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ERRATA

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Owing to certain errors detected in the previous edition of this Working Paper, the present edition has been published to replace it.

FE DE ERRATAS

Documento de Trabajo nº 9414

Debido a algunos errores detectados en la edición previamente difundida de este Documento de Trabajo, se ha procedido a realizar esta nueva edición que la sustituye.

- A B S T R A C T -

This paper aims to provide some sectoral estimates of the monetary transmission mechanism in Spain. Using a Vector Autoregressive (VAR) methodology, we look to trace through the effects of an exogenous monetary impulse upon the intermediate and final target variables of policy. Provided this mapping between (exogenous) instrument and (endogenous) intermediate and final variables is valid, such an exercise offers meaningful estimates of the size and speed of the effects of a monetary perturbation upon output and prices. And - as important from an intermediate target perspective - it is indicative of the dominant mechanisms through which monetary policy is propagated. Evidently, these issues are of direct policy relevance.

- I N D E X -

1.- INTRODUCTION

Central banks are typically modelled as having but a single instrument when implementing monetary policy - whether a money price (short-term interest rates), or a money quantity (outside money). The monetary authorities are also typically believed to have, at least in the long run, only a single objective - that of price stability. The monetary transmission mechanism maps the endogenous interaction between the authorities' single instrument and their single target. So empirical estimates of the monetary transmission process are of obvious -and particular - interest to central banks.

In this paper, we aim to provide some empirical estimates of the monetary transmission mechanism in Spain. That is, we look to trace through the effects of an exogenous monetary impulse upon the intermediate and final target variables of policy. Provided this mapping between (exogenous) instrument and (endogenous) intermediate and final variables is valid, such an exercise offers meaningful estimates of the size and speed of the effects of a monetary perturbation upon output and prices. And - as important from an intermediate target perspective - it is indicative of the dominant mechanisms through which monetary policy is propagated. Evidently, these issues are of direct policy relevance: consider Economic Unit (1993).

Neither these questions, nor some of the answers to them, are of course wholly new in a Spanish context. The interactions which make up the monetary transmission process have been extensively studied as a - univariate matter, in which respect: Escriva and Santos (1991) consider the estimation of a reaction function for the Spanish monetary authorities, endogenously relating the policy instrument to real and monetary magnitudes; Sastre (1991, 1992) considers the determination of (private and savings) banks' lending and deposit rates; in Cabrero, Escriva and Sastre (1992), and Vega (1992a, b), the structural determinants of bank balance sheet variables - money and credit - are explored; while the impact of financial magnitudes upon real-side variables in Spain has been considered by, inter alia, Estrada (1992) and Bover (1992). Taken

together, these structural univariate relations define many - if not most - of the more important channels of monetary transmission. It is a natural step, therefore, to consider these univariate relations in a systems-wide, multivariate context. Such is the aim of this preliminary exercise.

Our methodology does, in one important respect, detach itself from that used in the univariate structural approaches cited above: it is explicitly - and unashamedly - reduced-form in nature. But the system is far from being either arbitrary or atheoretic, the criticisms most often levelled at reduced-form estimation. Both the choice of variables, and the restrictions placed upon them for identification, have their roots firmly in theory. Accordingly, the responses from the system can usually be given a straightforward macroeconomic - if often not always strictly Neoclassical - interpretation.

Specifically, we look to employ a Vector AutoRegressive (VAR) methodology to estimate our system. VARs have proved an increasingly popular means of efficiently generating stylised facts regarding the monetary transmission process; they make for "nice pictures". Thus consider, inter alia, Bernanke (1986), Friedman (1983), King (1986), and most recently Bernanke and Blinder (1992) and Gertler and Gilchrist (1992) for evidence from the US; Dale and Haldane (1993c) in a United Kingdom context; and Sims (1992) for a selection of developed countries. The approach here follows most closely that of Bernanke and Blinder (op.cit.).

The paper is planned as followed. In section 2 we discuss in more detail the methodology employed, and juxtapose this with contending approaches. Section 3 considers the relations comprising our system and some of the motivation - part theoretical, part empirical -for wishing to consider these relations. In section 4 we discuss our results, and look to interpret these in the light of extant evidence. Section 5 briefly concludes. The Appendix discusses, in more detail, the data used.

2.- METHODOLOGY[1]

Our aim, as stated at the outset, is to delimit and quantify the structural effects of a monetary policy impulse. To do this we need first to define a structural model. Thus consider the following linear, dynamic system of equations, which we assume defines the "true" structure of the economy:

$$B_0 Y_t = B(L) Y_t + u_t \qquad (1)$$

where y is an n by 1 vector of endogenous economic variables; B_0 is an n by n matrix of impact multipliers; B(L) is a k'th-order matrix of structural polynomials in the lag operator L (such that $B(L) = B_1L + B_2L^2 + \ldots B_kL^k$); and u is an n by 1 vector of structural disturbances, with covariance matrix S_u.

There are an infinite number of ways in which the structural parameter and disturbance terms in (1) may be identified. Bernanke and Blinder (1992) define two broad approaches to this identification problem.[2] The first approach is to estimate (1), the structural form, directly. This is the standard approach in the simultaneous equation literature. Identification comes from assuming elements of the y vector are strongly exogenous. This, in turn, places zero (exclusion) restrictions on blocs of the B matrix.

In principle, given a sufficiently well-articulated theoretical model, implementing such a structural approach would be straightforward. In practice, theory in general - and monetary theory in particular - is rarely so well-defined as to suggest such (strong exogeneity) assumptions. Using exclusion restrictions for identification is thus at best problematic, and at worst "incredible" (Sims (1980)). This problem is particularly acute when defining the monetary transmission mechanism,

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[1]This section follows closely section 3 in Dale and Haldane (1993c).

[2]Though the dichotomy is clearly no more than illustrative. The two approaches differ only in that they impose different classes of identifying restriction upon the system.

since competing (Real Business Cycle and IS/LM) models would suggest strictly opposing exclusion restrictions.

The second approach, followed here and in recent papers by Bernanke and Blinder (1992) and Sims (1992) on the transmission mechanism, is to consider estimation of the reduced-form of (1):

$$Y_t = B_0^{-1} B(L)\ Y_t + B_o^{-1} u_t \qquad (2)$$

This can be given the more conventional Wold moving-average representation:

$$Y_t = C(L)\ e_t \qquad (3)$$

where $C(L) = (I - B_0^{-1} B(L))^{-1}$ is the reduced-form lag polynomial matrix and

$$e_t = B_0^{-1} u_t \qquad (4)$$

is a vector of reduced-form disturbances; and I is the identity matrix

Equation (3), the reduced-form, defines the path of the endogenous variables as an (infinite-order) distributed lag of past structural disturbances. The literature on VARs looks specifically to estimate and solve a system such as (3). Restrictions are then placed upon B and u, such as to allow identification of the structural parameters and disturbance terms (B_0, B(L) and u) given reduced-form empirical estimates of C(L) and e.

The original identifying restrictions in VAR models were those of Sims (1980). These are worth rehearsing, since they are the restrictions employed here. Note that if B_0 - the matrix of impact multipliers - were known, the structural lag polynomial matrix and structural disturbances could be derived directly from (3) given estimates of C(L). In practice, B_0 is not known. But we do have, from estimating the

reduced-form (3), an estimate of the covariance matrix of the reduced-form errors:

$$S_e = E(ee') = B_0^{-1} S_u B_0^{-1'} \qquad (5)$$

where E(.) is the expectations operator. Sims proposed two identifying restrictions: that S_u was diagonal (structural shocks are orthogonal) and that B_0 was lower triangular. From (5), these restrictions are sufficient to identify exactly B_0 from S_e, and thus B(L) and u from (3) given an estimate of C(L).[3]

The key restriction, from an economic perspective, is that upon B_0. It imposes a contemporaneous, recursive form on the system. This is consistent with a Wold causal ordering. As first outlined by Cooley and Leroy (1985), this structure is restrictive as an economic matter. But, insofar as defining the transmission mechanism is concerned, these restrictions would not appear unduly onerous (see next section). And, indeed, they offer some advantages.

To see this, note that our interest is fundamentally with the behaviour of the economy following a monetary shock. The contemporaneous, recursive form offers a simple means of isolating this policy shock. Sims' triangularisation of B_0 means that each **reduced-form** disturbance, e, is uniquely associated with a **structural** disturbance, u. This can be seen directly from (4). Perturbing the reduced-form errors of the reaction function is thus readily interpretable as a policy (structural reaction function) shock. With monetary policy shocks well-defined, simulations of these shocks are straightforward.

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[3]Formally, S_e contains n(n +1)/2 independent elements. This is the same number of elements contained on the RHS of (5) provided the matrix of impact multipliers is (lower) triangularised, and S_u is diagonalised and arbitrarily (but unimportantly) normalised on unity. These restrictions allow a unique (Choleski) decomposition of the matrices on the RHS of (5) - thus allowing identification of B_0.

The clear drawback of Sims' identification procedure is that the "true" structure of the economy may not conform to a Wold causal chain. These problems have led to alternative, more structured, approaches to VAR identification. Recent examples here would include Blanchard and Quah (1989), Gali (1992), King, Plosser, Stock and Watson (1992), and Shapiro and Watson (1988). These approaches look to impose alternative -typically long-run - identifying restrictions, which may have their source either strictly in theory (as in, for example, Blanchard and Quah (op.cit.)), or result from prior estimation of cointegrating relationships between variables (as in, for example, King, Plosser, Stock and Watson (op.cit.)).

The advantage of the structural route is that it is no longer necessary to impose that the economy conforms to some arbitrary recursive form. But there is a cost. With restrictions placed upon the long run, fewer restrictions need be put upon the short-run (impact) multipliers. As a result, structural - specifically monetary policy - shocks may no longer be uniquely identifiable from the reduced-form errors. Reduced-form shocks become a (potentially complex) linear combination of the structural shocks. Structural interpretation of the shocks is thus hindered - lessening the system's usefulness for defining the effects of a monetary policy shock.

Although it may not be desirable to restrict **explicitly** the VAR to take account of long-run or cointegrating relationships, non-stationarity in the data cannot be ignored. Suppressing significant levels terms from the estimated model would induce bias in the estimated coefficients and standard errors. The importance of equilibrium, levels terms can be considered by pre-testing for the existence of cointegrating relationships among the variables. If long-run relations are found to exist, the system should be estimated in levels.[4] The superconsistency theorem (Stock (1984)) then ensures unbiasedness of coefficient estimates. And the Wold decomposition is still defined for non-stationary variables.

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[4]Such a system could always of course be reparameterised as an unrestricted vector error-correction mechanism, estimated in differences but with unrestricted lagged levels terms included.

Accordingly, impulse response functions and variance decompositions are unimpaired. Estimating in unrestricted levels is clearly econometrically less efficient than if the system were (correctly) restricted in its long-run response. But it accommodates - without imposing - an equilibrium, while simultaneously ensuring that the estimated reduced-form is suitable for policy analysis.

3.- REDUCED-FORM RELATIONS IN THE SYSTEM

The y vector defines the monetary transmission process in our system. Its composition is fairly standard: a policy instrument (short-term interest rates); intermediate financial prices (the exchange rate, and commercial banks' lending and deposit interest rates); intermediate financial quantities (measures of broad money and credit); and final policy objectives (real domestic demand and prices.)[5]

The system is clearly minimalist: degrees of freedom problems are invariably prohibitive in VAR systems. But the relations between those variables which are defined cover most of the significant transmission mechanism interactions in a Spanish context. And most importantly, the variables included represent a reasonably well-defined (economically) and closed (econometrically) set. The reduced-form relations can, in many ways, be considered the unrestricted analogues of previously-estimated structural relations: as an economic matter, the system appears reasonably well-specified. While the fact that these structural relations were defined over a broadly common set of variables (those included here) means that we have fewer reasons to suspect omitted variable problems: as an econometric matter, the system appears to be a closed one. These points, and the restrictions imposed for identification, can be illustrated by considering in turn each of the reduced-form relations in the system.

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[5]Note that this is an extended subset of macro variables to that considered in other recent monetary transmission mechanism studies (Bernanke and Blinder (1992), Dale and Haldane (1993c), Sims (1992)). In particular, the inclusion of commercial bank (lending and deposit) interest rates is notable. We do not, however, accommodate stock prices within the model (unlike in Dale and Haldane (1993c)), the market in equities being relatively unimportant in Spain.

(a) Reaction Function Reduced-Form

This is the key reduced-form relation within the system; it defines the mapping between the policy and non-policy variables. Once this mapping is established as valid, all else follows more or less straightforwardly. As discussed, the monetary transmission mechanism can be thought to define the endogenous response of non-policy variables to an exogenous monetary impulse. Identifying this exogenous component of policy is important both economically and statistically. Economically, because it is the unanticipated - or "surprise" - part of policy which is typically thought to exercise greatest leverage over the real economy (Lucas (1972, 1973)).[6] Econometrically, because sufficient restrictions need to be placed on the reduced-form to allow identification of the reaction function and the structural shocks hitting it.[7]

Because policy is in part endogenous, however, this then poses an identification problem: endogenous and exogenous policy responses need to be decoupled in order to isolate the shock. Defining a reaction function helps in this task.[8] Provided this function is well-defined, the residuals from it are readily interpretable as exogenous policy shocks: the anticipated, endogenous part of policy is partialed out, leaving intact the unanticipated, exogenous component. But the reaction function needs to be specified carefully if the economic and statistical exogeneity requirements - alluded to above - are to be satisfied.

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[6]The endogenous, anticipated component having already been discounted by agents if they are sufficiently forward-looking.

[7]See Sims (1992) for an extensive discussion of this issue.

[8]Tangentially, but relatedly, endogeneity of the reaction function is also useful in helping stabilise dynamic systems where, in its absence, interest rates (and other nominal magnitudes) fail to mean-revert: see McCallum (1981).

(a)(i) Economic Exogeneity

Exogeneity, in an economic sense, requires: first, that the reaction function be reasonably well-specified; and second that, at least at the margin, the policy instrument in the reaction function be perfectly controllable by the authorities. Bernanke and Blinder (1992), when using the Fed funds rate as their instrument, establish some prior tests to check the validity of these two conditions (Bernanke and Blinder (1992), sections II and III). Here we are able to side-step the first - if not the second - of these problems.

On the first issue, and following Escriva and Santos (1991), our choice of policy instrument is the Banco de España's marginal intervention rate at its 10-day repo auctions in government securities. Prior work by the same authors established a stable relationship between this intervention rate and measures of the exchange rate (using various definitions), broad money (ALP relative to target) and real-side magnitudes (consumer prices).[9] Since our unrestricted system is defined over all of these variables, we have good reason to believe its reaction function is reasonably well-specified; that the conditioning set for endogenous policy responses is proximately valid.[10] This, taken together with the Sims restrictions, means that innovations in the reaction function in our system are readily interpretable as unanticipated shocks to the structural monetary policy reaction function.

The second problem, that of instrument controllability, is trickier. As discussed in Escriva and Santos (1991), in the late 1970s and the early part of the 1980s monetary control in Spain was better described as one of bank reserves targeting, than short-term interest rate smoothing. This mixed strategy towards monetary control appeared to change around 1984, much greater emphasis thereafter being placed upon

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[9]The first of these terms is likely to have become increasingly important to policy since Spain's accession to the Exchange Rate Mechanism of the European Monetary System in June 1989.

[10]So this obviates the need for separate consideration of the reaction function, as conducted in Bernanke and Blinder (1992).

short-term interest rate targeting (Escriva and Santos (op.cit.)). But since our sample covers the whole of the 1980s, there are potential endogeneity problems when using short-term interest rates as a policy proxy in the early part of the sample.

As a check on how acute this endogeneity problem might be, we followed the strategy used in Bernanke and Blinder (1992). This amounts to estimating the slope of the central bank's reserves supply schedule. An inelastic reserves supply schedule with respect to official interest rates would clearly then be worrying: it would be inconsistent with interest rate targeting by the central bank. An elastic reserves supply schedule would, by contrast, be consistent with interest rate setting.

The reserves supply schedule was identified in estimation by using shocks to macro variables as instruments for shocks to reserves demand. Since these macro variables are only observable with a lag, they must, by definition, be orthogonal to the contemporaneous reserves supply decision of the central bank within any one month. They are thus valid instruments. The results shown in Table A below use three sets of monthly instruments: output of consumer and investment goods (Set A); broad money and credit (Set B); and cement consumption and vehicle registrations (Set C).[11] We split the sample at 1984:1, in line with Escriva and Santos (op.cit.).

[11]Shocks to these variables were generated as the residuals from a VAR comprising (lags of) the instruments themselves, official interest rates, and bank reserves. These residuals were then used to instrument for reserves when regressed on official interest rates. The measure of bank reserves is an adjusted one: see Appendix for details.

Table A

Response of Official Interest Rates to a 1% Point Shock to Reserves Demand		
	1981:1-1984:1	1984:2-1987:2
Instruments:		
Set A	-0.03 (0.11)	-0.15 (0.63)
Set B	-0.16 (0.64)	-0.13 (0.67)
Set C	-0.04 (0.17)	-0.15 (0.63)

The results are similar to those reported by Bernanke and Blinder (1992): the coefficients are small and negative. This argues against a highly inelastic (steeply sloped) reserves supply schedule - on the face of it, consistent with interest rate targeting. But all of the coefficients are also poorly determined. An alternative interpretation of the results is, therefore, that our instruments are simply imperfect proxies for shocks to reserves demand: a good instrument is not just one which is orthogonal, but one which is also correlated with the regressor. This (imperfect instrument) explanation is particularly plausible in a Spanish context, where shocks to reserves demand exhibited large variance over our sample - thus rendering problematic delineation of the reserves supply schedule. In view of this uncertainty, we are particularly cautious when interpreting results from our system when taken from the beginning of the 1980s. Indeed, most of our conclusions are drawn from models estimated from 1983 onwards.

(a)(ii) Econometric Exogeneity

The second - econometric identification - aspect of exogeneity relates back to our earlier methodological discussion. There we discussed the advantages of Sims' identifying restrictions when conducting policy analysis with VARs. The obvious disadvantage of such an approach is its imposition of a recursive structure.

But provided there is no **contemporaneous** feedback from non-policy to policy variables, then a theoretical justification is provided for placing the policy instrument at the top of a recursively ordered system. With the monthly data used in this study, institutional and information lags mean that it is improbable that within-month values of the non-policy vector could influence policy choices during that month.[12] So weak exogeneity of the policy instrument - Sims' identifying restriction - will be satisfied. The policy/non-policy variable mapping - and thus our reduced-form representation of the monetary transmission mechanism - will thereby be a valid one.[13] And the recursive structuring of the system is no longer as restrictive or as arbitrary as may, on the face of it, appear to be the case.

(b) Borrowing and Deposit Rate Reduced-Forms

The borrowing and deposit rates of commercial banks used here are those constructed in Sastre (1991). These weight together the marginal interest rates charged on, or paid by, the various categories of (private plus savings) banks' assets and liabilities, using as weights their

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[12]The only exceptions to this general rule within our system are the financial asset prices - the exchange rate, certainly, and commercial banks' borrowing and lending rates, possibly. A diagnostic on the robustness of our weak exogeneity (of the policy instrument) assumption is obtained by allowing these asset prices to precede the policy instrument in our system: see below.

[13]Ordering of the non-policy vector is more subjective. Information lags, economic theory, and existing empirical evidence on speeds of response of financial and non-financial variables all offer some guide. But our general approach has been to experiment with a variety of orderings.

balance sheet shares.[14] Using banks' lending and deposit rates is particularly important because it allows us to disentangle the income and substitution effects of an interest rate change. While substitution effects are typically given prominence when accounting for the effectiveness of monetary policy, income effects can be as - if not more - important depending upon the balance sheet composition of private sector agents' assets. This factor is crucially important in a Spanish context: see below.[15]

Measuring commercial bank interest rates correctly would of course be unimportant if lending and deposit rates were equal to official interest rates and moved parri passu with them. But both theory and empirical evidence suggests that this will rarely be the case. As a theoretical matter, only under the limiting assumption that there exist perfect substitutes for bank assets/liabilities will this equivalence of official and commercial bank interest rates be guaranteed. See Bernanke and Blinder (1988) and Romer and Romer (1992) in this context.

Once imperfect substitutability between bank assets and/or liabilities is recognised, wedges will be driven between official and market interest rates. And, moreover, the correspondence between them following a policy perturbation will no longer be one-for-one (see, inter alia, Kashyap, Stein and Wilcox (1993), Dale and Haldane (1993a)). Put differently, bank margins will be both non-zero, and will adjust endogenously to a policy shock. In particular, imperfect substitutability may manifest itself as a "stickiness" of commercial bank interest rates in response to an official interest rate change: pass-through of official interest rate changes will be imperfect or sluggish.

Empirical evidence of this stickiness is provided in Berger and Udell (1992) for the US; Dale and Haldane (1993b) for the UK; Sastre (1991) for Spain; and Economic Unit (1993) for a cross-section of EC

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[14]The deposit interest rate can be considered, in a simplistic sense, the price dual of a conventional Divisia monetary aggregate.

[15]Further, when taken together lending and deposit rates offer a proxy for the behaviour of banks' margins.

countries. The factors which may give rise to imperfections in substitutability between assets/liabilities include: the lump-sum costs of accessing (bank and non-bank) markets; the structure of the financial system, in particular the degree of concentration (market power) in the banking industry; the availability of non-bank substitutes; and the extent and strength of bank-customer relationships. In a Spanish context, there are good reasons for expecting each of these to be important.

The monetary policy implications of such a detachment of official and commercial bank interest rates are potentially wide-ranging. To the extent that the marginal interest rates determining agents' expenditure decisions are better proxied by commercial bank - than by central bank -interest rates, bank interest rates will represent an important **independent** monetary transmission channel.[16] Their relation with official rates thence becomes crucial to interest rate transmission.

Clearly these are empirical issues; ones we are looking explicitly to address within our system.[17] But given the relatively embryonic financial infrastructure within Spain as regards **non-bank** sources of financing - which inhibits portfolio substitutability - our prior is that commercial bank interest rates should have an important role to play in explaining the dynamics of the monetary transmission mechanism. Consider Table B. Bank balance sheet variables comprise over 40% of both the non-bank private sector's total financial assets and their total financial liabilities. The income and substitution effects of deposit and lending rate movements are, by this simplistic arithmetic, immense.

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[16]In this respect, the fact that the commercial bank interest rates used here are those on new operations means that they capture accurately the **marginal** impact of a policy change.

[17]And ones which, to date, have rarely been addressed formally in the context of the macro monetary transmission mechanism. This most likely reflects the paucity of data on commercial bank interest rates.

Table B

SECTORAL BALANCE SHEETS IN 1992; PTAS BNS. (% OF TOTAL)

	Corporate sector		Personal sector	
Total Financial Assets	43,557		69,201	
o/w ALP	11,243	(26%)	40,544	(59%)
Total Financial Liabs.	69,831		35,256	
o/w Bank Credit	24,549	(35%)	18,806	(53%)
Net Financial Balance	-26,274		33,945	
o/w Net Financial Bal. with Banking System	-13,306		21,738	

As regards specification of the borrowing and lending rate reduced-forms, our system imposes a conditioning set not too divorced from that used in Sastre's (1991) structural modelling of these relations. Certainly, the inclusion of official, loan and deposit yields is consistent with Sastre's results; the latter terms reflecting the simultaneity of banks' margins decisions.[18] For these reasons, we expect our bank lending and deposit functions to be reasonably well-specified.[19]

[18]See Sastre (1992) for a theoretical justification, and empirical verification, of such a simultaneity of banks' margins decisions.

[19]One term found important in bank interest rate determination in Sastre, but excluded here, is a measure of long interest rates. This can again be justified by appealing to the largely bank-oriented nature of lending and depositing in Spain, which means that non-bank, longer-term asset yields are unlikely to exert a great deal of leverage.

(c) Exchange Rate Reduced-Form

The reasons for including the exchange rate within our system are threefold; all three are self-evident. First, the exchange rate is an obvious endogenous influence upon policy-setting, in particular since the peseta's ERM membership. Second, in an open economy such as the Spanish one,[20] there will clearly be strong feedbacks - direct and indirect - from the exchange rate onto demand and prices[21]. Third, exchange rate movements may generate portfolio shifts between domestic and foreign assets, with consequent effects upon demand.

Our choice of exchange rate is Spain's nominal effective exchange rate index measured against developed countries. This measure is clearly well-suited to picking up the second and third of the above interactions. Further, during much of the 1980s a weighted exchange rate index - rather than a bilateral DM one - was the measure most closely monitored by the Spanish authorities (see Escriva and Santos (1991)), so our measure of the exchange rate is also useful in the first role.

Regarding specification of the exchange rate reduced-form, existing empirical evidence offers only tentative clues. Meese and Rogoff's (1983) random walk result has proved difficult to dislodge. But by accommodating interest rates, money, output and prices - together with lags of the exchange rate itself - we have a similar conditioning set to that which would be expected from some hybrid sticky price/monetary model of the exchange rate (see, for example, Haache and Townend (1981)).

(d) Money and Credit Reduced-Forms

The potential importance of commercial bank balance sheet variables in the monetary transmission process is well-established. For

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[20]Imports and exports represented 21% and 18% respectively of Spanish GDP in 1992.

[21]Though our measure of activity comprises only domestic demand, and excludes exports and imports.

some of the earliest evidence see Friedman and Schwartz (1963), Sims (1972). The debate regarding the role of money quantities has persisted to date, at both a theoretical (see, inter alia, Bernanke and Blinder (1988), Gertler and Gilchrist (1992)), and empirical level (inter alia, Bernanke and Blinder (1992), Romer and Romer (1990)). Broadly, three strands of the literature have emerged.

The first, dating (at least) from Brunner and Meltzer (1972), has focused upon financial quantities. It asks: do bank assets or bank liabilities - credit or money - offer the larger independent monetary impulse? See, inter alia, Friedman (1983), King (1986), Bernanke and Blinder (1988, 1992) in a US context. The problem here comes in identifying independent money and credit shocks. Commercial banks' balance sheet artificially constrains money and credit to have non-zero covariance. Thus separating their independent effects is problematic. This is evident in the uniformly ambiguous - or conflicting - conclusions reached on the usefulness of money or credit in the empirical literature cited above.

One simple means of obviating this problem is to estimate separately sectoral money and credit responses. The aggregate bank balance sheet constraint is then significantly weakened, both in the short and long run. Thus the artificial collinearity in money and credit responses, which inhibits inference, is lost. This is the approach followed in Gertler and Gilchrist (1992) for the US, using a small firm-large firm distinction, and by Dale and Haldane (1993c) for the UK, using a personal-corporate sector distinction. This approach is followed here also, using a personal-corporate sector split.[22]

As well as being a statistical expedient, sectoral estimation affords economic benefits. Different sectors are known to exhibit differing degrees of asset/liability substitutability. And, following Bernanke and Blinder (1988), we know that the degree of portfolio substitutability helps determine the potency of monetary policy in general, and its money/credit

[22]Though we also estimate an aggregate system, which provides a counterfactual for the sectoral analysis.

mix in particular. So sectoral estimation offers insights into the potentially differing potency of policy across sectors, and the potentially differential channels through which it operates.

Further, the strength of the income effects which operate following an interest rate change depends, inter alia, on the bank asset/liability mix of agents' balance sheets.[23] And balance sheet composition shows marked sectoral differences in Spain. Consider again the evidence from Table B. There is a clear distinction between, on the one hand, persons who hold net assets with the banking system (and positive net financial wealth in aggregate); and, on the other, companies which hold a net liability position with banks (and in total net financial terms also). Thus the income effects of an interest rate change would clearly be expected to differ sectorally in Spain: net positive income effects for persons; and net negative income effects for firms. Demand responses from these sectors will differ accordingly. As shown below, these sectoral differences can prove important when explaining otherwise anomalous aggregate money/credit and output/price behaviour.

The second strand of the money literature has focused upon asset yields - financial prices rather than quantities. Sims (1980) and Litterman and Weiss (1985), and more recently Stock and Watson (1989) and Bernanke and Blinder (1992), have noted that the independent explanatory power of nominal money quantities tends to be absorbed once interest rate measures are incorporated.[24] The inclusion of official and commercial bank interest rates within our system can be seen as a means of testing the robustness of this finding in Spain.[25]

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[23]For a general discussion of this issue see, for example, Economic Unit (1993).

[24]Based upon variance decompositions for output and prices.

[25]Recent studies in the US have also looked to include measures of long rates (see, for example, Bernanke (1990), Bernanke and Blinder (1992)), and commercial paper rates (Stock and Watson (1989), Friedman and Kuttner (1992), Kashyap, Stein and Wilcox (1993)), often measured relative to official rates, as alternative asset yields. In most cases these are found to offer useful leading-indicator information. This is much less likely in a Spanish context, where non-bank auction markets in credit are

Of course, even if money and/or credit were found not to exert an independent monetary stimulus (over, say, asset yields), this would not necessarily argue against their usefulness as intermediate indicators. Provided their relationship with both the instrument and target variables is robust, and in the latter case is leading, then money/credit may still offer a useful guide-post for policy. This is true irrespective of the independent stimulus they provide, as measured by, for example, their contribution to explaining shocks to output and prices (in a variance decomposition). Thus, when considering the role of money and credit and of other intermediate variables, we will consider both the time-series mapping of these variables following a monetary shock (impulse response functions), and their relative explanatory power over final variables (as given by variance decompositions).

Finally, a third strand of the literature has focused upon the shock-absorber role of certain financial assets within monetary "buffer-stock" theories (inter alia, Laidler (1984), Knoester (1979), Milbourne (1988)). The foundations of this analysis lie in disequilibrium models, which stress the importance of non-price, quantitative adjustment when reachieving equilibrium following a disturbance. Inventory models are a frequently cited example.

According to buffer-stock theory, given uncertainty and constraints upon economic activity, it may be attractive for agents to accept short-run positions which are seemingly second-best in order to achieve long-term optimal positions. Far from being irrational, this behaviour represents an optimal decision-making process. Faced with an unceasing flow of news and disturbances, agents do not constantly reassess their economic decisions, but rather allow this disturbance initially to be felt by certain assets and/or liabilities whose characteristics make them suitable to act as buffers. Only when the holdings of these buffers are above or below certain limits are economic decisions taken which correspond to the nature of the disturbance.

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lesser used, both at short (commercial paper), and long (bond) maturities.

It is generally accepted that monetary balances are the most suitable instrument to play the role of buffers, since the adjustment costs of liquid asset holdings are significantly lower than those of other financial or real assets. However, some authors (for example, Milbourne (1988)) point out that credit balances may act simultaneously with, or alternatively to, monetary balances as financial buffers, particularly for firms. We use similar such buffer stock reasoning when interpreting the sectoral analysis reported below.

To summarise, in its use of sectoral money/credit, and its incorporation of commercial bank interest rate data, our system aims to shed light on the three strands of the literature outlined above: the "money versus credit" debate; the "financial prices versus quantities" debate; and the legitimacy of the "buffer-stock" notion. Tangentially, questions of obvious policy - intermediate target - relevance are explored.

On specification of the reduced-form money and credit demand functions, the conditioning set here is well-understood, not least in a Spanish context (see Cabrero, Escriva and Sastre (1992), Vega (1992a, b)). It typically comprises, inter alia, an interest opportunity cost, prices, and output. With all of these variables included (unrestricted) in the system, there is little reason to suspect gross mis-specification of the money/credit reduced-forms.

(e) Output and Price Reduced-Forms

Since they constitute the final goals of policy, the downstream responses of output and prices (and their mix) to a monetary perturbation are of obvious relevance. Of what size, and with what lags, does monetary policy influence demand and prices? More generally, how do financial variables in aggregate mesh with real-side ones during the monetary transmission process?

The questions posed are of both academic and policy significance. At a policy level, they give clues to the effectiveness of policy and its timing - both important in gauging optimal speeds of policy

response. At a theoretical level, they potentially enable us to discriminate between competing theories of monetary policy (in)effectiveness - IS/LM/Monetarist versus Real Business Cycle theory, say (Sims (1992)).

A final note on definition. For the aggregate (personal plus corporate sector) system, we use a measure of total domestic demand comprising both consumption and investment. When moving to the sectoral systems we decompose demand, using consumption as the scale variable for persons, and investment for companies. The construction of the monthly demand series is discussed in the Appendix.

4.- INTERPRETING THE RESULTS

(a) The System

The VARs were estimated using monthly data from 1981:1 to 1992:12, thus covering a twelve-year period spanning the 1980s.[26] The period prior to the 1980s most likely exhibited a much different interest rate transmission process. For example, short-term official interest rates were clearly more volatile - often much more volatile - during the latter half of the 1970s, making their signalling role questionable; and banks' borrowing and deposit rates were regulated during much of the 1970s and some of the 1980s. For these reasons, and for reasons of data availability,[27] the 1970s are not covered here.

The data were seasonally adjusted where appropriate (see Appendix). A preliminary screening using unit-root tests indicated, unsurprisingly, that all the variables were non-stationary. Most appeared

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[26]Though almost all of the results reported are for a system estimated over the period 1983:1 1992:12. The results over the two samples were qualitiatively similar, but were noisier when extended back to the beginning of the 1980s; most probably owing to the endogeneity of the impulse variable (official interest rates) over the earlier period, as suggested in section 3.

[27]Some of the monthly real-side data are only reliably available from 1980; and the quarterly sectoral split of the deposits data begins in 1983.

I(1), the exceptions being aggregate credit (and its split between persons and companies), vehicle registrations, building and equipment investment and consumer prices. All of these variables were on the margins between being I(1) and I(2) processes. Static regressions of the variables used to make up the system indicated valid long-run levels relationships between them.[28] Since the systems therefore appeared to have a well-defined equilibrium, all of the variables were entered in (log) levels.[29] Our system can thus be interpreted as an unrestricted vector error-correction mechanism: a multivariate, dynamic system whose equilibrium is freely estimated.

The shortness of the sample restricted the lag length of the VAR to eight - longer than that used in Bernanke and Blinder (where it was six), but shorter than used in Dale and Haldane (1993c) and Sims (1992) (where it was fourteen).[30] The VAR coefficients themselves are uninteresting and so are not reported. More insightful are the impulse response functions and variance decompositions embedded within the VARs' moving-average representation. It is these which are considered below, starting with the aggregate system and then moving on to consider separately the sectoral responses of persons and firms.[31]

(b) Aggregate Responses

Figure 1 plots the impulse response functions of each of the eight variables listed, with respect to an innovation in the interest rate

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[28]That is, any potential I(2) processes appeared jointly to cointegrate with other I(2) processes in the system to produce an I(1) process, which then itself cointegrated with the other I(1) variables to give a stationary residual.

[29]With interest rates entered as log(1+r/100).

[30]It seems unlikely that changing the lag length would greatly alter the qualitative patterns of the variables.

[31]Because the sectoral systems are estimated separately, we do not accommodate cross-sectoral interactions. Doing this would cause us to run into degrees of freedom problems, which would more than counter-balance any efficiency gain from sector estimation.

residual equivalent to a 1 percentage point rise in official interest rates.[32] The responses are shown over a five-year horizon. The broad measure of money used is the official aggregate ALP, and the domestic demand variable combines consumption and investment. Definitions of the other variables are given in the Appendix. The ordering of the VAR - for orthogonalisation of its reduced-form residuals - is as shown in the diagram: official interest rates; the exchange rate; deposit rates; lending rates; ALP; credit; domestic demand; and prices.[33] Accordingly, shocks to the reduced-form interest rate residual are readily interpretable as monetary policy (reaction function) perturbations. Since the variables are in logs, the impulse responses have the interpretation of cumulative growth rates relative to base (except interest rates, which can be interpreted as percentage point movements relative to base).

In general, the qualitative patterns exhibited by all of the variables following a monetary tightening accord with our priors. An interest rate rise serves to: raise the exchange rate; increase deposit and lending rates in the short-run; depress money and (with a lag) credit growth; and reduce output and prices over the medium term. All of the responses appear to be settling down by the end of the five-year period: the system stabilises, with any cycles of decreasing amplitude.

The responses from the aggregate VAR address a number of issues regarding the dynamics of the interest rate transmission process. But they also pose a number of questions. To see these, consider, in turn, the responses of each of the variables.

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[32]An extension of this work might consider shocks to variables other than official interest rates, such as broad money and credit. But our variance decompositions already offer some partial evidence on the role of these shocks in driving the sectoral dynamics of the system.

[33]Alternative ordering restrictions - with the exchange rate and commercial bank interest rates preceding official rates - did little to alter the qualitative responses of the variables. This is further evidence favouring the (proximate) exogeneity of official interest rates over the sample.

Official interest rates appear to follow a (slowly) mean-reverting process. This is consistent with the results in Sims (1992) and Dale and Haldane (1993c) in a monetary policy context, and with Saunders and Unal (1988) for short-term interest rates more generally. Mean-reversion in official interest rates is consistent with policy being adjusted to offset temporary, randomly distributed, shocks.[34] In our system, initially positive policy responses are offset by a sequence of negative responses after around three years.[35] This latter sequence coincides with the largest (negative) responses from prices and output, indicating the endogenous operation of the reaction function to stabilise the system.

Predictably, the positive response of the exchange rate to a policy shock is both rapid and short-lived: the response is maximised after four months and persists for only eight months. Thereafter, the dynamics of the exchange rate mimic reasonably closely those of official interest rates - as UIP would predict.

The dynamic responses of banks' lending and deposit rates are among the more interesting. As expected, the temporal pattern of these rates is closely related to official rates. But both exhibit a "stickiness": the adjustment in bank interest rates lags that in official rates, and is less large - sometimes much less large - than that in official rates. This inertia in commercial bank interest rates is consistent with a degree of imperfect substitutability between bank and non-bank assets/liabilities (Bernanke and Blinder (1988), Dale and Haldane (1993a)).

The stickiness is particularly evident among deposit rates, the lags on which are longer, and the responses smaller, than those of lending rates. The mean lag in response to an official interest rate change is around four months longer for deposit than for lending interest rates;

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[34]This mean-reversion is the result of our having shocked a nominal variable, which thus has only a transitory impact. It is not inconsistent with official interest rates being I(1) processes in the long run, due to the influence of real shocks.

[35]There is also a small period of negative responses after around one year, the explanation for which is given below.

and the mean responses (measured peak-to-peak) to a 1 percentage point official interest rate change are around 0.25 percentage points for deposit rates, compared to around 0.50 percentage points for lending rates. Part of the explanation for this can be found in the fact that some deposit interest rates were regulated over part of the sample, and were not fully liberalised until 1987.

The differential responses of deposit and lending rates are shown up most clearly when they are entered as a difference term - a proxy for the behaviour of banks' margins. Bank margins are then clearly positively related to official interest rates, rising when rates are raised and narrowing when they fall. The differential dynamics of loan and deposit interest rates have important implications for the way we interpret output/price dynamics in the system - in particular sectorally - because of their contribution to generating the income and substitution effects of interest rate changes.

There is a permanent response from both of the bank balance sheet variables - money and credit - following an official interest rate change. This accords with the empirical evidence in Bernanke and Blinder (1992), Dale and Haldane (1993c) and Sims (1992).[36] But while the steady-state responses of money and credit are congruent, their dynamic paths are not. ALP responses are large and fairly rapid;[37] those in credit, sluggish and, for a time, perverse.[38]

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[36]Part of the explanation for which can be found in the similarly permanent effect upon prices. So real monies need not be affected in steady-state; though Bernanke and Blinder's (1992) results indicated a permanent effect from real monies also.

[37]The large short-run response from ALP is consistent with the results from structural models of deposit determination in Spain; it derives from the behaviour of interest-sensitive agents in response to sticky deposit rates.

[38]These patterns are robust to changes in the definition of the broad money aggregate. Both wider (ALP2) and narrower measures of liquidity gave similar patterns, though the perversity in the credit response was then less lengthy.

The relatively greater sluggishness of aggregate credit can be given a straightforward institutional explanation. Loans and deposits of sufficiently long maturity can be likened to contractual agreements, the termination of which can only occur with time.[39] Since there is a maturity mismatch between the asset and liability structure of banks' balance sheets in Spain - bank assets are, on average, of longer maturity than their liabilities - there is a relatively less speedy response from bank assets than from liabilities following a policy shock.[40]

But the above still leaves unresolved a number of issues. What **behaviourally** underlies this price/quantity split of money/credit responses? And what explains the perversity of the aggregate credit response in the short run?

The demand responses are the least well-defined, so conclusions are more tentative. But the general pattern is of a short-run response in demand - occurring between around ten and seventeen months - followed by a larger, more protracted response from around twenty months onwards, which peaks after around 3 1/2 years.[41] A notably similar two-cycle response is evident in prices and, correspondingly, in official interest rates via the reaction function. So what explains this two-cycle response in output/prices?

Other aspects of the demand response are more Neoclassical. Demand is returning to base by the end of the five-year horizon. The freely estimated model thus appears to generate naturally a long-run

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[39]Or by paying a punitive penalty cost.

[40]Bernanke and Blinder (1992) use a similar contractual argument to explain the sluggishness of credit responses to an interest rate shock in the US.

[41]Disaggregation of demand gave quite contrasting responses: consumption a small and temporary response; investment - construction investment in particular - a larger, permanent response. These differential responses are returned to below in the context of the sectoral system.

neutrality (vertical aggregate supply) condition.[42] The commonality of dynamic demand and price responses suggests, however, the operation of a non-vertical aggregate supply curve in the short-run. Indeed, monetary policy in the system appears to "work" precisely by moving the economy up and down such a non-vertical aggregate supply curve. From a theoretical perspective, therefore, these results are more easily explained in an IS/LM world, than in one where only real shocks matter.

The response of prices is consistently negative throughout. Notably, the price response exhibits few signs of the perversity which has been found in other recent studies of the monetary transmission mechanism in developed countries (Sims (1992), Dale and Haldane (1993c)).[43]

Since it comprises financial prices and quantities, taken on both sides of the banks' balance sheet, our aggregate system should be well-placed to offer information on two of the debates alluded to in section 3: the "financial prices versus quantities" debate; and the "money versus credit" debate.[44] Variance decompositions offer a potentially useful means of arbitrating on both these issues. Since they are compiled using orthogonalised innovations, they allow for more efficient inference than standard (non-orthogonalised) Granger-causality tests. Table 1 gives a variance decomposition of the intermediate and target variables - money, credit, demand and prices - in terms of the other variables in the aggregate VAR system. In line with the impulse responses, the results are shown at a five-year horizon.

On the financial prices versus quantities issue, the evidence from Table 1 is equivocal: neither financial prices nor quantities appear consistently to dominate when accounting for money/credit and/or output/price dynamics. This is at odds with the existing literature, which

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[42]The type of which is imposed directly as an identifying restriction in Blanchard and Quah (1988).

[43]One caveat: the first period price response is positive. Estimating the model back to 1981 leads to a lengthier perversity in price response; but even then, this does not extend beyond five months.

[44]The third issue - the buffer-stock notion - is returned to below.

has tended to favour financial prices. And Table 1 raises other questions. Why is so small a role played by official interest rates in the aggregate system and, more surprisingly still, so significant a role played by deposit rates?

On the money versus credit issue, the evidence from Table 1 is less murky: a clear preference for money over credit is suggested from the variance decomposition, whether using money prices or money quantities.[45] But money and credit are thought useful primarily as intermediate indicators, rather than as independent sources of shocks.[46] Impulse response functions are better-suited to assessing the usefulness of a variable in the former - intermediate indicator - role. Unfortunately, taken by themselves, the impulse responses from the aggregate system make the choice between money and credit unclear. For example, while money initially exhibits the speedier (non-perverse) response - and thus better explains demand's short-run movement - the peaks in output after 3 1/2 years are more obviously preceded by the peaks in credit than those in money.[47] In general, impulse response evidence is ambiguous. So is it money or credit (or both, or neither) which offers the better intermediate indicator of output and prices?

These ambiguous results on the respective roles of money versus credit are of course commonplace in the literature to date. They derive primarily from the high collinearity between aggregate money and credit. Our aggregate system offers little additional insight into these debates. But - as with the other questions posed by the aggregate system - sectoral estimation does.

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[45]This result is, moreover, insensitive to reordering: placing deposit prices or quantities after their credit counterparts in the ordering leaves this conclusion intact.

[46]Indeed, a prevalence of independent shocks may argue against a variable as an intermediate indicator.

[47]Again, this is as found in Bernanke and Blinder (1992) - a result which leads them to conclude, tentatively, that credit may exert greater leverage over final variables than money.

(c) Sectoral Responses

Figures 2 and 3 plot the responses of sectoral money, credit and output and prices to the same 1 percentage point shock to the reaction function residuals, for the personal and corporate sectors.[48] The sectoral decomposition of the money and credit data is described in more detail in the Appendix. Consumption was used as the scale variable for the personal sector, and (equipment plus construction) investment as the scale variable for corporates; again, definitions in the Appendix. Ideally, bank borrowing and lending rates would be included on a disaggregated basis, since these will be certain to differ across sectors. But, given the duality characteristic of equilibrium in all markets, our sectoral measures of money and credit should in any case yield equivalent information to sectoral deposit and lending rates.[49]

Marked differences in the sectoral responses are evident from Figures 2 and 3. Theoretically, this is as we would expect. Perhaps the most notable general difference in responses is their longevity. For persons, the effects of an interest rate rise appear fleeting and transient: by the end of the five-year horizon the responses of all of the variables have returned - at least proximately - to base. By contrast, the corporate sector VAR generates a significantly larger and permanent response from all of the variables. Evidently, then, it is the behaviour of the company sector, rather than of persons, which underpins the medium-term behaviour of the intermediate and target variables in the aggregate system. The interest rate transmission mechanism appears much the more potent -with respect to money, credit, output and prices- for companies than for persons.

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[48]Since official interest rates, the exchange rate, and deposit and lending interest rates are common across the two sectoral systems, their responses are not shown. In almost all cases - the exchange rate being the exception - these variables exhibited similar patterns to those shown in Figure 1.

[49]Also missing from our sectoral system is some measure of aggregate income, which might be legitimately included, for example, in the consumption function. But the inclusion of financial wealth - a proxy for permanent income - means that this is probably not a serious shortfall.

The money and credit responses of the two sectors are markedly at odds. Persons exhibit a strong, but short-lived, response from credit, together with a more muted response from deposits. While for companies the reverse is true: a strong and rapid money response, together with a sluggish - and initially perverse - credit response. Clearly, then, it is the behaviour of companies which generates the short-run perversity of credit in the aggregate system. Reassuringly, a similar such short-run perversity in corporate credit is found in Dale and Haldane (1993c) for the UK, and in Gertler and Gilchrist (1992) for the US. The explanation used there is that the corporate sector uses **net** money holdings as a buffer stock. The cashflow shortfall resulting from a monetary contraction is met, in the short-run, by companies accruing liabilities (distress borrowing) and/or by liquidating assets (reducing deposits). So credit rises and deposits fall in the short run. The financial behaviour of firms within our model thus accords relatively closely with "buffer-stock" theories of optimal adjustment in the face of (monetary) disturbances.

The sectoral demand and price responses are likewise different. For persons, the effects upon consumption - although poorly defined - have disappeared completely after two years; while the price response is maximised after around twelve months and has been lost completely after four years. By contrast, the demand response of companies is more sustained, beginning to dissipate only after three years and remaining permanent even after five years; while the price response is similarly more protracted, the negative effects only fading after four years and the effect again permanent.

These results are consistent with those found for other countries (see Economic Unit (1993) for a survey). Direct interest rate effects upon consumption are generally found to be small[50] - as found here for Spain. While the interest rate elasticity of investment - construction investment in particular - is generally found to be larger and

[50]Though our system precludes the operation of indirect effects via **non-financial** wealth, which are sometimes found to be important.

more persistent. Replacing total with construction investment in our system generates just this conclusion.

These distinct sectoral output/price dynamics provide one explanation for the two-cycle in output and prices observed from the aggregate system. The initially strong negative effect upon output/prices reflects the responses from the personal (consumption) and corporate (investment) sectors working in tandem; the latter - more muted - response, the effects from investment alone, offset partly by the small positive effects from consumption. Without a sectoral breakdown, this two-cycle in output/prices would have remained anomalous.

But this still leaves open the question of what, behaviourally, accounts for these separate, sectoral responses in money/credit and output/prices. Consider first families. For persons, the effect of an official interest rate rise is felt first by loan interest rates - these being the fastest and largest to react. As borrowing rates rise, credit demand is choked-off: there is a substitution effect. This occurs (quickly and powerfully) because persons, invariably, are unable to access alternative (to bank) sources of finance: see Table B. Credit offers no buffer of liquidity for persons since most of their borrowing is on fixed terms (for example, mortgages), thereby allowing little latitude. The large, short-run negative response of lending is consistent with this well-documented "specialness" of bank lending for the less-substitutable sector. The contraction in credit, in turn, then feeds into expenditure, which is depressed in the short run.[51]

With a lag, deposit rates begin also to adjust. As these adjust, income effects come into play: income streams on personal sector assets rise. In the medium-term, these income effects dominate the initial substitution effects arising from the interest rate rise: spending, deposits and credit all increase. The primary reason for this dominance of the income effect is the composition of the personal sector's balance sheet.

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[51]This short-run transmission from credit to spending is shown up particularly clearly when vehicle registrations - a good proxy for durables spending - is used as the scale variable.

Bank credit to families is only around 46% of personal sector deposits;[52] persons have a net positive asset position with the banking system. The resulting net positive income effects result in only a small negative short-run (substitution) effect from personal sector expenditure, and a perverse medium-term (income effect) impact.

Variance decompositions for the personal sector strongly corroborate this story. Table 2 reports a breakdown of the forecast error variance, five-years-ahead, of personal sector deposits and lending, consumption and prices. Two features are notable. First, the dominant role played by deposit interest rates in driving the system - the product of the personal sector's net positive balance sheet position with the banking system and the pervasive income effects which result.[53] For example, deposit interest rates account for 40% or more of money and credit variation, and between 10-25% of output and price variation. Second, observe the relatively more powerful influence exerted by credit versus money - the product of credit's "specialness" for persons. Both these results are consistent with the above account of the personal sector interest rate transmission mechanism.

For companies, the implied interest rate transmission mechanism is much different. As official rates rise and cashflow contracts, firms borrow in the short run and run-down deposits. That is, they use their net position with the banking system as a buffer. The deposit response is assisted by the sluggish upwards adjustment of deposit rates, which provides companies - able, unlike persons, to access other assets - with an incentive to switch their portfolios out of deposits. The perverse credit response is facilitated by the fact that much borrowing by firms is on non-fixed, non-contractual terms - for example, via overdrafts - thus allowing firms greater financial latitude in the short run. These short-run responses accord with a buffer-stock theory of money/credit adjustment.

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[52] Again, see Table B.

[53] This also helps account for the strong role played by deposit interest rates as an independent source of shocks in the aggregate system.

Over the medium term, the substitution effects of the rise in loan rates take hold. Credit, and with it investment, both contract. That they continue to contract over a protracted period compared to persons again reflects the effects of balance sheet composition. Corporate sector deposits are less than half company borrowing from banks. Thus income effects are negative and serve to augment - rather than offset - substitution effects following an interest rate change. The net debit position of the corporate sector with respect to the banking system generates a relatively more potent interest rate transmission channel for firms.

Variance decompositions are again supportive of the above story: see Table 3. The most notable feature is the increased importance attaching to official interest rates - over, say, deposit rates - in driving the dynamics of the system. One anomaly from the aggregate system was precisely that official rates played so limited a role. But for firms, official rates account for around 30% of the variance of (sectoral) bank balance sheet variables, 18% of demand's variance, and almost 40% of price variation. The explanation for this result is twofold.

First, as for families, there is a balance sheet composition effect: net debtors (companies) will be relatively more affected by changes in official and credit interest rates;[54] net creditors (persons) relatively more by effects from deposit interest rate changes. Second, there may be an influence from imperfect substitutability. The higher degree of substitutability between bank and non-bank credit for companies means that the loan rates they face are more closely aligned with official rates. Accordingly, changes in official interest rates are a good summary measure of the marginal change in firms' monetary stance (see Dale and Haldane (1993c), who also find evidence of this for the UK). This is less true of persons, for whom changes in official interest rates are a poorer proxy of the marginal change in the monetary conditions they face.

[54]Notably from Table 3, credit interest rates play a much more significant role than do deposit rates - the obverse of that found for persons.

Having outlined some of the behaviourial interactions among financial and non-financial prices and quantities in the system, it is natural to ask what additional insights our sectoral estimates provide on the "money versus credit" and "financial price versus quantity" debates. Recall, the aggregate system did little to enlighten these debates.

On the prices versus quantities issue, consideration of Tables 2 and 3 clearly leads us to prefer financial prices over quantities when accounting for the dynamics of intermediate and target variables. For example, the cumulative contribution of interest rates in explaining the variance of prices is 53% for firms and 37% for persons, compared to 12% and 27% respectively for financial quantities. This accords with existing empirical evidence. Less in accordance with existing evidence - but in line with the above - is the fact that different financial prices appear to drive different sectoral systems: deposit interest rates for persons; official and credit interest rates for firms. The reasons for this - balance sheet composition - were outlined above. Such sectoral differences were obscured by the aggregate system which, as a result, blurred the distinction between the relative contributions of prices and quantities.

The dominance of financial prices in the variance decompositions leads us naturally to conclude that nominal financial quantities in general play a more passive - or reactive - role in the system than do financial prices. This can be interpreted as evidence against strong (quantity) rationing effects with respect to, for example, bank credit. That rationing which does occur, appears to do so primarily by price.[55]

On the money versus credit issue, the sectoral impulse response functions also provide a clearer picture than did the aggregate system. For persons, the time-series responses of credit accord much the

[55]And those cases where shocks to nominal quantities do exercise some leverage occur primarily for the (less-substitutable) personal sector, for whom quantity rationing effects would be expected to be more prevalent.

more closely with demand than those of money[56] - consistent with the "specialness" of bank credit for this sector. While for firms, there is evidence of money displaying the more accurate and timely pattern with respect to investment dynamics: the peak response from credit lags that in investment. The buffer-stock interpretation put upon corporate sector money and credit responses means, however, that the short-run relationship of both with demand and prices is blurred.

5.- CONCLUSIONS

We have estimated a monthly, sectoral Vector AutoRegressive model of the interest rate transmission mechanism in Spain during the 1980s. On the basis of this, the main conclusions we would draw are:

(a) Our results support the case for a relatively disaggregated approach to considering the monetary transmission process. For example, the estimation of separate, sectoral channels of monetary transmission helped resolve some of the puzzles which otherwise emerged when considering the aggregate monetary transmission process. By combining the corporate/personal sector, and financial price/quantity disaggregations, a plausible account can be given of the underlying forces which shape output/price responses following an interest rate shock.

(b) The analysis suggests that the dominant channel through which monetary policy "works" is via its effect upon corporate sector investment. The consumption demand response of the personal sector is, by comparison, weak and transient. Underpinning these differences in demand response are sectoral differences in balance sheet composition. For firms, their net debit position with respect to the banking system means that the substitution effects of an interest rate change are augmented by negative income effects - thus generating a relatively more potent effect from monetary policy. For families, their net asset position with banks gives rise to income effects which offset the substitution effect - thereby generating shorter-lived, weaker effects from interest rates.

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[56] In particular, with vehicle registrations as the scale variable.

(c) Finally, our model highlighted significant sectoral differences in the behaviour of bank balance sheet variables. For firms, for whom substitutability between assets/liabilities is higher, a buffer-stock interpretation can be given to money and credit responses. For the less-substitutable personal sector, such buffer mechanisms are typically less-present. There is thus more limited scope for perverse responses from, in particular, personal sector credit - consistent with the well-documented "specialness" of credit for households.

APPENDIX

APPENDIX: DATA CONSTRUCTION AND TRANSFORMATION

Official Interest Rates: are given by the Banco de España's marginal intervention rate at its 10-day auction in government securities. The interest rate is a monthly average of daily data, constructed using the criteria defined in Escriva and Santos (1991). Source: Banco de España, Boletin Estadistico, Table 20.1.

Exchange Rate: Spain's nominal effective exchange rate measured relative to developed countries. The data are monthly averages of daily observations, and have been rebased to 1990=100. Source: Banco de España, Boletin Estadistico, Table 19.22.

Adjusted Bank Reserves: are the same series used in Escriva and Santos (1991), and as discussed in more detail in Mauleon, Perez and Sanz (1986). That is, bank reserves adjusted for changes in, inter alia, reserve requirement ratios and the definition of eligible liabilities; they are seasonally adjusted (using X-11 ARIMA). The series ends in 1987.

Commercial Bank (Deposit and Lending) Interest Rates: are the ones used in Sastre (1991). Broadly, the data are weighted averages of the marginal interest rates - that is, the interest rates on new operations - on different classes of loans and deposits held by banks and savings banks. The weights are given by the balance sheet shares of each class of instrument. Source: Banco de España, Boletin Estadistico, Tables 5.71 and 5.72.

Financial Quantities: ALP and ALP2 - the two official broad measures of private sector liquidity - are as defined in Banco de España, Boletin Economico, Table 6; they are seasonally adjusted.

The split of deposits between persons and firms is made on the basis of a narrower measure of liquidity. This comprises deposits, repos and participaciones de activo held by families and firms (other financial institutions are excluded) at the deposit institutions (banks, savings banks and cooperative banks). This narrower measure of liquidity

constituted around 80% of ALP during 1992; it was seasonally adjusted using X-11 ARIMA. The sectoral decomposition of this aggregate was achieved by interpolating the quarterly sectoral split between families and firms, and then by applying the resulting proportions to the aggregate monthly deposit data.

Total credit to families and firms is as given in Banco de España, Boletin Economico, Table 13; it is seasonally adjusted. The sectoral split of this aggregate between families and firms was achieved using the same procedure as used above for deposits.

Prices: Consumer prices are as given in Banco de España, Boletin Estadistico, Table 25.1; they have been seasonally adjusted using X-11 ARIMA and rebased to 1990=100.

Real Domestic Demand: The aggregate measures of consumption and investment were calculated by interpolation of the respective quarterly National Accounts series, using as indicators of the monthly patterns: output of consumer goods for total consumption; output of investment goods for equipment investment; and cement consumption for construction investment. Equipment and construction investment added together provided our measure of gross fixed capital formation; total demand being the sum of this and consumption.

Of the monthly indicators, the total industrial production index, and its split into consumption and investment goods, is as given in Table 23.1 of Banco de España, Boletin Estadistico. These indexes are rebased to 1990=100 and were seasonally adjusted. Cement consumption is given in Table 23.10 of the Boletin Estadistico. The number of new vehicle registrations - a good proxy for durables consumption - was also used as a scale variable for persons' consumption; it is as given in Table 23.12 of the Boletin Estadistico. Both of the latter two series were indexed, based to 1990=100 and seasonally adjusted.

TABLES

Table 1: **Variance Decomposition of Deposits, Credit, Output and Prices for the Aggregate System at a five-year horizon; %**

		Official Interest Rates	Exchange Rate	Deposit Interest Rates	Credit Interest Rates	Deposits	Credit	Output	Prices	Total[1]
Variance Decomposition of:	Deposits	10	11	37	1	30	4	2	5	100
	Credit	6	15	33	3	29	3	2	10	100
	Output	8	10	11	4	11	7	38	13	100
	Prices	10	9	32	2	23	6	2	16	100

[1] Rows may not sum exactly due to rounding.

Table 2: **Variance Decomposition of Deposits, Credit, Consumption and Prices for the Personal Sector at a five-year horizon; %**

		Official Interest Rates	Exchange Rate	Deposit Interest Rates	Credit Interest Rates	Deposits	Credit	Consumption	Prices	Total[1]
Variance Decomposition of:	Deposits	6	4	40	10	9	19	8	4	100
	Credit	2	4	46	10	2	22	9	5	100
	Consumptio	4	6	10	7	12	8	44	8	100
	Prices	10	8	25	11	7	20	5	13	100

[1] Rows may not sum exactly due to rounding.

Table 3: **Variance Decomposition of Deposits, Credit, Investment and Prices for the Corporate Sector at a five-year horizon; %**

		Official Interest Rates	Exchange Rate	Deposit Interest Rates	Credit Interest Rates	Deposits	Credit	Investment	Prices	Total[1]
Variance Decomposition of:	Deposits	27	6	3	13	18	3	26	3	100
	Credit	31	7	2	8	15	4	32	1	100
	Investment	18	9	2	8	8	4	41	9	100
	Prices	39	3	5	9	10	2	27	5	100

[1] Rows may not sum exactly due to rounding.

CHARTS

Chart 1

IMPULSE RESPONSE FUNCTIONS FOR AGGREGATE SISTEM

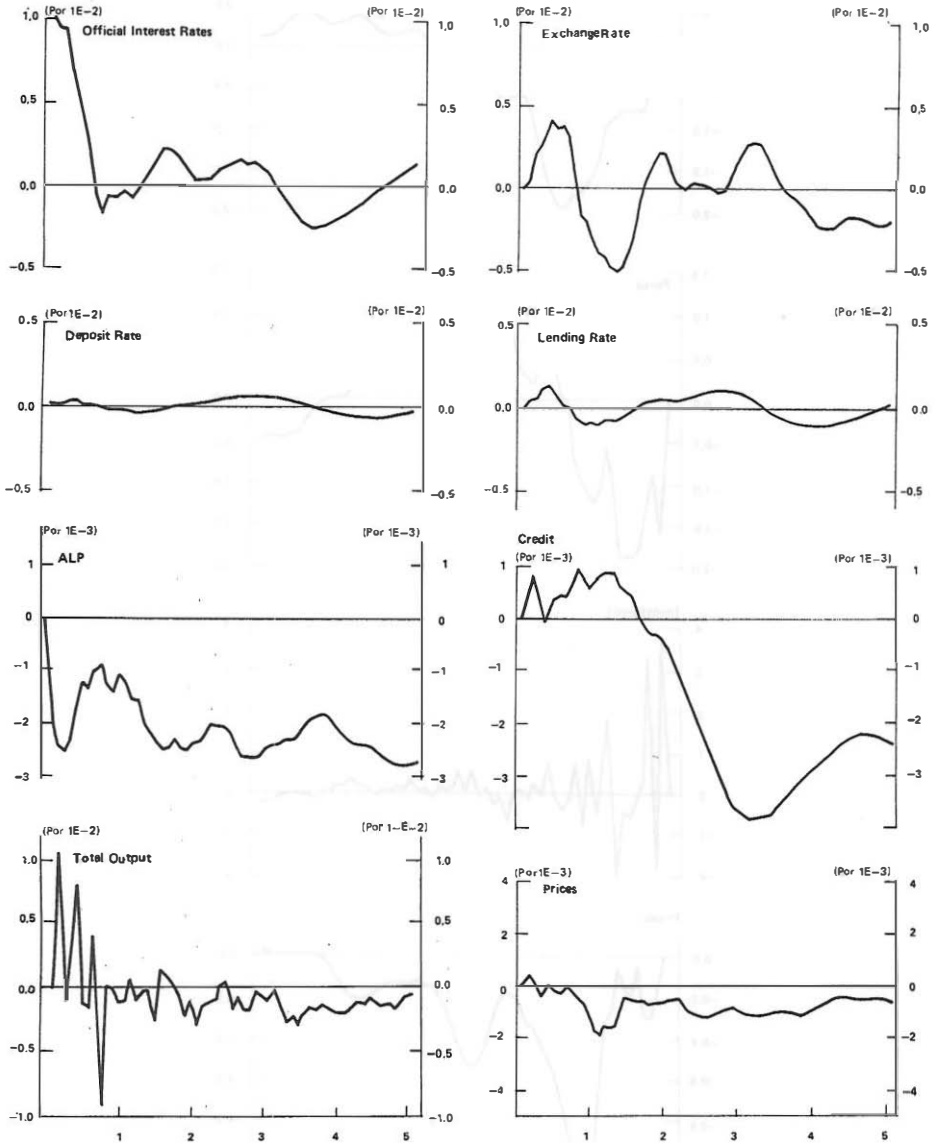


Chart 2

IMPULSE RESPONSE FUNCTIONS FOR PERSONAL SECTOR

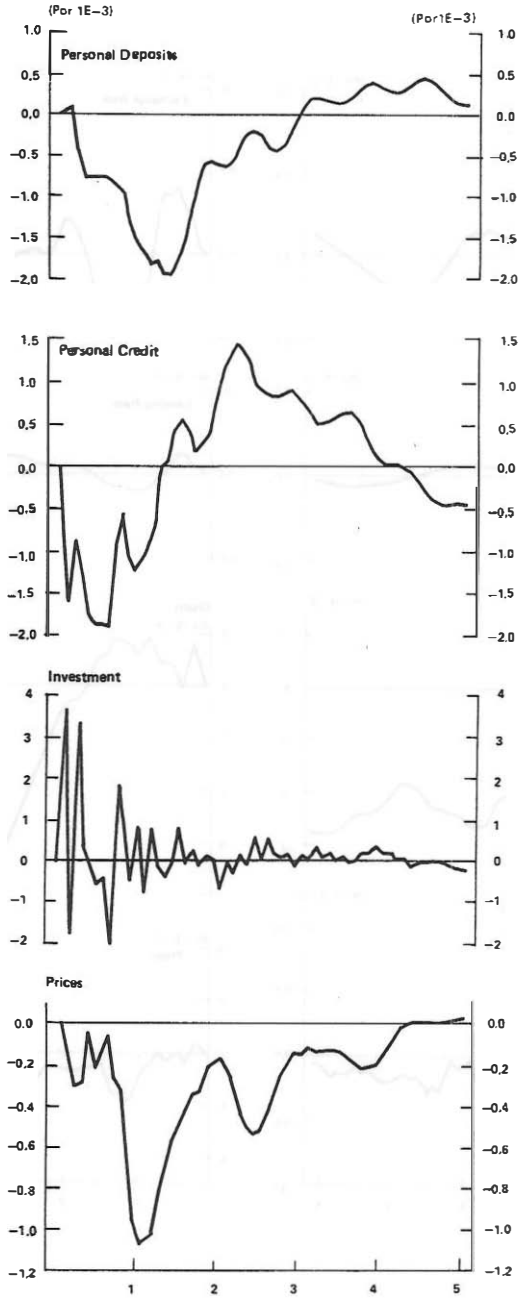
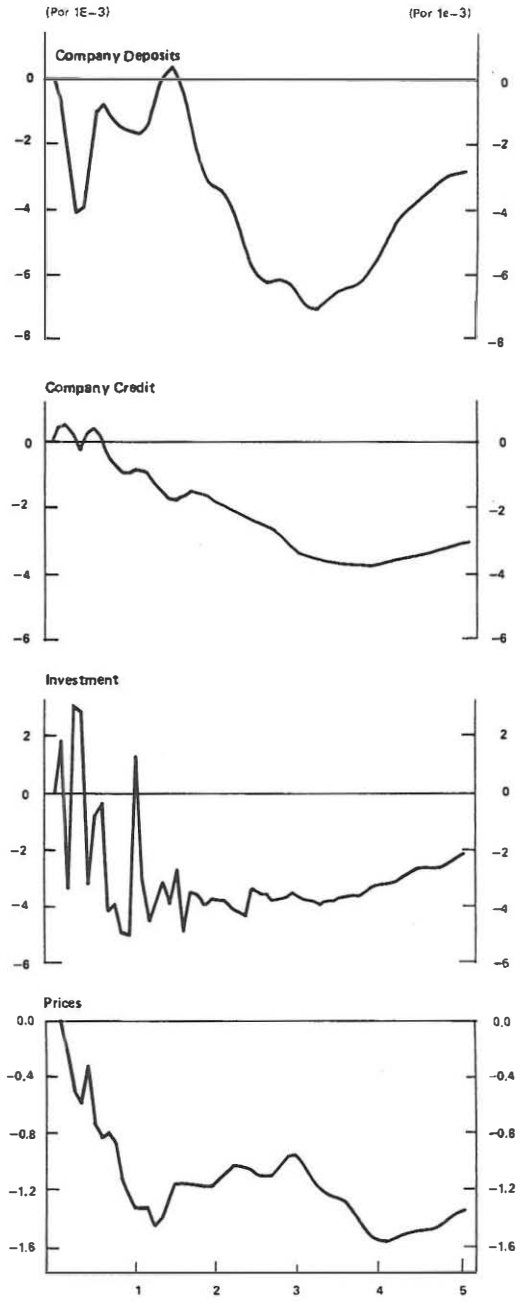


Chart 3

IMPULSE RESPONSE FUNCTIONS FOR COMPANY SECTOR



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