Other financial corporations: Cinderella or ugly sister of empirical monetary economics?

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Abstract

This paper reports estimates of an econometric model of the determinants of OFCs' broad money holding and M4 lending to OFCs. This is of interest both as providing information about a component of UK money and credit aggregates and because it provides some evidence of the link between financial activity and growth of the real economy. We model the long-run equilibria for money holding and lending to this sector as being driven by GDP, wealth, the return to financial services and various interest spreads. The dynamics of OFCs' money and lending are shown to be interdependent. We then consider the evidence for interactions between OFCs and other sectors. Our results indicate that M4 lending to OFCs is significantly related to aggregate investment in the long run, but is largely unrelated to the spending of households.

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Summary

UK monetary data are typically analysed at the sectoral level, as it has been found easier to identify stable money demand functions for households and for 'private non-financial corporations' (PNFCs) than for the private sector as a whole. This is at least in part because the behaviour of 'other financial corporations' (OFCs) has been hard to explain and fairly volatile. As a result there are few studies of OFCs even though they hold a significant component of the broad money stock. There is also a question of relevance for monetary policy makers here. OFCs' money holdings and borrowing have grown rapidly in recent years and it is important to understand whether this has any consequences for aggregate demand and ultimately for inflation.

This paper offers an empirical analysis of the determinants of OFCs' money holding. It does so in a framework in which OFCs' sterling borrowing from the banking system is modelled simultaneously. Both OFCs' money holdings and bank borrowings are shown to be cointegrated with a common set of driving variables. These cointegrating equations could be interpreted as evidence of stable long-run OFCs' money demand and credit demand relationships.

The long-run relationships identified perhaps add to the literature on the links between financial activity and economic growth. But the main point of this analysis, that is of potential relevance for monetary policy, is to test whether links can be identified between OFCs' money and borrowing and UK aggregate demand. We use models of household and PNFC behaviour (developed by us elsewhere) to test for linkages from OFC money and borrowing to consumption and investment.

The main results are that there is no detectable relationship between OFCs' money and borrowing and consumption, but there does appear to be a long-run relationship between OFCs' borrowing and aggregate investment. This could be because some OFCs borrow in order to buy capital equipment, which is then leased to PNFCs. Or it could be that OFCs provide financial services to PNFCs which make them better able to invest (for example, by lowering the cost of capital as suggested in the finance and growth literature). This implies that there may be a link from OFCs' financial behaviour to aggregate demand and inflation via investment and so it would be dangerous to ignore OFCs entirely. However, only a study of OFCs' behaviour at a disaggregated level will be able to distinguish whether this link is via leasing companies or whether there is a more general influence of financial firms on the investment behaviour of PNFCs. This remains for future work.

1. Introduction

The other financial corporations (OFCs) sector of the UK monetary system could legitimately be described either as the Cinderella or the ugly sister of empirical work on sectoral monetary aggregates. Excluded from serious consideration while the other sectors have received much attention from monetary economists, they certainly resemble Cinderella. But they also have characteristics of an 'ugly' sister, so far as modelling their economic behaviour is concerned. Few empirical economists have made a serious attempt to apply conventional econometric analysis to this sector,[(1)] and for good reason—despite much effort, the shoe does not appear to fit.

Barefoot or not, OFCs have certainly been having a ball. Chart 1 shows that the rapid growth of both OFCs' M4 deposits and M4 lending to OFCs in the second half of the 1990s, and the equally rapid slowdown that appeared in 1998-99, have been two of the most notable features in the UK monetary data. The rapid growth and subsequent slowdown created difficulties for monetary policy makers, as it was not clear what weight should be given to OFCs' money and lending growth in the assessment of inflation prospects. It was not even clear that the behaviour of the sector could be modelled, as the activities of the other principal non-bank sectors have been (*cf* Brigden and Mizen (1999) and Chrystal and Mizen (2001)).

Interest in the growth of OFCs does not stem only from the needs of monetary policy makers to interpret data on monetary aggregates. There is also a long-running and extensive literature on the links between financial activity and economic growth. This goes back at least as far as Gurley and Shaw (1955) and was further stimulated by Goldsmith (1969). Arestis and Demetriades (1997) and Levine (1997) provide surveys of the literature. Some recent work has pointed out the potential links from financial development to economic growth via the effects of cheaper financial intermediation that lower the cost of external finance for firms (Harrison, Sussman and Zeira (1999); Khan (1999); Levine, Loayza and Beck (2000)).

The current study is not primarily addressed to the issue of the effects of finance on growth. Rather, it is motivated by an attempt to identify whether OFCs' money and credit are linked to aggregate demand in the short to medium term. However, this study provides empirical evidence on how OFCs' growth is linked to growth of GDP and wealth. We do not attempt to establish any clear direction of causation between OFCs and GDP growth, indeed we find that real GDP can be treated as exogenous to OFCs. We do, however, provide some evidence for the United Kingdom showing that growth of OFCs' liabilities is positively related to aggregate investment. This is consistent with there being a positive relationship between financial activity and real economic growth, but the direction of causation is uncertain.

Two key questions form the main focus of this paper. First, can we explain OFCs' money holding and bank borrowing by estimating an explicit econometric model of their behaviour?

[(1)] One notable exception is Thomas (1997a, b). His work includes OFCs' money but excludes credit from consideration. Drake and Chrystal (1994, 1997) and Barr and Cuthbertson (1989, 1991) study personal and corporate sector money demand but avoid OFCs' money. Barr and Cuthbertson (1992) do study OFCs' asset allocation but they do not distinguish 'money' from other liquid assets and do not consider debt at all.

And, second, can we use this model to test whether the growth of OFCs' money and credit is linked in any way to the spending of sectors that determine the major components of private domestic demand in the economy? We show that the first question can be answered in the affirmative. In answer to the second question, as noted above, we find some evidence of a link between lending to OFCs and aggregate investment. The interpretation of this is open to debate, but it is possible that we have uncovered a channel through which OFCs influence aggregate demand, which could throw doubt on the argument that OFCs (or at least some subset of OFCs) can safely be ignored in the assessment of monetary conditions.

The paper is organised as follows. Section 2 discusses some background issues. Section 3 reviews the econometric modelling approach in preparation for Section 4, which contains a model of a structural VAR for the OFC sector, explaining both real money holding and bank credit. Section 5 then explores whether there are any linkages between OFCs, households and firms. Section 6 concludes and suggests some potential policy implications.

2. What do OFCs do and why might they matter?

The business of OFCs is financial and intangible and this makes them rather different from private non-financial corporations (PNFCs) and households (HHs), whose spending decisions have an obvious influence on demand for goods and services through investment, intermediate goods demand and final consumption decisions. OFCs, in contrast, are non-bank financial institutions such as pension funds, life insurance companies, securities dealers, leasing companies and investment trusts. These institutions generally manage savings, provide financial services, or trade in financial markets on their own behalf. Pension funds, life assurance companies and investment trusts manage long-term savings, while securities dealers typically take shorter-term financial positions.

Of course OFCs do invest in their own buildings and infrastructure, such as computers, and they do employ people, thereby generating incomes and other components of value added. A subset of OFCs' business is directly related to real activity as leasing companies buy capital equipment directly to lease to PNFCs. However, it is possible that the main channel for OFCs' activity to affect the real economy is through indirect financial linkages with *other* sectors that enable firms or households to change their spending patterns, such as by lowering the cost of finance.

It would clearly be possible to define money and credit aggregates so that OFCs disappeared entirely as an independent sector. Suppose, for example, that OFCs were classified as monetary and financial institutions (MFIs) along with banks and building societies. Interbank (and building society) deposits and lending are netted out of the data in construction of money stock and lending data, so OFCs' deposit holding and bank credit would disappear entirely from the aggregate monetary statistics (though some household and PNFC deposits and loans with OFCs would need to be added). Would this matter, or could the financial activities of OFCs be removed from the data without compromising the information content of relevance to real activity and inflation? We cannot be sure, but it seems likely that the more that OFCs' activity links with PNFCs and HHs (rather than just with banks and other OFCs) the greater is likely to be the impact of OFCs' activities on spending and inflation.

We now discuss further what it is that OFCs do, in order to form a hypothesis about the types of variable that might explain their growth. OFCs provide a mixture of financial services to the household and corporate sectors. Some of these activities involve portfolio management that is driven primarily by scale (gross financial wealth) and relative returns to different types of financial assets. Other activities of OFCs involve the provision of different types of non-bank finance directly secured on invoices receivable or indirectly arranged through bond or equity finance. Money holding and bank borrowing are used to facilitate this business and are positively related to the scale of the provision of financial services that might be measured by the return to, or the value added of, financial institutions, or by the gearing that they adopt in their operations.

Two further points are worth noting. First, money holding and bank borrowing within the sector appear to have been undertaken by different types of OFC. Unlike other sectors, where the same firms and households may simultaneously hold money balances and borrow to finance real expenditure, it is not generally the case that the same OFCs hold significant positive real money balances and borrow from banks. Life insurance companies and pension funds, for example, hold money on deposit but they do not take on significant bank borrowings, while leasing companies borrow from banks but do not hold substantial money balances. At the end of 1999, within the OFC sector, the life insurance companies and pension funds held 40% of OFCs' sterling bank deposits but only 10% of sterling bank lending, while leasing companies held 27% of bank lending but only 3% of deposits. Securities dealers held 18% of OFCs' sterling deposits, and 23% of the lending.

None of this prevents us from estimating aggregate money demand and borrowing equations as a simultaneous system if both sides of OFCs' balance sheets are driven by a common set of forcing variables. Indeed, the expansion of financial services in general is likely both to be driven by and contribute to the growth of real economic activity. We provide evidence that, although the real money holdings of the sector and bank borrowing are mainly undertaken by different OFCs, the equations are related to an overlapping set of forcing variables. Indeed, functional separation of institutions may provide a case for treating the sector in aggregate, rather than opting for further disaggregation.[(2)]

Second, OFCs tend to hold mainly wholesale deposits, and these have historically been the most volatile components of the broad money aggregates. Chart 1 shows that OFCs' M4 has been the most variable of the three sectors' money balances, and that for most of the 1990s M4 lending to OFCs grew faster than lending to either of the other two sectors. One influence may be that OFCs' M4 deposits and M4 lending grew significantly after the inception of the repo market, as some OFCs acted as counterparties in the asset and liability management of banks. Chart 2 demonstrates that M4, excluding OFCs' M4 holdings, has a more stable velocity than M4 itself, with a less pronounced downward trend since 1994. By studying OFCs' financial behaviour and its links with aggregate demand, we may be able to ascertain whether any information would be lost by ignoring this sector entirely in the assessment of monetary conditions. The next section outlines the econometric approach adopted to answer these questions.

[(2)] In any event data limitations do not permit a disaggregation between further categories of OFC for the full period of the current study.

3. The econometric modelling approach

The econometric model adopted for the OFCs sector is based on the 'Encompassing the VAR' approach described by Hendry and Mizon (1993), Hendry (1995) and Hoffman and Rasche (1996). The first step involves the estimation of an unconditional q-th order VAR over a sample t =1, 2, ...T, where the index, i, indicates that the model is estimated for sector i:

$$\Pi(L)z_{it} = e_{it} \qquad \textbf{(1)}$$

where z_{it} is a vector of p variables, $\Pi(L) = I - \sum_{j=1}^{q} \Pi_j (L^j)$ is a q-th order lag polynomial and e_{it} is a p-dimensional random vector of serially uncorrelated error terms with variance-covariance matrix, Σ. Equation **(1)** can be re-written as a linear dynamic system as follows:

$$\Delta z_{it} = \Pi_i z_{it-1} + \sum_{j=1}^{q-1} \Gamma_{ij} \Delta z_{it-j} + e_{it} \qquad \textbf{(2)}$$

where Γ_{ij} are matrices of short-term parameters and Π_i is a matrix of long-run coefficients.

The variables are all non-stationary variables with an order of integration equal to one. We test for the existence of rank reducing cointegrating relationships between these variables using the maximum likelihood based approach of Johansen (1996), which entails examining the canonical correlations between Δz_{it} and z_{it-1}. Translating this into a problem in terms of eigenvalues, ranked from largest to smallest as l_1, l_2, ..., l_p, a likelihood ratio LR(r) = -Tlog(1- l_r) where H(r-1) = $K - \frac{T}{2}\sum_{j=1}^{r-1} \log(1 - l_j)$, H($r$) = $K - \frac{T}{2}\sum_{j=1}^{r} \log(1 - l_j)$ tests whether rank $(\Pi_1) \leq r$ by determining if l_r is statistically different from zero (which it would be for a non-cointegrating combination). A trace test Tr(r) = $-T\sum_{j=1}^{r} \log(1 - l_j)$ is a joint test of whether all l_j for j = r, r+1, ..., p are insignificantly different from zero. The distributions are non-standard but are given in Osterwald-Lenum (1992) and Johansen (1996). The reduction in the rank, r, allows us to write the long-run equilibrium relationships of the system given by the pxp dimensional matrix Π_i in the familiar form of the product of two pxr matrices a_i and b_i. The matrix b_i defines the cointegration space and the matrix a_i defines the error correction space.

The vector of variables z_{it} can be decomposed into endogenous variables v_{it} and exogenous variables x_{it} so that we can write **(2)** as a conditional system such as **(3)**.

$$\begin{pmatrix} \Delta v_{it} \\ \Delta x_{it} \end{pmatrix} = \sum_{j=1}^{q-1} \begin{pmatrix} \Gamma_{ijv} \\ \Gamma_{ijx} \end{pmatrix} \Delta z_{it-j} - \begin{pmatrix} a_{iv} \\ a_{ix} \end{pmatrix} b_i' z_{it-1} + \begin{pmatrix} e_{ivt} \\ e_{ixt} \end{pmatrix} \qquad \textbf{(3)}$$

Endogenous variables are defined by the conditional system **(4)**, but exogenous variables are defined by a marginal process that excludes the long run relationship $\Pi_i z_{it-1}$. Effectively the part of the error correction space that determines the feedback of the long-run cointegrating relationships on the dynamics of the exogenous variables, x_t, is composed of zeros (a_{ix}=0). A test of this weak-exogeneity proposition can confirm the validity of the partition between endogenous variables, v_{it}, and the exogenous variables, x_{it}. Only the endogenous variables, v_{it}, are conditionally dependent on the long-run cointegrating relationships $\Pi_i z_{it-1}$:

$$\Delta v_{it} = w_i \Delta x_{it} + \sum_{j=1}^{q-1} \Gamma_{ij} \Delta z_{it-j} - a_i b_i' z_{it-1} + e_{it} \quad \textbf{(4)}$$

The conditional model is just identified but to ensure that the model is exactly identified in a structural sense we must impose a minimum of a further $s(s\text{-}1)$ additional restrictions, where $s = p\text{-}r$. We also introduce contemporaneous changes in exogenous variables on the right-hand side of the equation. Other additional overidentifying restrictions may be imposed and tested based on economic considerations. Exact and overidentifying restrictions are imposed jointly by premultiplying by a contemporaneous coefficient matrix, A_i, and tested by a likelihood ratio test.

$$A_i \Delta v_{it} = A_i w_i \Delta x_{it} + A_i \sum_{j=1}^{q-1} \Gamma_{ij} \Delta z_{it-j} - A_i a_i b_i' z_{it-1} + A_i e_{it} \quad \textbf{(5)}$$

The identification issue requires us to define the structure by creating a matrix of restrictions A_i (see, for example Bardsen and Fisher (1993), Johansen and Juselius (1994), Boswijk (1995), Thomas (1997a,b), Hoffman and Rasche (1996), Favero (2001) for a discussion of the issues). The choice of how to do this is determined by the information set we possess on the structure of the relationships between the variables in our model and can legitimately be drawn from economic, statistical or institutional knowledge.

If we have information on the contemporaneous relationships between our variables we could define A_i from the relationship between elements in Dv_{it}. Alternatively, we may be able to discern the error covariance matrix, which would then allow us to define the structure of the model from the restrictions required on the reduced form covariance matrix, $A_i S A_i'$. If the error covariance is diagonal or triangular we can determine the structure by ensuring that this is reflected in A_i (see Blanchard and Quah (1989)). A further alternative exists if we know how the long-run relationships enter each structural model, since we can define A_i by determining the impact of the long-run relationships on the dynamic adjustments (see Bardsen and Fisher (1993), and Boswijk (1995)). In addition to these *exact identifying restrictions* we may also impose *overidentifying restrictions* based on economic or institutional information.

Once we have fully identified the system for sector i we wish to ask questions about the impact of disequilibria from one sector on the dynamics of other sectors. Consider that there are now two sectors ie i =1,2, assuming the same notation and lag length, the combined conditional model is:

$$\begin{pmatrix} \Delta v_{1t} \\ \Delta v_{2t} \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} b_1 z_{1t-1} \\ b_2 z_{2t-1} \end{pmatrix} + \sum_{j=1}^{q-1} G_j \begin{pmatrix} \Delta z_{1t-i} \\ \Delta z_{2t-i} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \quad \textbf{(6)}$$

where G_j are matrices of short-run coefficients.

There are two tests here. First, the test of whether sector 1 influences sector 2 can be tested in the same way as weak exogeneity was tested, by restrictions to the error correction space. Effectively we are testing the exogeneity of the sector 1 (sector 2) to sector 2 (sector 1) by a test of the restriction $a_{21} = 0$ ($a_{12} = 0$). This implies that a disequilibrium in sector 1 (sector 2) does not have an impact on the dynamic behaviour of sector 2 (sector 1). If the $a_{21} = 0$ ($a_{12} = 0$) then

we can conclude that $b_2'z_{2t-1}$ ($b_2'z_{2t-1}$) has no impact on Δv_{1t} (Δv_{2t}) and is a test of the existence of financial linkages from one sector to another. The second test is simply an assessment of the importance of the dynamic terms from one sector on the other.

Since **(6)** is a full VAR representation based on a common set of explanatory variables, $\Delta Z_t = (\Delta z_{1t}, \Delta z_{2t})'$, we can test the propositions by estimating the separate conditional systems with the inclusion of the dynamic terms and cointegrating relation from the 'other' sector $b_1'z_{2t-1}$ ($b_2'z_{2t-1}$):

$$\Delta v_{1t} = w_1 \Delta x_{1t} + \sum_{j=1}^{q-1} \Gamma_{11j} \Delta z_{1t-j} + \sum_{j=1}^{q-1} \Gamma_{12j} \Delta z_{2t-j} - a_{11} b_1' z_{1t-1} - a_{21} b_2' z_{2t-1} + e_{1t}$$
$$\Delta v_{2t} = w_2 \Delta x_{2t} + \sum_{j=1}^{q-1} \Gamma_{21j} \Delta z_{1t-j} + \sum_{j=1}^{q-1} \Gamma_{22j} \Delta z_{2t-j} - a_{12} b_1' z_{1t-1} - a_{22} b_2' z_{2t-1} + e_{2t} \qquad \textbf{(7)}$$

There remains one final possibility, which is that the elements of z_{1t-1} and z_{2t-1} are themselves cointegrated. Taking $Z_{t-1} = (z_{1t-1}, z_{2t-1})'$ we can search for further cointegrating relations $b_3'Z_{t-1}$ and re-write **(6)** as:

$$\begin{pmatrix} \Delta v_{1t} \\ \Delta v_{2t} \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{pmatrix} \begin{pmatrix} b_1 z_{1t-1} \\ b_2 z_{2t-1} \\ b_3 Z_{t-1} \end{pmatrix} + \sum_{j=1}^{q-1} G_j \begin{pmatrix} \Delta z_{1t-j} \\ \Delta z_{2t-j} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \qquad \textbf{(8)}$$

If $b_3'Z_{t-1}$ exists then the impact of the cointegrating relation on each sector will be subject to the test $a_{13}=0$, $a_{23}=0$. Clearly, if $b_3'Z_{t-1}$ is a true cointegrating vector then at least one of $a_{i3} \neq 0$, following the Granger Representation Theorem (Granger (1986); Engle and Granger (1987); Johansen (1996), Theorem 4.2).

In Section 5, we will take sector 1 to represent HHs or PNFCs and sector 2 will be the OFC sector. The dimensions of the system under **(6)** or **(8)** involve the estimation of parameters for the three-equation system for HH or PNFCs taken from Brigden and Mizen (1999) and Chrystal and Mizen (2001) plus the two-equation system developed below for OFCs. Our model is therefore a five-equation model and the loading matrix will be at least (5x5), and bigger if there are further cointegrating relations, $b_3'Z_{t-1}$.

4. An empirical model for other financial corporations

The data we use conform to the new European System of Regional and National Accounts (ESA95) for 'other financial corporations' and are provided by the ONS for national accounts data and by the Bank of England for money and lending data. Our variables include: real M4 balances held by OFCs (m); real M4 lending to OFCs by banks and building societies (l); real gross domestic product (y); OFCs' real gross financial wealth (w); the real transfer earnings of the financial sector as a whole (including banks) from intermediation services (p);[3] a maturity spread measured by the difference between the long-gilt rate and the three-month Treasury bill

[3] The variable used is 'financial intermediation services indirectly measured (FISIM)' which measures interest payments to the financial sector that are considered a transfer from other sectors and not considered part of the economy's Gross Value Added (at basic prices). This used to be called 'adjustment for financial services'.

rate (r_s); and a spread of the long-gilt rate over the Financial Times-30 dividend yield (r_l-dy). All variables are in logarithms except interest rates. Our sample for estimation is 1980 Q1–1999 Q3.

Preliminary inspection of the VAR suggested that the unconditional VAR model should be specified with a lag length of $q = 3$. All variables are I(1), so we test for the existence of linear restrictions between the variables to reduce the rank of the system through cointegration, using the Johansen procedure. The assignment of endogenous and exogenous variables is as follows: $v_t = (l_t, m_t)$ and $x_t = (y_t, w_t, p_t, r_{st}, (r_l - dy)_t)$, we define $z_t = (v_t, x_t)$. The results, reported in Table A, imply that the existence of two cointegrating relationships cannot be rejected on the basis of the maximum eigenvalue and trace tests using the small-sample correction at the 5% significance level. The same statistics without the small-sample correction suggest that there may be three or four cointegrating relationships using a 5% critical value. In practice we have strong economic reasons to believe that there are two relationships between the variables that specify broad money and lending equations. The decision to impose a rank of two was subsequently verified by weak exogeneity tests reported at the foot of Table B. These tests verified that the marginal models for the remaining five economic variables in our vector were not significantly affected by the disequilibrium terms from the cointegration analysis.

The restricted cointegrating vectors that represent equilibrium real lending and money equations are reported in Table B. Our disequilibria are defined as follows.

$$e_{t-1} = b' z_{t-1}$$

$$b' = \begin{pmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} & b_{17} & b_{18} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} & b_{26} & b_{27} & b_{28} \end{pmatrix}$$

$$z_t' = \left(m4l_t, m4_t, w_t, (r_l - dy)_t, y_t, p_t, r_{st}, \text{constant}\right)$$

Unlike most economic models we cannot rely on economic theory to define our identification scheme. OFCs are heterogeneous and our knowledge of their practices is drawn from institutional and anecdotal sources rather than theoretical ones. We require n^2 restrictions including unit coefficients on the endogenous variables. We impose that M4 and M4 lending enter the equations of the other and do so symmetrically; since the unrestricted coefficients are close to 0.5 we impose $b_{21} = b_{12} = 0.5$ (two restrictions). These together with the unit coefficients on the endogenous variables provide *exact identification*.

We know that OFCs have a tendency to expand and contract their books symmetrically so we impose equality on the coefficients ($b_{13} = b_{23}$), indicating that OFCs can expand both sides of their balance sheets by increasing their transactions, without altering the ratio of real balances to borrowing. Further overidentifying restrictions are:

$b_{14} = 0$ (no long gilt-equity spread effect on lending equation)
$b_{15} = 1$ (unit coefficient on output in lending equation)
$b_{16} = 0$ (no direct influence of financial services on lending)
$b_{25} = 0$ (no direct output effect on money)
and in addition:
$b_{17} = 0$ (no effect of the real short-term interest rate)

Through the interactive structure all variables appear in both equations after substitution. The interpretation of each coefficient must be drawn after direct and indirect effects have been calculated. The level of real lending is positively affected by real gross domestic product. The elasticity on output is close to unity and can be restricted to equal one, this implies that the level of bank borrowing is strongly driven by real activity and is pro-cyclical. Since quasi-banks and leasing companies undertake the largest part of OFCs' bank borrowing to finance their activities it is not surprising that there is a positive response to a cyclical upturn or downturn in activity. Real gross financial wealth has a more muted effect on money and borrowing, but it still has a positive influence on borrowing. The negative coefficient on the real short-term interest rate in the lending equation is expected in theory, but the estimated coefficient is insignificantly different from zero suggesting that the influence is negligible (this is later restricted to zero using a further overidentifying restriction).

The equation for real money balances is also driven by real gross financial wealth, with a coefficient set equal to the coefficient in the lending equation, and by a variable measuring the return to financial intermediation services. In effect, this is a measure of the transfer earnings of the financial sector arising from interest and fee income. It has a positive effect on the level of real money balances. A rise in the spread of long gilts over equity returns leads to a rise in money balances that may indicate that money balances are regarded as a safe asset in the portfolio when dividend yields on equities are falling relative to the yield on gilts.

The overidentifying restrictions imposed on the cointegrating vectors reported in Table B are far from being rejected by a likelihood ratio test (p value = 0.9885). Chart 3 shows that, for M4 and M4 lending, the model fits the actual data on a time series plot extremely well (panel (a)); cross-plots of actual and fitted values lie almost exactly on a 45 degree line (panel (b)); and scaled residuals lie within the two standard error bands (panel (c)).

Equilibrium money and equilibrium lending are interactive, so the long-run equilibria cannot be treated as independent. In each case the coefficient is freely estimated at close to a half and can be restricted to be equal to a half, so that the variables affecting money balances influence lending indirectly through this linkage, and *vice versa*. Given that the two equilibria are driven by the same small set of exogenous variables, it is not at all surprising to find that there are spillovers between the two cointegrating vectors.

To explore the nature of the interaction, we estimated an unconditional vector equilibrium correction model. The loading matrix from the cointegration analysis suggests that feedback runs from the lending and money disequilibria to lending, and from the money disequilibrium to money (ie there is no linkage in the dynamic feedback equations from lending disequilibrium to money). Therefore, we take up this triangular relationship to identify our structural model, allowing feedback from lending *and money* disequilibria on lending but only money disequilibrium on money. The implication for the error correction space in equation **(3)** is that the loading matrix is made up of $a_{iv} = \begin{pmatrix} a_{ll} & a_{ml} \\ a_{lm} & a_{mm} \end{pmatrix}$ and $a_{ix} = 0$, which is confirmed by the exogenity tests at the foot of Table B. From this we derived the parsimonious structural model reported in Table C.

The associated fitted values are plotted against the actual data in Chart 4. It is clear from this chart that the dynamic equation for money fits better than that for lending. The latter in particular is close to rejection of the hypothesis of no autocorrelation. However, it should be emphasised that these are highly variable series that have proved hard to model in the past, and that the equations reported are highly parsimonious. Other researchers have often used dummy variables to remove outliers from the data, but no such device is used here.

In the dynamic structural model (Table C), the lending equation has a strongly negative and significant feedback coefficient on its own disequilibrium and the disequilibrium in money balances is associated with a negative change in bank lending. The dynamic equation for real money balances shows strong negative feedback from its own disequilibrium term. The significant negative coefficients on the diagonal are indicative of dynamic stability and these properties are confirmed by the impulse response functions shown in Chart 5. The negative coefficient on money disequilibrium in the lending equation indicates that 'excess' money balances are used by OFCs to reduce borrowing.

Scale variables are important in the dynamics. Real GDP growth has a positive contemporaneous impact on lending growth, indicating that the stage of the business cycle is influential over changes in bank lending to the OFC sector. Financial wealth growth has a positive but lower coefficient that is about one-third of that on GDP growth. A further scale effect is found through growth of earnings from intermediation services that is positively related to lending growth in the current period. The effect is unwound in the following period, which implies that it is changes in the growth of return to financial intermediation services that drives growth in borrowing.

Changes in the long gilt-equity spread have a small but significant effect on the change in bank lending, but the coefficient is an order of magnitude smaller than the one reported in the equilibrium equation. Changes to the long gilt-equity spread also have a significant positive effect on money balances, as do the changes to the real short rate. None of these effects is large by comparison with the effects of lagged endogenous variables, disequilibria or scale effects.

The likelihood ratio test of the overidentifying restrictions does not reject the null at conventional levels of significance. The diagnostic statistics of the model were acceptable on the same criteria, rejecting autocorrelation, non-normality and ARCH for individual equations and the system as a whole. The impulse respose functions alluded to earlier demonstrate that the model has stable characteristics (see Chart 5). Allowing each of the endogenous variables to be given a unit impulse (shock) in turn, we find that the response of the model ensures reversion as the shock to money or lending is worked off. The responses are more rapid than those for the household and firm sectoral models (see Brigden and Mizen (1999) and Chrystal and Mizen (2001)).

5. The interaction between OFCs and the real expenditure of other sectors

If we are to discover whether there is any interaction between the OFC sector and the spending decisions of other sectors we must look for financial linkages from disequilibria in each sector on the activity of others. Principally, we are interested in the impact of the OFC sector on the spending decisions of PNFCs and HHs, as these make up the main components of domestic

demand. But we are also interested in any relationship that may work in the other direction. Our approach towards the first issue is to consider how disequilibria in OFCs' money and lending might influence the system of equations for the PNFC and HH sectors reported in Brigden and Mizen (1999) and Chrystal and Mizen (2001). Our strategy is as follows.

The first step is to establish whether there are further cointegrating relationships between the variables in the OFC sector model and the 'other' sector. If there is a direct relation it may suggest that further disequilibria, between the previously separate sets of variables z_{1t} and z_{2t}, have an influence on each sector. If this is the case we should first determine the nature of the new cointegrating relations (ie $b_3'Z_{t-1}$) and then include these disequilibria as additional explanatory variables in the conditional model described by **(8)**.

If there are no new cointegrating relationships then we can treat the underlying disequilibria as unrelated, but potentially influential over the dynamic behaviour of both sectors. The disequilibria can be included as variables in the dynamic system for each sector described by equation **(7)**, since we know that they are I(0) by construction. We can then determine whether they have an influence over the dynamic adjustment. Disequilibria in OFCs' money and lending, for example, may stimulate investment and consumption spending by PNFCs and HHs. Likewise, PNFC and HH disequilibria may influence the scale of OFCs' activities.

The following sections explore these possibilities by considering the feedback between sectors. This is achieved by first considering the number of cointegrating relations within and between sets of variables z_{1t} and z_{2t} (ie the dimensions and characteristics of the b matrix). When the dimensions of b are known we consider the magnitude of the loading coefficients that are summarised by the error correction matrix a.

Private non-financial corporations

Do the OFC disequilibria matter to the PNFC sector? There are some economic reasons to think that they should. From an economic perspective, OFCs' bank borrowing is most likely to influence the PNFC sector since OFCs borrow from banks in order to offer quasi-bank intermediation services, dealing facilities and to purchase the capital equipment that they subsequently lease to PNFCs. We might expect that lending to OFCs, l^{OFC}, would be influential over PNFC investment, i^{PNFC} and perhaps lending and money balances, l^{PNFC} and m^{PNFC}. If OFCs lending is a substitute for bank lending then the very arguments made to justify a credit channel influence of bank lending on investment operate on OFCs lending. In this case, we might expect the level of OFC borrowing from banks to be influential over PNFCs' real activity in the long run.

The results of a search for further cointegrating vectors including OFC borrowing and PNFC activity variables bears out our intuition, as can be seen in Table D. A new cointegrating relation is found in the PNFC sector where the real investment equation includes the OFC lending variable in the long-run equation, where it has a positive and significant coefficient. Effectively, it is a sixth cointegrating relation that can be found between the elements of $Z_{t-1} = (z_{1t-1}, z_{2t-1})'$, which we label ECM_i^{PNFC}, and has some similarities to the previous disequilibrium in investment. The model accepts at the 5% significance level the same set of identifying and overidentifying

restrictions used by Brigden and Mizen (1999) on the other two PNFC relations, which are isomorphic to the cointegrating relations reported in that paper. The discovery of the new relation is an interesting result because it shows that, even if OFCs expand and contract the asset and liability sides of their balance sheet proportionally and have no direct spending component that feeds into aggregate demand, they may still influence the real activity of firms—possibly through the costs of financial intermediation. OFCs' borrowing matters for real activity since the effects of this increase in borrowing are associated with higher levels of real investment, although we cannot say whether this results from the role of leasing companies in investment or from the indirect effects via PNFC investment.[4]

We now move on to estimate the extended conditional system **(8)**, including the new cointegrating relation between the elements of the PNFC and OFC systems, embedded as a further influence on the dynamics of investment. The estimated model indicates that the original disequilibrium in investment is now insignificant and is dominated by the new relation containing the OFC lending variable. As a result we drop the insignificant term and proceed with five disequilibrium terms, these are the three error correction terms from the PNFC model ECM_i^{PNFC}, ECM_l^{PNFC}, ECM_m^{PNFC} (where the first is the modified disequilibrium containing OFCs' lending) and the two error correction terms from the OFC model ECM_l^{OFC}, ECM_m^{OFC}. The loading matrix reporting the impact of each of these terms on the system **(8)** is reported in Table E. The top (3x5) matrix represents the re-estimated PNFC model when we allow for potential linkages from the OFC sector. The newly estimated PNFC system is given by the (3x3) matrix in the top left corner, and the OFC disequilibria are appended to it in the right-hand corner. The bottom (2x5) matrix is the re-estimated OFC model (bottom left corner) when we allow for the PNFC disequilibria to influence OFC behaviour (reported in the (3x3) matrix in the bottom right corner).

We now discuss the implications of the estimated coefficients. Zero terms with stars are restricted to identify the model using the same restrictions that were explained in the Brigden and Mizen (1999) paper. Compared with the original PNFC model, the (3x3) matrix in the top left corner has stronger feedback to 'own' disequilibria on the diagonals, indicating that the model is more strongly reverting following a shock to the endogenous variables than before. The off-diagonals are weaker, however, and in the investment equation insignificantly different from zero. The same pattern is observed in the bottom right (2x2) matrix, compared to the original OFC model in Section 4. The strong response to the new investment disequilibrium implies that the OFC lending is influential over whole-economy investment growth. This represents the clearest signal that OFCs may influence real activity in the economy through their own borrowing activity to purchase equipment for leasing and/or for on-lending to the PNFC sector. Though, of course, the demand for this equipment will be driven mainly by the firms that use it.

Of further interest to us are the financial linkages via the impact of disequilbria across sectors. The dynamic terms in the PNFC sector seem to be largely unaffected by OFC disequilibria—as demonstrated by the insignificant coefficients in the (3x2) matrix in the top right corner—implying that imbalances in the OFC sector with respect to money holding and borrowing have

[4] Here the effect is on aggregate investment but even if we were to use 'business' investment this does not distinguish between investment by PNFCs and investment by OFCs.

no effect on PNFC activity. In the opposite direction, however, the bottom left matrix shows PNFC disequilibria in money and lending do influence the dynamics of money holding in the OFC sector. Here, 'excess' PNFC borrowing reduces the growth of OFCs' money balances and 'excess' PNFC money increases it.

Households

The link between OFCs and households is likely to be through the long-term management of savings by institutional investors such as pension funds and life assurance companies, as well as through unit and investment trusts. These funds are liable to be 'locked in' for a considerable period of time, but the perceived wealth effects of these funds may influence the sustainable consumption that households believe they can maintain. The link between the wealth that is held and managed by OFCs and household wealth is very strong, and gross wealth has been shown to be influential over money and lending by OFCs. But it is not immediately clear why the levels of money or lending and hence disequilibria in these variables should affect the consumption of households, on whose behalf the wealth is invested.

The search for additional cointegrating relations between variables in the OFC and HH models concluded that there were no long-run influences of the kind that we discovered in between OFCs and the PNFC sector. Therefore, we did not attempt to model the system **(8)** but rather chose to proceed with system **(7)** in which the ECM terms from the original models are allowed to impact on the dynamics of the other sectors. Thus there are no new b vectors to report and the estimated system involves a (5x5) matrix of a coefficients relating to the original b vectors in the HH and OFC models. The b vectors are ordered as follows ECM_c^{HH}, ECM_l^{HH}, ECM_m^{HH}, ECM_l^{OFC}, ECM_m^{OFC} and the loading matrix corresponding to these is reported in Table F.

As with the PNFC model, the diagonal feedback coefficients are stronger than in the original models excluding financial linkages, but the off-diagonal feedback terms are weaker. In the (3x2) matrix in the top right corner, there is only one feedback coefficient that is significant, and this corresponds to the influence of the disequilbrium in OFC money on consumption growth. Perversely, the coefficient sign is negative, indicating that the 'excess' OFCs' money balances are associated with lower consumers' expenditure growth. But, if OFCs hold more money than they desire at times when other assets are perceived as overvalued, the effect may reflect the influence of risk-averse behaviour on their part. Consumers may take this as a signal that the expected wealth in assets must be revised down and their expenditure plans must contract accordingly. This is consistent with our interpretation of money holding in the long-run equation, where the response to a rising long gilt-equity spread was positive and M4 was treated as a safe asset by OFCs. Thus, the expectation of a stock market correction, for example, that might lift OFCs' money holdings above their long-run equilibrium value might also reduce consumer expenditure growth as perceived wealth of households is revised. There are no other influences from OFCs to HHs, or *vice versa*.

The conclusion we draw is that there is less likelihood of an influence from OFCs to consumer spending (compared to investment of firms) because the driving forces for the household and OFC sector are different. Households' financial activity is to be found in retail markets but OFCs operate largely in wholesale markets, at least as far as the determinants of their money holding

and borrowing is concerned. Clearly, there are subsets of the OFCs that are big in the business of managing household wealth (the insurance companies and pension funds (ICPFs) especially). But these are likely to be influenced by the cumulative effects of household saving decisions, rather than exert an influence of their own over short to medium-term spending decisions.

6. Implications and policy conclusions

The paper focuses on the broad money holding behaviour and M4 lending to the neglected and awkward sector made up of a number of heterogeneous financial intermediaries— 'other financial corporations' (OFCs). There are many reasons to think that the OFCs are simply processing the financial wealth of other sectors in a way that has no real impact on aggregate demand. We can confirm that greater wealth *does* expand both money holding and borrowing in this sector, to leave the ratio of real money balances and bank borrowing unchanged. But this is not the whole story.

The results in the second section show that OFCs' real money holding and bank borrowing are interactive, despite being held by different types of financial corporation. The equilibria themselves are interdependent, and are driven by the same small set of explanatory variables. In the structural dynamic equations, the interactions become apparent as disequilibrium real money balances feed through negatively to the growth rate of real borrowing.

Section 3 shows that there are effects from OFCs' disequilibria on real aggregate demand. OFCs' bank borrowing influences aggregate investment in the long run, and through this effect alters the short-term dynamics of investment spending. By contrast, the OFC sector has little measurable net impact on the long-run behaviour of the household sector. This suggests that financial linkages from OFCs to aggregate demand may exist, primarily through investment. There are small instances of feedback from the PNFC sector to OFCs but these are offsetting if money holding and borrowing disequilibria are of equal size.

The main outstanding problem in interpreting the link between OFCs' bank borrowing and aggregate investment is that we are unable to say whether this effect comes solely from the investment behaviour of leasing companies, or whether there are other indirect effects on PNFCs' investment coming from the financial services they receive from OFCs. A distinction between these two channels could only be made by a disaggregated study which distinguished between leasing companies and other OFCs in the lending data and between leasing companies, other OFCs and PNFCs in the investment data. However, limited data availability makes such a study (at least for the full period of our study) impossible. This is a topic worthy of further investigation, but the deliberate focus of the present study has been on the OFC sector as a whole.

The results in this paper reveal (in a slightly new light) that there appear to be links between growth in financial activity and real economic growth. Some of what OFCs do is simply managing the accumulated savings of households, but there is also a clear connection with GDP growth and investment. These results also have direct relevance to the assessment of monetary conditions. It was tempting in the late 1990s environment to suggest that the rapid growth of OFCs' money balances and borrowing has no informational content useful for the formulation of

monetary policy. After all, some OFCs can expand and contract their balance sheets more or less at will, and velocity measures have been more stable when OFCs' money is excluded. However, this paper has presented the first evidence of which we are aware that OFCs' financial behaviour has some measurable link to aggregate spending on goods and services. At the very least, this suggests that OFCs' behaviour merits further study, not just out of curiosity, but rather because they are an integral part of the real economy. The next step will undoubtedly involve further disaggregation, but that is another pantomime—maybe involving seven dwarfs.

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Chart 1

Chart 1a: Sectoral M4 growth

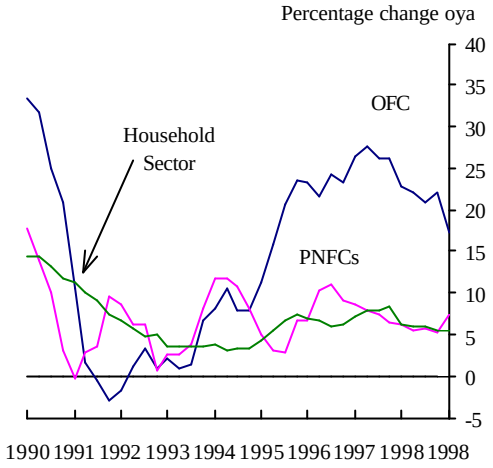


Chart 1b: Sectoral M4L growth

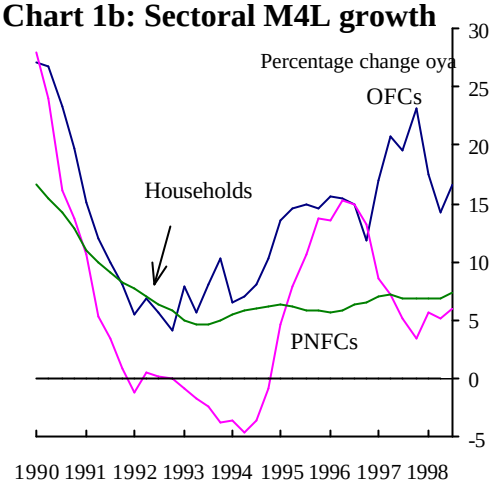
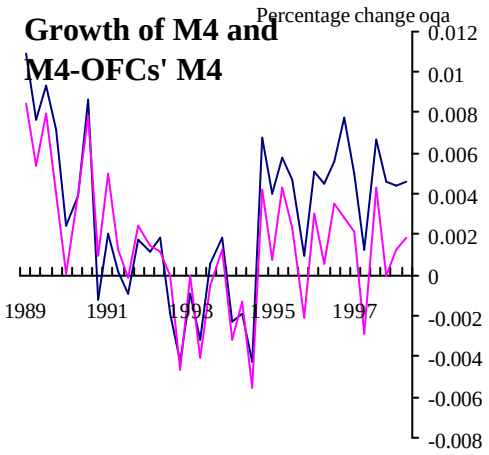


Chart 2a: Growth of M4 and M4-OFCs' M4 Chart2b: Agg. M4 and agg. M4-OFCs M4 velocity

Growth of M4 and M4-OFCs' M4



Agg. M4 and agg.M4-OFCs M4 velocity

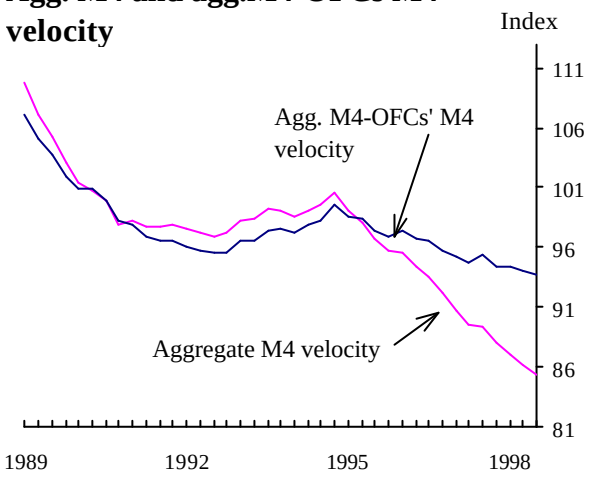


Chart 3

Cointegrating relations

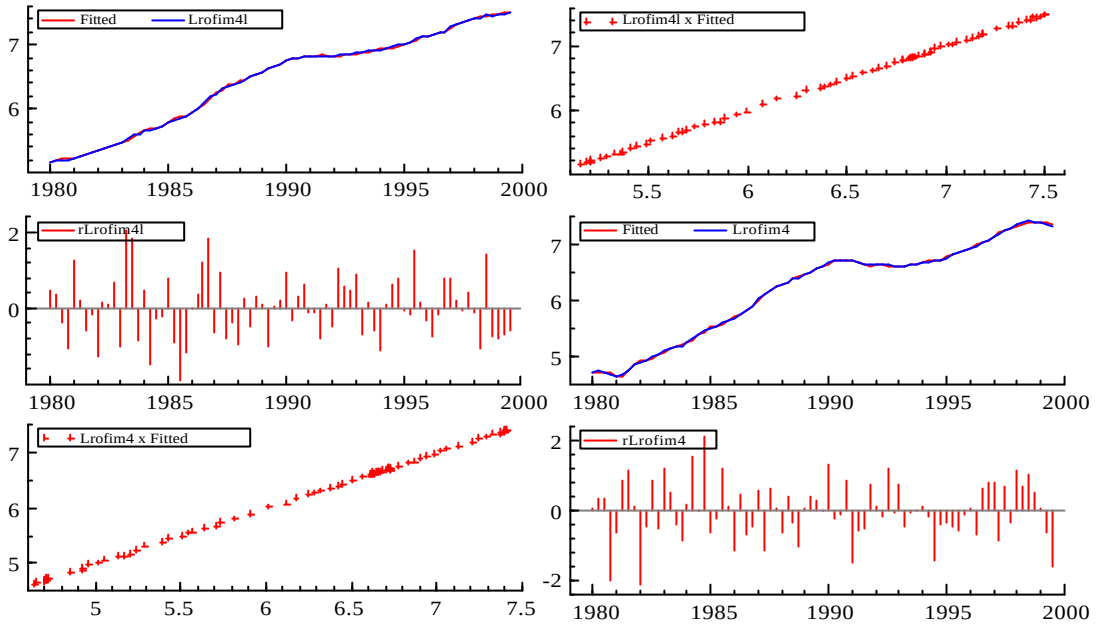


Chart 4

Structural models: actual and fitted equations

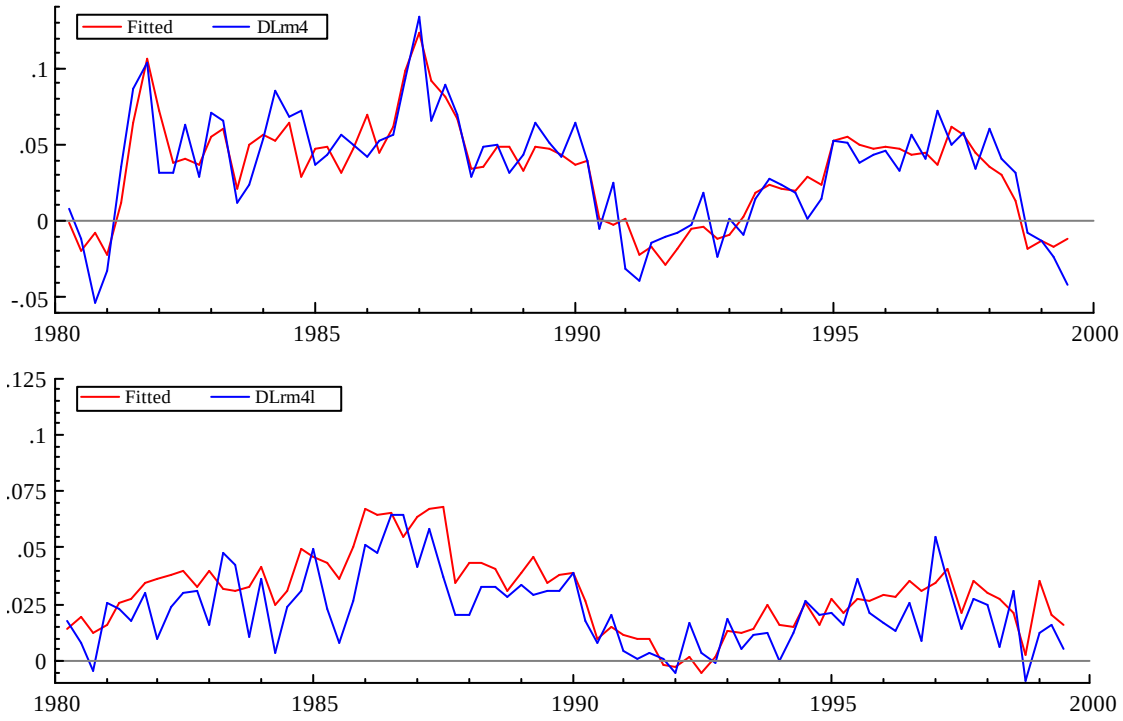
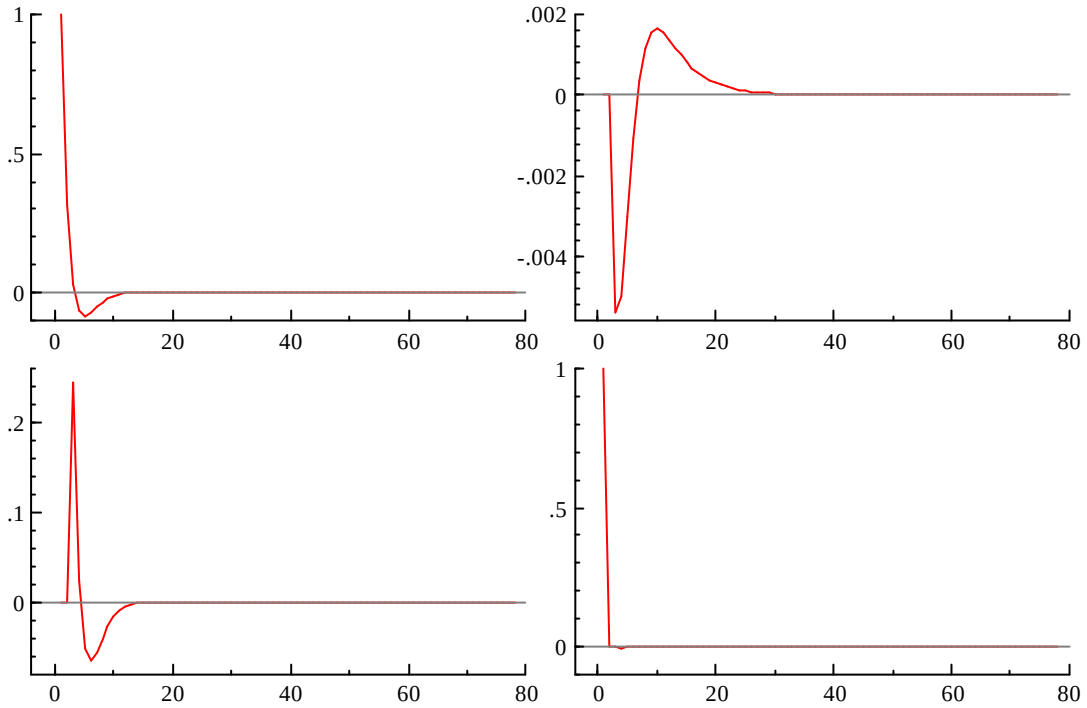


Chart 5

Impulse responses: unit shock to endogenous variables



Panel (a) and (b), temporary shock to money (1%) and response in lending.

Panel (c) and (d), response in money to a temporary shock to lending (1%).

Table A

Cointegration analysis: Johansen results

	Maximum eigenvalue			Trace		
Ho: rank=r						
	-Tlog(1-λ)	for T-nm	95%	-TΣlog(1-λ_i)	for T-nm	95%
r == 0	72.19**	56.4**	46.5	228.5**	178.5**	131.7
r <= 1	60.1**	46.96**	40.3	156.3**	122.1**	102.1
r <= 2	41**	32.03	34.4	96.21**	75.16	76.1
r <= 3	21.46	16.77	28.1	55.21*	43.13	53.1
r <= 4	15.67	12.24	22.0	33.75	26.37	34.9
r <= 5	11.43	8.929	15.7	18.08	14.13	20.0
r <= 6	6.655	5.199	9.2	6.655	5.199	9.2

** 5% level

* 10% level

Table B

Identified cointegrating vectors for OFCs

Normalised and restricted

standardized *b*' eigenvectors (standard errors in brackets)

	b_l	b_m
l	-1.000 (0.000)	0.500 (0.000)
m	0.500 (0.000)	-1.000 (0.000)
y	1.000 (0.384)	0.000 (0.000)
w	0. 254 (0.021)	0. 254 (0.021)
p	0.000 (0.000)	1.413 (0.0914)
r_s	0.004 (0.005)	-0.037 (0.005)
$(r_l$-*dy)*	0.000 (0.000)	0.0627 (0.011)
Constant	5.8098 (0.316)	10.859 (0.226)

Restricted log likelihood = 677.77352; unrestricted log likelihood = 678.23259
LR-test, $Chi^2(6)$ = 0.91816 [0.9885]

Weak exogeneity tests

Urbain (1992) test
Significance of ECM terms in the marginal models:

ECM (*l* - *l**) F(5,56) = 2.238 [0.0629]
ECM (*m* - *m**) F(5, 56) = 1.6337 [0.1661]

Table C
FIML estimates of structural models for OFCs

Sample period: 1980 Q4 to 1999 Q3

Equation 1 for Δl_t

Variable	Coefficient	Std.error	t-value	t-prob
ECM_{Lt-1}	-0.23772	0.019939	-11.923	0.0000
ECM_{Mt-1}	-0.13586	0.026054	-5.215	0.0000
Δy_t	0.38940	0.25952	1.500	0.1379
Δw_t	0.11215	0.028514	3.933	0.0002
$\Delta^2 \pi_t$	0.28998	0.098100	2.956	0.0042
$\Delta^2 (r_l - dy)_{t-1}$	0.00615	0.002627	2.344	0.0219

Equation 2 for Δm_t

Variable	Coefficient	Std.error	t-value	t-prob
Δm_{t-1}	0.31689	0.082047	3.862	0.0002
Δl_{t-2}	0.24410	0.10258	2.380	0.0200
ECM_{Mt-1}	-0.21869	0.03347	-6.533	0.0000
$\Delta \pi_t$	0.53928	0.15468	3.486	0.0008
Δw_t	0.13715	0.036736	3.734	0.0004
$\Delta(r_l - dy)_t$	0.00704	0.00406	1.732	0.0876
$\Delta(r_l - dy)_{t-2}$	-0.00948	0.00389	-2.436	0.0174
Δr_{st}	0.00804	0.00232	3.461	0.0009
Δr_{st-1}	0.00409	0.00234	1.749	0.0846

Log likelihood = 654.72; T = 78
LR test of overidentifying restrictions: $Chi^2(28) = 14.591$ [0.9824]
LR test of restrictions: $Chi^2(2) = 1.07668$ [0.5837]

System diagnostics

Lending
Portmanteau 9 lags = 19.369
AR 1- 4 F(4, 52) = 2.4958 [0.0539]
Normality $Chi^2(2)$ = 3.1149 [0.2107]
ARCH 4 F(4, 48) = 0.67301 [0.6139]

Money
Portmanteau 9 lags = 5.3598
AR 1- 4 F(4, 52) = 2.2085 [0.0808]
Normality Chi^2 (2) = 1.6899 [0.4296]
ARCH 4 F(4, 48) = 0.74383 [0.5669]

System
Vector portmanteau 9 lags = 33.987
Vector AR 1-4 F(16,124) = 0.77866 [0.7068]
Vector normality Chi^2 (4) = 4.1644 [0.3842]

Table D
New cointegrating relations for PNFCs including OFCs' M4 lending

	b_i	b_l	b_m
i	-1.000	0.500	0.500
	(0.000)	(0.000)	(0.000)
l	0.000	-1.000	0.000
	(0.000)	(0.000)	(0.000)
m	0.000	0.000	-1.000
	(0.000)	(0.000)	(0.000)
y	1.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
w	0.000	1.000	0.500
	(0.000)	(0.000)	(0.000)
p	0.000	-0.500	0.000
	(0.000)	(0.000)	(0.000)
c_k	-0.494	0.000	0.000
	(0.927)	(0.000)	(0.000)
s_u	-1.000	0.500	0.500
	(0.000)	(0.000)	(0.000)
r_d	0.000	3.030	11.222
	(0.000)	(2.920)	(3.987)
lrma	0.000	0.113	0.113
	(0.000)	(0.028)	(0.028)
l^{OFC}	0.054	0.000	0.000
	(0.022)	(0.000)	(0.000)

Restricted log likelihood = 1075.72; unrestricted log likelihood = 1088.14
LR-test, $Chi^2(19)= 24.843$ [0.1658]

Note: Standard errors in brackets.

Table E
PNFC sector financial linkages

Loading matrix:

$$\begin{pmatrix} -0.2352 & -0.041 & 0.0189 & \vdots & -0.0157 & 0.0111 \\ (0.0345) & (0.032) & (0.0300) & & (0.0469) & (0.0523) \\ 0* & -0.1407 & 0.0601 & \vdots & 0.0392 & -0.0033 \\ & (0.0284) & (0.0218) & & (0.0303) & (0.0325) \\ 0* & 0* & -0.0933 & \vdots & -0.0728 & 0.0150 \\ & & (0.0241) & & (0.0457) & (0.0441) \\ \cdots & \cdots & \cdots & \vdots & \cdots & \cdots \\ -0.0115 & 0.0143 & -0.0337 & \vdots & -0.2394 & 0* \\ (0.0225) & (0.0307) & (0.0363 & & (0.0403) & \\ -0.0160 & -0.0479 & 0.0552 & \vdots & -0.085 & -0.2345 \\ (0.0194) & (0.0239) & (0.0264) & & (0.0390) & (0.0406) \end{pmatrix}$$

Note: Standard errors in brackets.

Table F
HH sector financial linkages

Loading matrix:

$$\begin{pmatrix} -0.2213 & 0* & 0* & \vdots & -0.0051 & -0.051 \\ (0.0583) & & & & (0.0189) & (0.0255) \\ 0.0309 & -0.1761 & 0* & \vdots & 0.0195 & -0.0007 \\ (0.0197) & (0.0231) & & & (0.0117) & (0.0124) \\ 0.2296 & -0.3834 & -0.1456 & \vdots & -0.0154 & -0.0277 \\ (0.1099) & (0.0869) & (0.0360) & & (0.0217) & (0.0234) \\ \cdots & \cdots & \cdots & \vdots & \cdots & \cdots \\ 0.0703 & -0.0919 & -0.0047 & \vdots & -0.2364 & 0* \\ (0.0974) & (0.0849) & (0.0057 & & (0.0377) & \\ 0.0361 & 0.1337 & -0.0016 & \vdots & -0.1434 & -0.2886 \\ (0.0772) & (0.0779) & (0.0046) & & (0.0353) & (0.0519) \end{pmatrix}$$

Note: Standard errors in brackets.