their cumulative value within two years in some cases—namely, those involving the variables entering in the demand for credit ($P_x$, $i^*$, $dP_a$, and $Y_p$)—and more than 95 percent of their value within a single year in the other cases ($DM/\$$, $i_1$, $\lambda$, $CFD$, $C_t$). According to the model, variables which do not appear in the demand for money cannot affect the quantity of money under fixed rates. This explains all the null effects on $M_1$ and $M_4$ when $X$ is zero in Table 1.

Table 1 implies that the rate of intervention of the Bank of France, $i_1$, has perverse effects on money, reserves, and the franc. This can only mean, contrary to theory, that the positive effect of $i_1$ on $M/A$ dominates the negative one on $A$. An important consideration in this regard is the large competitive presence of the French government in the issue of deposits via the system of postal checking accounts and the savings banks. As the commercial banks reduce their services to depositors subsequent to a rise in $i_1$, there is therefore wide scope in France for a rise in deposits with the government. (Corresponding to such a rise in deposits there is also necessarily lower borrowing by the Treasury from the Bank of France and/or net purchases of securities by the financial intermediaries in the sphere of the Treasury, as more balance sheet information would show.) However, these reduced-form coefficients of the influence of $i_1$ can be questioned and need further corroboration (compare Melitz, 1977, Part II, p. 96).

The other reduced-form coefficients in Table 1 accord with a priori expectations. Their only drawback are many wide differences in the estimates of the influences on $F$ and $FF/\$$ depending on $M_4$ or $M_1$. This is true for example, of the effects of $P_x$, $i^*$, $DM/\$$, and $C_t$ on $F$, and the effects of $P_x$, $i^*$, and $C_t$ on $FF/\$$ (compare with the last paragraph of Appendix B, concerning the structural estimates). Despite these differences in the results depending on the money measures, three major conclusions emerge from Table 1:

1) Movements of official reserves offset about 70 percent of changes in $CFD$. The effects of $CFD$ on money are correspondingly

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TABLE 1—THE REDUCED-FORM COEFFICIENTS OF INFLUENCE ON $F$, $FF/\$$, AND $M$[a]

| | $M_4$ | | | $M_1$ | | |
|---|---|---|---|---|---|---|
| | $F$ | $FF/\$$ | $M$ | $F$ | $FF/\$$ | $M$ |
| $P_x$ | | | | | | |
| $X = 1$ | 0.18 | −0.0051 | 3.33 | 0.29 | −0.0086 | 1.60 |
| | (4.0) | (4.0) | (12.7) | (6.3) | (6.3) | (11.5) |
| $X = 0$ | 0.18 | – | 3.44 | 0.31 | – | 1.70 |
| | (3.9) | | (34.4) | (6.0) | | (17.0) |
| $DM/\$$ | | | | | | |
| $X = 1$ | 1.09 | 0.99 | 20.4 | 1.77 | 0.97 | 9.84 |
| | (4.0) | (29.5) | (29.5) | (6.2) | (30.2) | (30.2) |
| $X = 0$ | – | – | – | – | – | – |
| $i_1$ | | | | | | |
| $X = 1$ | −1.48 | 0.043 | 0.88 | −2.56 | 0.076 | 0.78 |
| | (4.0) | (4.0) | (4.0) | (7.7) | (3.3) | (7.4) |
| $X = 0$ | −1.52 | – | 0 | −2.70 | – | 0 |
| | (3.9) | | | (7.7) | | |
| $i^*$ | | | | | | |
| $X = 1$ | −2.25 | 0.065 | 1.35 | −1.33 | 0.040 | 1.35 |
| | (5.5) | (5.3) | (5.3) | (3.3) | (3.3) | (3.3) |
| $X = 0$ | −2.33 | – | 0 | −1.40 | – | 0 |
| | (5.5) | | | (3.4) | | |
| $\lambda$ | | | | | | |
| $X = 1$ | 0.83 | 0.024 | −0.49 | −0.38 | 0.011 | 0.12 |
| | (0.74) | (0.74) | (0.74) | (0.4) | (0.4) | (0.4) |
| $X = 0$ | 0.86 | – | 0 | −0.40 | – | 0 |
| | (0.74) | | | (0.4) | | |
| $dP_a$ | | | | | | |
| $X = 1$ | −5.14 | 0.15 | 1.2 | −4.95 | 0.15 | −6.40 |
| | (8.6) | (8.3) | (0.7) | (7.0) | (6.8) | (4.2) |
| $X = 0$ | −5.30 | – | −1.90 | −5.22 | – | −7.91 |
| | (8.7) | | (1.1) | (7.1) | | (4.8) |
| $CFD$ | | | | | | |
| $X = 1$ | −0.71 | 0.021 | 0.43 | −0.67 | 0.020 | 0.20 |
| | (12.4) | (11.5) | (11.5) | (14.9) | (13.0) | (13.1) |
| $X = 0$ | −0.74 | – | 0 | −0.70 | – | 0 |
| | (12.4) | | | (14.5) | | |
| $Y_p$ | | | | | | |
| $X = 1$ | 0.19 | −0.0055 | 3.12 | 0.34 | −0.010 | 0.93 |
| | (3.2) | (3.2) | (25.6) | (6.1) | (6.0) | (12.4) |
| $X = 0$ | 0.19 | – | 3.23 | 0.36 | – | 1.04 |
| | (3.2) | | (26.10) | (5.9) | | (12.6) |
| $C_t$ | | | | | | |
| $X = 1$ | 0.28 | −0.0080 | −0.16 | 0.17 | −0.0050 | −0.051 |
| | (7.3) | (7.0) | (7.0) | (5.0) | (4.9) | (4.9) |
| $X = 0$ | 0.28 | – | 0 | 0.18 | – | 0 |
| | (7.5) | | | (5.2) | | |

[a]The coefficients of influence refer to effects of changes in one percentage point in $P_x$, $DM/\$$, $i_1$, $i^*$, $\lambda$, and $dP_a$, and one billion francs in $CFD$, $Y_p$, and $C_t$. The terms $M_4$, $M_1$, and $F$ are in units of one billion francs. These coefficients concern total cumulative impacts over time. See Appendix B for more information.

moderate, those on $M_4$ being naturally larger than the ones on $M_1$. As mentioned earlier, the large offset coefficients of $CFD$ are plausible because virtually all financing of fiscal deficits took place through the central bank rather than bond issues to the private sector in most of the study period. According to these estimates then, any genuine open market operations in France, if they took place, would be offset by 70 percent or somewhat more

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(since there would then be no diminution of the offset coefficient through bond financing).

2) The influences on official reserves under fixed exchange rates are only slightly, almost negligibly, smaller under flexible rates. Thus, what used to put downward (upward) pressure on official reserves in France before 1971.4 still causes virtually the same decrease (increase) in official reserves. Despite this, however, the franc was able to undergo all of the substantial movements in Figure 2. If small deviations from the levels of official interventions that would be required to keep the franc fixed can thus bring about large movements in the franc, the conclusion can only be that the stabilizing influence of the franc is weak, at least in the short run, in line with the literature on "overshooting."

3) Since the abandonment of fixed rates, the $DM/\$$ rate has become a dramatic influence on official reserves, the franc, and money in France. This can be seen by comparing the coefficients of $DM/\$$ in Table 1, first, with the mean values of $F$, $M_4$, and $M_1$ in the study period (see Appendix B) and second, with the other coefficients in the table.

In conclusion, this study may be said largely to constitute an attempt to rescue the monetary approach from a certain simplism in theoretical formulation and test procedure which could prove more damaging to it in the long run than any amount of criticism. The outcome, we hope, is a more persuasive confirmation of the value of the approach, despite a clear view of some of its limitations.

## Appendix A

$A$ = Net commercial bank assets
$B$ = Reserve base
$B_m$ = Base money
$C_b$ = Loans to the private sector financed by the commercial banks themselves; or commercial bank credit in this sense
$C_t$ = Loans to the private sector financed by the public credit institutions under Treasury control
$CFD$ = The cumulative value of fiscal deficits
$D_b$ = Commercial bank deposits
$D_{po}$ = Postal checking deposits
$D_{sb}$ = Deposits at the national savings banks
$DM/\$$ = Price of the U.S. dollar in terms of the deutschmark
$F$ = Official foreign reserves
$FF/\$$ = Price of the U.S. dollar in terms of the French franc
$i$ = The domestic interest rate, i.e., the interest rate on bank credit
$i^*$ = The foreign interest rate
$i_1$ = The central bank rate, i.e., bank rate
$M_4$ = Money in the sense of currency plus total demand deposits (inclusive of postal checking accounts), and total savings deposits (inclusive of those with the state savings banks as well as with the commercial banks)
$N$ = Currency
$P$ = Price level
$P_x$ = Exogenous component of the price level
$dP_a$ = Anticipated rate of inflation
$r$ = $R_r/D_b$, weighted-average legal reserve requirement
$R$ = Commercial bank reserves
$R_e$ = Commercial bank excess legal reserves
$R_r$ = Commercial bank legally required reserves
$RD$ = Rediscounts or commercial bank refinancing
$TAR$ = Target value of $FF/\$$ under fixed exchange rates
$X$ = Dummy variables for the system of flexible exchange rates
$Y_p$ = Permanent real income
$Y_{tr}$ = Transitory real income
$\lambda$ = The competitive legal disadvantage of the commercial banks relative to the national savings banks in the issue of savings deposits
$\psi_4$ = Competitive position of commercial bank deposits relative to base money

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## Appendix B: The Full-Information Maximum Likelihood Estimates of the Structural Form

With respect to data, we used quarterly averages for all stocks, interest rates, and foreign exchange rates. We used the three-month Euro-dollar rate for the foreign interest rate $i^*$, the rate on commercial bank overdrafts for the rate on domestic bank credit $i$, the legal rate on traditional savings deposits at the savings banks (*les dépôts traditionnels*) for $i_d$, and the Bank of France's daily rate at the "open market" desk for the cost of refinancing at the central bank, $i_1$. The additional interest rate expression $\lambda$ is the excess of the legal rate on the traditional savings deposits at the savings banks over the legal rate on the identical type of deposits at the commercial banks (*les comptes sur livrets*), plus an adjustment for the tax advantage on the interest income received from the savings banks. Our measure of real income $Y$ is the real domestic product. The price level $P$ is the implicit deflator of $Y$. Regarding permanent income and anticipated inflation, we used the traditional measures:

$$Y_p = \left[\sum_{i=1}^{19}\left(\frac{0.9}{1+g}\right)i\right]^{-1}\sum_{i=1}^{19}(0.9)^i\,Y_{t-i};$$

$$dP_a = \left[\sum_{i=1}^{19}(0.9)^i\right]^{-1}\sum_{i=1}^{19}(0.9)^i\,dP_{t-i}$$

The variable $g$ in the formula for permanent income is an adjustment for secular growth, and the 0.9 coefficient in both formulas, which is standard, was found to perform better than lower decimal values in earlier single equation estimates of the demand for credit. With respect to real transitory income $Y_{tr}$, or $Y - Y_p$, the negative values following the political disturbances of May–June 1968, completely dominate the French series for 1962.1 to 1974.4. Therefore we use a dummy variable for the last three quarters of 1968 as an index of $Y_{tr}$. Except for the three-month Euro-dollar rate, which comes from the *International Financial Statistics*, our basic sources of statistics are the Conseil National du Crédit and the Institut National de la Statistique et des Etudes Economiques. More information about construction of the series, original sources, and final data inputs, may be obtained directly from the authors.

The full-information maximum likelihood estimates of equations (8)–(13) over 1962.1–1974.4 are as follows for $M_4$:

$$(8)\quad \frac{C}{P_x + 0.06FF/\$} = \underset{(29)}{-382} - \underset{(4.21)}{8.32i} + \underset{(5.51)}{6.68i^*} + \underset{(5.82)}{13.73\,dP_a} + \underset{(19)}{2.75\,Y_p} - \underset{(2.42)}{5.10\,Y_{tr}}$$

$$(9)\quad C = \underset{(12.6)}{-268} + \underset{(12.4)}{45.24i} - \underset{(1.75)}{3.40i_1} - \underset{(4.58)}{26.84\lambda} + \underset{(1.30)}{122r} + \underset{(13)}{3.58F} + \underset{(12.1)}{2.16CDF} + C_t$$

$$(10)\quad A = \underset{(13)}{-242} + \underset{(12.3)}{40.1i} - \underset{(3.84)}{6.67i_1} - \underset{(3.07)}{16.4\lambda} - \underset{(6.3)}{454r} + \underset{(15.1)}{3.41F} + \underset{(15.3)}{2.28CFD}$$

$$(11)\quad \frac{M}{A} = \underset{(21.5)}{2.42}\frac{1}{1-r} - \underset{(9.1)}{0.147}\frac{i}{1-r} + \underset{(9.24)}{0.087}\frac{i_1}{1-r} + \underset{(1.94)}{0.056}\frac{\lambda}{1-r} - \underset{(5.75)}{0.0055}\frac{Y_p}{1-r}$$

$$(12)\quad \frac{M}{P_x + 0.06FF/\$} = \underset{(28.9)}{-332} - \underset{(1.06)}{1.55dP_a} + \underset{(26.1)}{2.63Y_p}$$

$$(13)\quad \frac{FF}{\$} = \underset{(34)}{3.10X} - \underset{(37)}{0.03FX} + \underset{(30)}{1.02}\frac{DM}{\$}X + TAR$$

In order to interpret the coefficients of these equations, it is necessary to note that all stock and flow values are in billions of francs;

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$i$, $i^*$, $i_1$, $i_d$, and $\lambda$ are in percentage points (for example, a 7 percent interest rate is 7.0); and $r$ is in units of 100 percentage points (for example, a 7 percent legal reserve requirement is 0.07). (This divergent treatment of $r$ is in keeping with the $1 - r$ notation of equation (11).) Thus, the coefficient of $i$ in equation (9), for example, says that a one percentage point rise in $i$ raises the supply of $C$ by 45.24 billion francs. The coefficient of $r$ in this same equation says that a rise of $r$ of 100 percent raises the supply of $C$ by 122 billion francs. These are all cumulative-impact coefficients. The total time of influence, as can be seen from the text, is three years for equation (8) (except for $Y_{tr}$), one year for equations (9)–(12) (except for $r$), and one quarter for equation (13). The mean values of $C$, $A$, $M_4$, $M_1$, and $F$ are, respectively, 321, 193, 422, 209, and 29. The values in parentheses below the coefficients are ratios of parameter estimates to asymptotic standard errors. (The particular *FIML* procedure supposes that all of the errors are serially uncorrelated but involves correction for the covariance of errors between equations.)

The coefficients of determination, or $R^2$s, depend on the system as a whole and not the quality of any single equation. For $C$, the $R^2$ is 0.990, for $i$ it is 0.950, for $A$, 0.978, for $M$, 0.990, and for $F$, 0.698. The $R^2$ regarding $FF/\$$ is meaningless for the period as a whole, which covers mostly fixed exchange rates. We have therefore constructed a special $R^2$ for this variable relating strictly to the period of flexible exchange rates 1971.4–1974.4 (thirteen observations). This we have done by taking one minus the sum of the squared errors during the subperiod divided by thirteen times the variance of $FF/\$$ during the period as a whole. The $R^2$ is then 0.729. The comparable $R^2$ for $F$ over the same subperiod is 0.647.

In the case of $M_1$, the *FIML* estimates of the equations are

$$(8')\quad \frac{C}{P_x + 0.06FF/\$} = \underset{(22)}{-365} + \underset{(0.40)}{1.30i} + \underset{(3.31)}{6.44i^*} + \underset{(2.18)}{7.58dP_a} + \underset{(10.7)}{2.23Y_p} - \underset{(2.48)}{6.13Y_{tr}}$$

$$(9')\quad C = \underset{(12.6)}{-304} + \underset{(12)}{58.8i} - \underset{(2.55)}{6.18i_1} - \underset{(5.11)}{30.26\lambda} - \underset{(0.91)}{80r} + \underset{(13)}{3.57F} + \underset{(11.9)}{2.23CFD} + C_t$$

$$(10')\quad A = \underset{(12.9)}{-270} + \underset{(12.3)}{48.5i} - \underset{(4.96)}{10.57i_1} - \underset{(4.24)}{24.74\lambda} - \underset{(7)}{476r} + \underset{(14.6)}{3.33F} + \underset{(14.3)}{2.24CDF}$$

$$(11')\quad \frac{M}{A} = \underset{(14.5)}{1.344}\frac{1}{1-r} - \underset{(10.8)}{0.162}\frac{i}{1-r} + \underset{(9.01)}{0.078}\frac{i_1}{1-r} + \underset{(3.15)}{0.073}\frac{\lambda}{1-r} - \underset{(5.45)}{0.0043}\frac{Y_p}{1-r}$$

$$(12')\quad \frac{M}{P_x + 0.06FF/\$} = \underset{(12.9)}{-62} - \underset{(4.82)}{6.43dP_a} + \underset{(1.46)}{0.85Yp} - \underset{(1.46)}{4.78i_d}$$

$$(13')\quad \frac{FF}{\$} = \underset{(34)}{3.14X} - \underset{(29.32)}{0.03FX} + \underset{(31)}{1.02}\frac{DM}{\$}X + TAR$$

The $R^2$s, in the case, are 0.992 for $C$, 0.979 for $i$, 0.989 for $A$, 0.988 for $M$, and 0.856 for $F$. For the subperiod of flexible exchange rates, the $R^2$ for $FF/\$$, calculated as before, is 0.858, and that of $F$, 0.866. It can be seen that the use of $M_1$ leads to marked improvements in $R^2$s for $i$, $F$, and $FF/\$$. Also, apart from equations (11′) and (12′), where we must expect differences depending on the money measure, there are notable differences in the structural estimates for the two money measures. In particular, the coefficients of $i$ and $dP_a$ in the demand for credit differ in the two cases, that of $i$ being insignificant and of the wrong sign in the case of $M_1$ but highly significant and of the right sign in the case of $M_4$. On the other hand, $i_1$ performs notably better in the supply equations (9) and (10) for $M_1$ than $M_4$.

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