Understanding broad money

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Broad money is at the heart of the monetary transmission mechanism and consequently plays an important role in the assessment of inflationary pressures. This article examines the factors behind stronger broad money and credit growth in 1995, using recent econometric research undertaken at the Bank.

Broad money has played an important role in the formulation of monetary policy in the United Kingdom over the past 25 years. Between 1976 and 1986, targets were published for various definitions of broad money. And within the current monetary framework (announced in October 1992) there is a monitoring range of 3%–9% for the annual growth of the M4 measure of broad money.(1) The role of broad money is primarily to provide information about future movements in nominal demand and inflation along with a wide range of other indicators. So, for example, Section 2 of the Bank's *Inflation Report* pays close attention to developments in broad money and credit in the context of the government's inflation target.

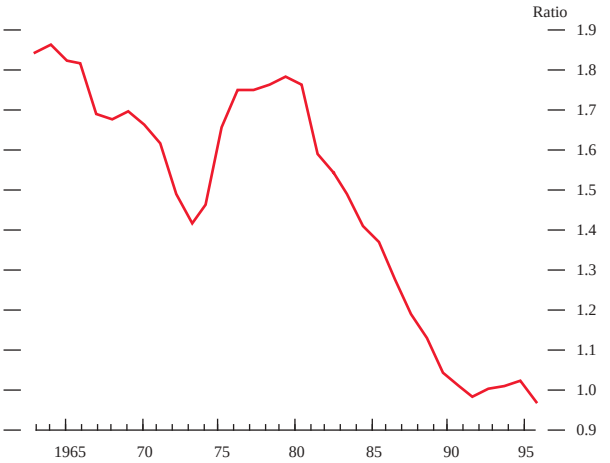
During 1995 the twelve-month growth rate of broad money increased steadily, rising above the upper limit of the M4 monitoring range. Recent *Inflation Reports* have identified this as a source of upside risk to the government's inflation target should such growth persist. This article analyses in more detail the factors underlying broad money growth in 1995,(2) and the wider role of broad money in the transmission mechanism of monetary policy. It uses recent Bank research on the determinants of M4 to address these issues.

Broad money and its sectoral components and counterparts

The measure of broad money used by the UK authorities, M4, consists of holdings by the 'M4 private sector'(3) of sterling notes and coin and of sterling deposits (including certificates of deposit and similar bank and building society deposits) held at banks and building societies in the United Kingdom. At the end of December 1995, the stock of M4 totalled £623 billion, roughly equal to one year's nominal GDP and almost 30 times the size of the stock of sterling notes and coin in circulation.(4)

The relationship between the growth of M4 and the growth of nominal activity has been quite variable over the past 30 years. The income velocity of M4, which measures the ratio of nominal GDP to the stock of M4, has shown several distinct phases (see Chart 1). In the period before 1980, velocity did not exhibit any consistent trend. But it declined steadily during the 1980s when—in response to financial deregulation and liberalisation—banks' and building societies' balance sheets expanded more rapidly than nominal income.(5) Between 1991 and 1994, M4 velocity was fairly stable. But during 1995 velocity started to decline once more, raising the issue of whether this indicates incipient inflationary pressures or is simply a reflection of further changes in the structure of the financial sector.

Chart 1
Income velocity of M4(a)

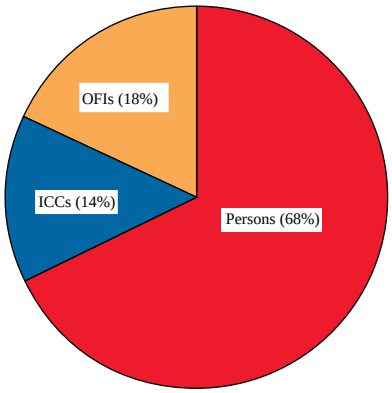


(a) Annual nominal GDP divided by the stock of M4.

Within M4, there have also been some interesting patterns in *sectoral* money holdings. Chart 2 shows a breakdown of M4 holdings by sector. At the end of 1995, the personal sector was the dominant holder of M4 assets, accounting for roughly two thirds of the stock of M4. Of the remainder, 14% was held by industrial and commercial companies (ICCs), and 18% by other financial institutions (OFIs).

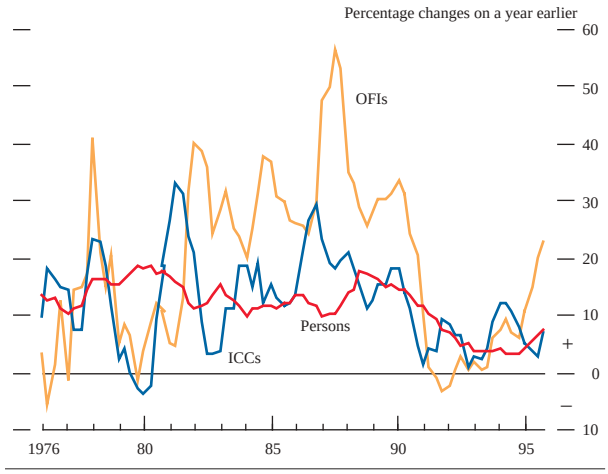
(1) See Salmon, C (1995).
(2) Data for the first quarter of 1996 are discussed in the May 1996 *Inflation Report*, together with the impact of the open gilt repo market on broad money and credit.
(3) All UK residents except the public sector, banks and building societies.
(4) See Janssen, N (1996).
(5) See Bank of England (1986).

Chart 2
Sectoral holdings of M4 (percentage of total M4)



The pattern of growth for each of these three sectors has been quite different over the past 20 years (see Chart 3). Personal sector M4 growth has been much less volatile than the growth of corporate sector holdings (both ICCs and OFIs). In particular, OFIs' M4 holdings have grown at a considerably faster and more erratic rate than those of either ICCs or persons. Thus, although personal sector holdings are important in determining trend movements in M4, shorter-term fluctuations in M4 are typically dominated by changes in corporate sector money holdings. That was again true in 1995.

Chart 3
Growth in M4 by sector



Another way of decomposing M4 holdings is to look at its 'counterparts' on the bank and building society sector balance sheet.(1) As Chart 4 shows, the most important counterpart to M4 growth has been sterling lending to the M4 private sector—'M4 lending'. This too has exhibited interesting sectoral patterns over the recent past. Chart 5 shows that corporate sector (ICCs and OFIs) borrowing, like corporate sector M4 deposits, has historically been more volatile than personal sector borrowing; it has also been the most important factor driving recent fluctuations in M4 lending. In particular, there has been a rapid turnaround in

Chart 4
M4 and M4 lending

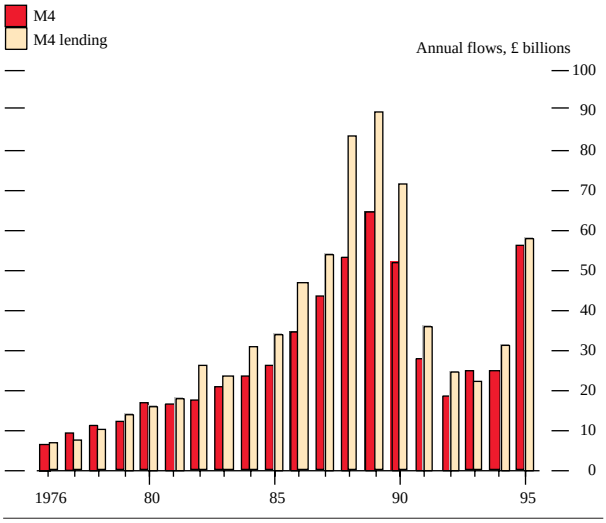
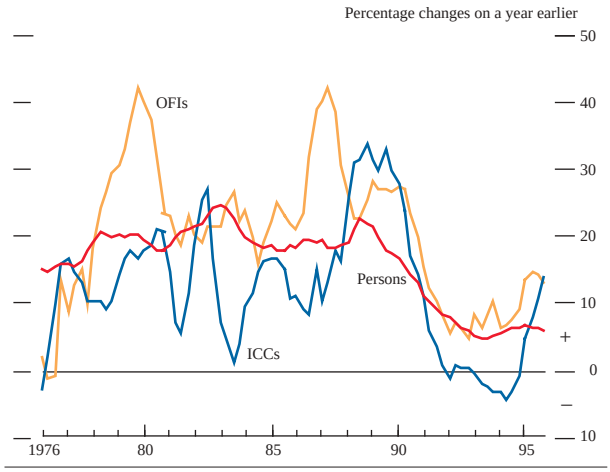


Chart 5
Growth of M4 lending by sector



the position of ICCs from being net repayers of debt for much of 1992–94 to substantial net borrowers during 1995. The growth of personal sector borrowing, by contrast, has remained subdued for much of the 1990s.

Money, credit and the transmission mechanism

In general, movements in M4 will depend on both the *demand* for broad money and on its *supply*. The second of these can be linked to developments in the credit market, given the way in which banks and building societies typically manage their balance sheets.

Looking first at the *demand* side, broad money balances are held for two main reasons. First, they serve as a medium of exchange, since banks' and building societies' deposit liabilities are generally accepted as a final means of settlement, in much the same way as cash. Second, bank and building society deposits can serve as a store of value. A large proportion of M4 is interest bearing, so agents will hold broad money as part of a diversified wealth portfolio alongside other financial (such as equities) and real (such as

(1) See Bank of England (1987).

houses) assets. Taken together, these two roles suggest that the aggregate demand for broad money is likely to be determined by real spending, prices, wealth and the opportunity cost of holding money (the difference between the return on money and the return on non-monetary assets, real and financial). Over the longer term, these determinants of broad money holdings can be thought to define a target level of money balances—the long-run demand for broad money. But, over the short term, agents may also accept higher or lower money balances as a (possibly very temporary) means of bridging a gap between payments and receipts whose timing are uncertain. And agents will then adjust money positions over time towards their desired longer-run level. This is known generally as the buffer-stock theory of money demand.(1)

The *supply* of broad money depends on the behaviour of banks and building societies. A useful approach in this context is to think of the banking system as managing its liabilities. The banking system undertakes profitable lending opportunities at the prevailing level of interest rates and this, in turn, determines the extent to which it needs to bid for deposits from the rest of the private sector. This implies that conditions in the credit market determine the supply of broad money. The demand for credit—borrowing from banks and building societies—is likely to depend on the current and expected future level of activity in the economy, (real) borrowing rates and the difference between the cost of credit from banks and building societies and other forms of finance, such as retained earnings or capital market issues. For certain types of borrowers, most notably small businesses and consumers, substitution possibilities between borrowing from banks and building societies and other forms of finance are likely to be limited. The amount of lending will then also depend on the willingness of banks and building societies to provide credit. Ultimately, it is the interaction of these demand and supply—or money and credit—factors which determine holdings of broad money at any one time.

So what role do money and credit play when assessing inflationary pressures? Since the price level is conventionally defined as the relative price of a consumption bundle in terms of money, the interaction between the demand and supply of money is clearly at the heart of the inflationary process. But the precise transmission mechanism through which money and credit affect activity and inflation, and *vice versa*, is not well understood; it is still the subject of much disagreement among economists. And, as demonstrated in Chart 1, finding a stable and predictable relationship between movements in broad money and nominal activity is often problematic. Changes in transactions technology and financial structure affect the velocity of broad money in ways that are often difficult to predict. This implies that it is not sensible to steer monetary policy by reference to the money and credit aggregates alone, but to use them as part of a wider range of indicators of economic conditions.

Broadly speaking, money and credit can fulfil one of two roles when used as indicators. These encapsulate competing theoretical views on the role of money and credit within the transmission mechanism. First, money and credit may provide only *corroborative* information on the economy; that is, they offer information which helps support or reject the signals emerging from alternative indicators. This would be the case, for example, in a world where money and credit flows were entirely demand determined or where relative financial yields moved rapidly to equate the supply and demand for money.(2) Every time a (real or nominal) disturbance hit the economy, agents would immediately reshuffle their asset portfolios so that money holdings remained in equilibrium. Money and credit would then serve as purely passive indicators of movements in demand, wealth and interest rates in the economy—the arguments entering the long-run money demand functions; they would not have any explanatory power in their own right. M0 is an example of a monetary aggregate which is very largely demand determined. Hence, over the short run, it is used as a corroborative indicator of cash-financed spending. Even in a world where money and credit balances are always in long-run equilibrium, however, they may still offer better signals of impending inflationary pressures than other indicators because data on them are available in a more timely fashion and are much less subject to revision.

Second, money and credit may provide *incremental* information about the economy, offering signals which are not immediately observable in other indicators. There are a variety of mechanisms through which this could occur.

One is if money and credit are used as short-run buffers, insulating agents' real decisions from shocks to the economy. In these circumstances, disturbances do not bring about an immediate adjustment of money balances back into line with long-run equilibrium holdings. Instead, in the short run, agents accept higher (or lower) money balances as a temporary abode of purchasing power. Equilibrium is then restored only gradually, as individual agents attempt to eliminate their 'excess' money holdings through purchases of goods and real and financial assets. This process will continue until nominal spending has risen sufficiently to bring the aggregate demand for money back into line with its supply. Under this scenario, money balances may generate a dynamic of their own. Both money and credit would no longer be passive indicators of nominal demand but instead may be an independent cause for inflationary concern.

Another such mechanism could operate if banks play a 'special' role in the provision of credit to some sets of agents—such as small firms and households who are not able to access non-bank forms of financing. The behaviour of banks when they supply credit to these agents could then have direct effects on spending—a 'credit channel'.(3)

(1) See Laidler, D (1984) and Milbourne, R (1988).
(2) See Kaldor, N (1970), Moore, B (1988) and Howells, P (1995).
(3) See Dale, S and Haldane, A G (1993) and Bernanke, B and Gertler, M (1995) for a survey.

These two roles for money are not mutually exclusive. In practice, there will be a continuum of speeds at which agents adjust their portfolios following a shock. Agents demanding deposits for portfolio reasons—such as OFIs—are likely to re-equilibrate their portfolios very quickly. Others—such as households—may let their money and credit balances cushion them from shocks, thereby giving rise to prolonged and pronounced deviations from equilibrium holdings. Both of these stories have a role to play when accounting for the recent behaviour of broad money and credit.

Research on broad money

The above discussion highlights the challenges facing empirical researchers in explaining movements in broad money and in modelling its wider role in the transmission mechanism. Previous research at the Bank has concentrated on the estimation of money demand models, in keeping with the large academic literature in this area.(1) Different vintages of the Bank's money demand models have focused on a variety of important issues:

- *Measuring the opportunity cost of money*. Prior to the 1970s, the long-term bond rate was the term typically used to proxy the relative rate of return on M4 deposits.(2) This seemed to show a stable relationship with M4 velocity, at a time when bank deposit (and lending) rates were largely administered.(3) But with Competition and Credit Control in the early 1970s, and the rapid process of financial liberalisation after 1980, a new approach was necessary, since deposit rates were determined increasingly by the banking system's need to fund its expanding loan business. The studies of broad money in the mid-1970s consequently began to include an explicit own-rate of return on M4 assets, often using a certificate of deposit rate in this role.(4) During the 1980s, as a much wider range of financial instruments became available to both the personal and corporate sectors, researchers began to include a variety of alternative opportunity cost terms too, such as overseas interest rates and the rate of return on equity.(5) Overall, however, the ability of these various proxies to pick up shifts in expected rates of return has been limited, with interest elasticities typically small and poorly determined.

- *The role of wealth.* Prior to the 1980s, measures of GDP were largely sufficient for picking up trend movements in M4 holdings. But in the 1980s financial liberalisation led to the payment of interest on a wide variety of bank and building society liabilities. This increased the attractiveness of M4 as a savings instrument, particularly for the personal sector. Consequently, M4 holdings came increasingly to be viewed as part of a wider wealth portfolio. Indeed, this phenomenon seems largely responsible for the steady decline in M4 income velocity during the 1980s observed in Chart 1. A number of studies at the Bank have confirmed that using wealth, in addition to a measure of transactions, does indeed explain much of the trend in M4 velocity through the 1980s.(6) This is consistent with agents' money holdings being dictated by their permanent—current plus expected future—income, rather than by current income alone.

- *Joint modelling of money with other variables*. The discussion above suggests that money, credit, nominal income and interest rates are in practice likely to be jointly determined. This calls for M4 to be modelled as part of a wider system of variables, if any information about the transmission mechanism is to be recovered. Recently, this has been done for both narrow and broad measures of money.(7) Such an approach allows the interaction between money and its explanatory variables to be identified explicitly. In particular, it helps in identifying how money and activity are likely to move in response to different types of (real and nominal) disturbance.

- *Sectoral modelling of broad money balances.* Most early studies at the Bank and elsewhere concentrated on modelling M4 at an aggregate level. But recent research suggests that this may conceal important sectoral differences.(8) This is readily apparent from the diverse patterns in sectoral broad money growth. Different agents are likely to have very different motives for holding money. In particular, persons and some ICCs are likely to hold a larger proportion of their money balances as a transactions medium than OFIs, for whom a portfolio-based model is likely to be more appropriate. Identifying these sectoral demands for broad money separately is thus likely to improve our (statistical and behavioural) understanding of them. And, as a by-product, it may make the channels within the transmission mechanism clearer and easier to understand.(9)

The Bank's most recent work on M4 tackles all of these issues. We consider money demand at a sectoral level, modelling sectoral money holdings jointly with sectoral measures of spending, together with wealth and appropriate interest rate differentials. This offers an illustrative set of behavioural models of sectoral money demand, which can be used as a framework for assessing the interaction between monetary and real magnitudes and hence the

(1) See Cuthbertson, K (1991) for a survey.
(2) See Kavanagh, N and Walters, A (1966).
(3) See Artis, M and Lewis, M (1984).
(4) See Haache, G (1974).
(5) See Hall, S G, Henry, S G B and Wilcox, J B (1989).
(6) Hall, S G, Henry, S G B and Wilcox, J B, *op cit*.
(7) See Hendry, D and Mizon, G (1993) and Fisher, P G and Vega, J L (1993).
(8) See Fisher, P G and Vega, J L, *op cit*.
(9) Dale, S and Haldane, A G, *op cit*, for example, found that sectoral measures of money and credit responded quite differently following a shock to interest rates.

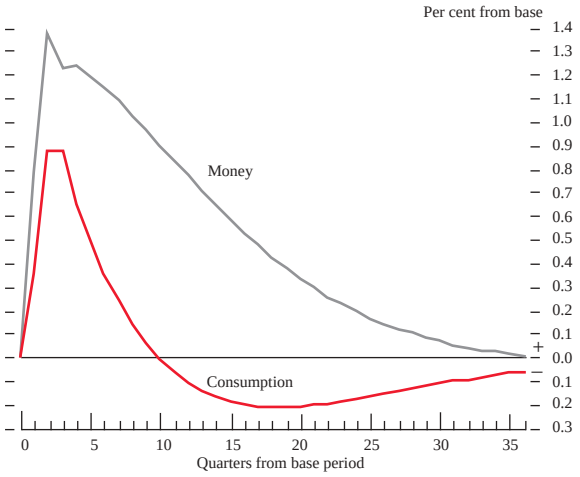
implications of recent strong M4 growth. The Appendix provides some technical details on the estimation of these models.

Personal sector

For the personal sector, M4 holdings are modelled jointly with consumption—so we have equations for both personal sector money holdings and consumption. Personal sector money holdings are modelled in such a way as to encompass their role as both a medium of exchange and as a store of value. In the long run, money holdings are determined by disposable income, gross wealth (measured as the value of personal sector financial and tangible assets) and two opportunity cost terms. The first is the interest differential between the own-rate on personal sector M4 and a three-month rate of interest (Treasury bill yield); the second is the inflation rate, which proxies the relative rate of return on money versus real assets. The long-run consumption function relationship is standard, with consumption depending on income, wealth and short-term real interest rates, plus a 'precautionary saving' effect proxied by the change in the unemployment rate.

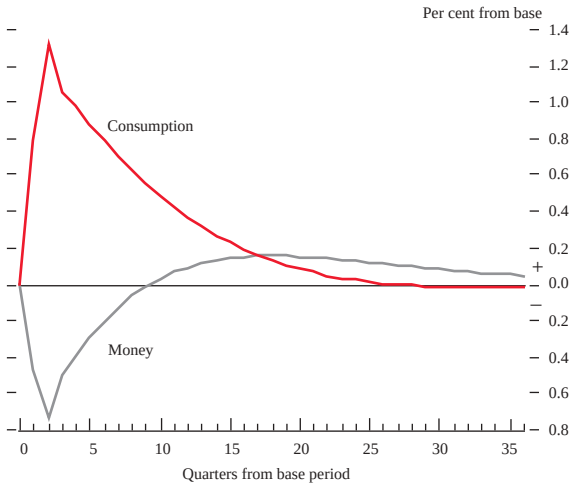
One interesting feature of the model is the short-term interaction between money and consumption. In the money equation, there is a *negative* short-run correlation between money and consumption. So, for given income and wealth, an increase in consumption will be financed initially by running down money balances. This suggests money is used as a buffer against short-term fluctuations in spending. In the consumption function, there is a *positive* short-term relationship between money and consumption. So a short-term rise in money balances leads to a rise in consumption. These short-run interactions between money and consumption occur simultaneously. And this simultaneous interaction yields interesting results when the model is subject to nominal and real disturbances—that is,

Chart 6
Response of money and consumption to a disturbance to the money equation



when there is an unexpected change in the money and consumption relationships. Charts 6 and 7 show the effects

Chart 7
Response of money and consumption to a disturbance to the consumption function



of a temporary 1% disturbance to the money equation and a temporary 1% disturbance to the consumption function, respectively.

A 1% disturbance to the money equation tends to raise both money balances and consumption in the short run. We might think of this as a one-off increase in the provision of credit by banks and building societies, which in the first instance leads to higher personal sector deposits as accounts are credited with the funds. But households have not borrowed to hold money but to spend it. And as they start spending consumption rises, while personal sector deposits fall back as funds flow into the corporate sector. Over time, both money and consumption return to their initial equilibrium levels.

A 1% disturbance to the consumption function, on the other hand, leads to a negative correlation between money and consumption in the short run. This would be the effect of a one-off fall in precautionary saving, for example. For given income and wealth, higher spending tends to reduce personal sector balances in the short run, as funds flow out to the corporate sector. But money balances are then gradually built back up to their initial level.

The simulations represent only a partial analysis of the effects of nominal and real disturbances. In reality, income, wealth and other variables are also likely to change as money and consumption change. This is likely to restore equilibrium somewhat faster than implied by Charts 6 and 7. But these simulations show how personal sector money balances, in conjunction with other real-side variables, can act as a barometer of the disturbances hitting the economy. If we observe money and consumption moving in the same direction in the short run this makes it more likely that there has been a monetary disturbance of some kind. If, on the other hand, they are moving in opposite directions, this suggests there has been a real expenditure disturbance. More complicated correlations can arise from disturbances which affect both variables, such as those to disposable income.

Corporate sector: ICCs and OFIs

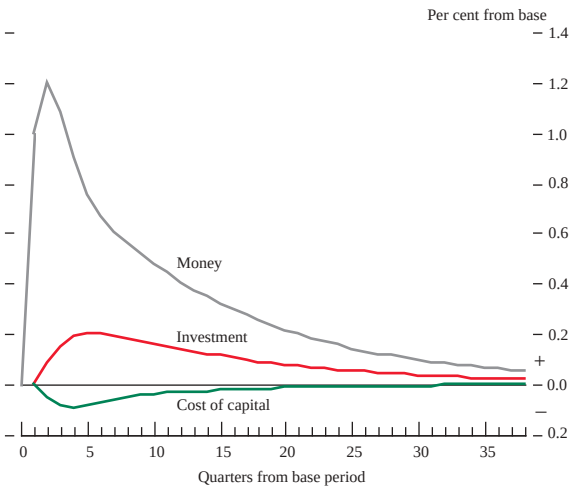
Corporate sector M4 has historically been more volatile than personal sector M4. This may be because corporates hold M4 assets principally for portfolio reasons, so shifts in firms' perceptions of the relative rates of return on various assets may have large effects on their M4 holdings. But because firms' expectations of asset returns are unobservable and difficult to proxy, this limits our ability to model their money holdings. In previous Bank research, M4 holdings were modelled for the corporate sector as a whole. But our more recent research has found significant differences in the motives for holding money by ICCs and OFIs.

(a) ICCs

ICCs' holdings of M4 are modelled jointly with investment (whole-economy gross fixed capital formation) and a measure of the real cost of capital. ICCs' money holdings are modelled both as a transactions balance and as a store of value. So, in the long run, they depend on investment spending, gross financial wealth, and various rates of return on money and alternative assets including the cost of capital. Interestingly, the real cost of capital has a negative effect over the long term on money holdings. When the real cost of capital is high this suggests that firms' profit streams are high relative to their valuation. This provides an incentive for some firms to increase their take-over activity, part of which it is optimal to finance out of money balances. The long-run determination of investment is entirely standard, depending on GDP, the real cost of capital and a proxy for the capital-output ratio (capacity utilisation). The real cost of capital reverts to a constant in the long run.

Again, the interesting features of the model are its dynamic properties. In particular, the effect of a temporary positive 1% disturbance to the money equation (see Chart 8) is to create a deviation between short-run holdings of money and desired long-term holdings. These 'excess' money balances in turn have a negative effect on the real cost of capital—which could be the case, for example, if firms shed excess liquidity by buying up other companies rather than by investing directly. But, by reducing the cost of capital, this raises investment expenditure over the longer term.(1) As can be seen from the chart, the effects are significant, if not large. A 1% disturbance to the money equation has at its peak just over a 0.2% effect on investment.

Chart 8
The effect of a 1% disturbance to the money equation on investment and the cost of capital



Again this is very much a partial analysis. But there is some evidence of a corporate sector monetary transmission channel working through 'liquidity' effects on the real rate of return on capital and, ultimately, on the level of investment spending. Indeed, since a falling real cost of capital is likely to imply higher stock market prices and higher wealth, this may lead to further indirect effects on aggregate demand which are not picked up in this model.

(b) OFIs

For OFIs, our research suggests a simple two-equation portfolio model, reflecting the demand for and supply of OFIs' M4 balances. In the money demand equation, OFIs' M4 holdings depend on wealth, and three relative rates of return: a 'money-market' spread, which is the own-rate on corporate sector M4 less the three-month Treasury bill rate; an 'equity market' spread, which is measured by the own-rate less the *ex post* three-month holding period return on the FTSE ordinary share index; and the *ex post* real deposit rate, which proxies substitution between money and real assets. All three rates of return are clearly only rough proxies for the true expected returns that govern OFIs' portfolio decisions. The long-run supply of M4 equation is a simple deposit rate setting function. Deposit rates are tied to money-market rates reflecting the close substitutability between wholesale deposits and other money-market instruments. A term in the scale of OFIs' deposits picks up the trend effect of financial liberalisation on money-market spreads.

The two equations in the model together give a flavour of the interaction between banks' and building societies' management of their liabilities and OFIs' portfolio allocation decisions. But the model reveals little about any direct role in the transmission mechanism for OFIs' M4 deposits; it is difficult to find any significant direct link between them and real activity variables. This, of course, may reflect our inability to model OFIs' M4 adequately—in particular, our inability to pick up shifts in relative rates of return.

Overall, the three sectoral models indicate that broad money contains significant information about the nature of the disturbances hitting the economy at any one time and about the underlying determinants of each sector's demand for monetary assets. They also give an illustration of the channels through which various disturbances may be transmitted to the rest of the economy and the patterns which we might observe in the behaviour of monetary and

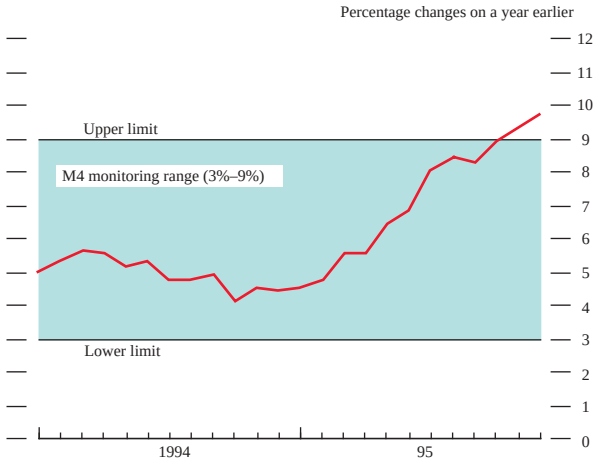
(1) This provides a structural interpretation of the leading indicator properties of ICCs' M4 over investment found by Astley, M and Haldane, A G (1995).

real variables as all these effects work through the system. This is important if we are to interpret money movements meaningfully at a conjunctural level—in particular, when seeking to understand the recent strength of broad money growth and its implications for inflation over the longer term.

Explanations and implications of broad money growth in 1995

The twelve-month growth rates of both broad money and credit picked up sharply during 1995. The twelve-month growth rate of broad money increased from 4.4% in December 1994 to 9.7% in December 1995—above the upper limit of the M4 monitoring range (see Chart 9). But

Chart 9
Growth rate of M4



many other indicators, especially those from the real side of the economy, appeared to be more consistent with a slowdown in economic growth during 1995. So how best can we interpret the recent signals from money and credit?

Tables A and B show the contributions by sector to the increases in broad money and credit during 1995, in both absolute and percentage terms.

Table A
Private sector M4(a)

	Persons	*of which, individuals*	ICCs	OFIs	Total M4
Quarterly flows in £ millions; seasonally adjusted					
1995 Q1	8,001	*4,877*	1,396	6,361	15,758
1995 Q2	5,586	*6,495*	-35	5,391	10,941
1995 Q3	7,818	*7,458*	536	5,084	13,438
1995 Q4	6,904	*5,956*	3,456	4,790	15,150
1994 average	3,057	*2,434*	1,530	1,420	6,006
1995 average	7,077	*6,197*	1,338	5,407	13,822
Contributions to quarterly growth (percentages)					
1995 Q1	1.4	*0.9*	0.2	1.1	2.8
1995 Q2	1.0	*1.1*	—	0.9	1.9
1995 Q3	1.3	*1.3*	0.1	0.9	2.3
1995 Q4	1.1	*1.0*	0.6	0.8	2.5

(a) Rows may not sum to totals due to rounding.

Over half of the increase in M4 deposits in 1995 was accounted for by the personal sector, most of which

Table B
Private sector credit(a)

	Persons (excluding unincorporated businesses)		Unincorporated businesses	ICCs	OFIs	Total M4 lending
	Secured	Unsecured				
Quarterly flows in £ millions; seasonally adjusted (b)						
1995 Q1	4,661	1,525	495	6,101	4,539	17,320
1995 Q2	4,379	1,364	295	2,187	2,868	11,094
1995 Q3	4,034	1,493	314	3,327	3,684	12,851
1995 Q4	4,147	1,860	404	5,901	3,175	15,487
1994 average	5,250	1,065	-36	-379	2,248	8,147
1995 average	4,305	1,561	377	4,379	3,567	14,188
Contributions to quarterly growth (percentages) (c)						
1995 Q1	0.7	0.2	0.1	0.9	0.7	2.6
1995 Q2	0.6	0.2	—	0.3	0.5	1.7
1995 Q3	0.6	0.2	—	0.5	0.8	2.0
1995 Q4	0.6	0.2	0.1	0.8	0.5	2.2

(a) Rows may not sum to totals due to rounding.
(b) Excluding the effects of securitisation and other loan transfers.
(c) Including the effects of securitisation and other loan transfers

represented deposits by individuals. Most of the remaining increase in deposits was from OFIs, except in the final quarter of 1995 when ICCs also built up their deposits.

Personal sector lending is split into secured and unsecured lending. The growth of secured lending to persons (mostly mortgage lending) weakened steadily throughout 1995 and its contribution to overall lending growth was small given that it amounts to around half of the total stock of bank and building society lending. Unsecured borrowing by persons was strong in 1995, with twelve-month growth rates well above 10%. But most of the growth in M4 lending in 1995 was attributable to the corporate sector (ICCs and OFIs).

The February *Inflation Report* offered two explanations of the aggregate—and sectoral—pattern of broad money and credit growth during 1995. The first focused on the weakness of the economy in 1995. Heightened employment uncertainty and the continued weakness of the housing market may have caused the personal sector to increase their precautionary saving, partly in the form of higher M4 deposits. As a counterpart to this, firms may have experienced an unexpected fall in demand and may have responded by maintaining their output by building up stocks which were financed through increased borrowing from the banking system.

The second explanation was based on the strength of merger and acquisition activity and the marked increase in equity prices during 1995. This could explain the strength of the corporate sector's (both ICCs and OFIs) demand for credit, with ICCs borrowing to finance acquisitions and OFIs borrowing to finance positions in equities and other securities. This expansion in credit was funded through increases in both personal and wholesale deposits: in part as agents held (perhaps temporarily) in the form of M4 deposits the receipts from sales of shares in companies which were acquired for cash; and in part as banks and building societies bid up the relative rate of return on M4 in order to attract deposits.

These two explanations are best explored by examining the position of each sector, drawing on the results of the research described above.

Personal sector

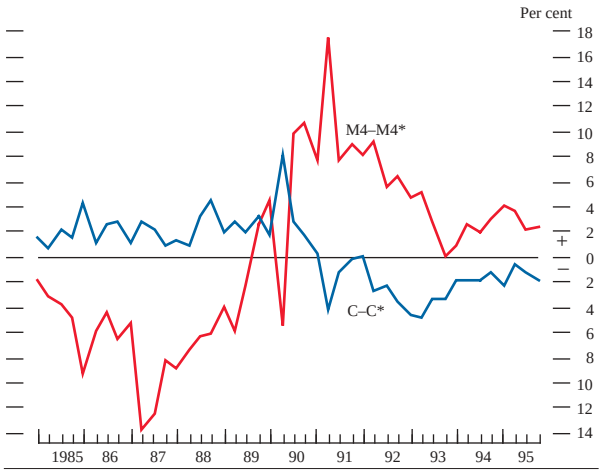
On the latest estimates, the saving ratio rose from 9.2% in 1994 Q4 to 10.5% in 1995 Q4. The earlier analysis suggests that a negative disturbance to real spending would be consistent with a pattern of slower growth in consumption and stronger growth in personal sector M4. One possibility is that increased employment uncertainty (relating to a slowdown in the rate at which unemployment was falling) and continuing weakness in the housing market may have led households to increase their saving for precautionary purposes, part of which was in the form of higher money balances.

Another factor contributing to stronger personal sector M4 growth is the possibility of a rise in the personal sector's long-run demand for money. Growth in deposits from this sector might then represent an adjustment towards a higher desired long-run level of money holdings. The two most likely sources of this shift are the rise in equity prices throughout 1995, which raised the value of private sector wealth, and the rise in disposable income, both of which would increase the desired level of money balances.

The model presented above can be used to estimate the relative contributions of these factors to the growth of personal sector M4 in 1995. For the first three quarters of 1995 the fall in unemployment slowed significantly and our estimates suggest that the higher employment uncertainty implied by this slowdown may have reduced real consumption by an average of 0.3% a quarter up to 1995 Q3 and raised nominal personal sector deposits by an average of 0.2% a quarter. When unemployment started to fall faster in 1995 Q4 some of these effects were partially reversed. Nevertheless, the model slightly underpredicts the growth in personal sector M4 in 1995, which in part may be due to factors other than employment uncertainty influencing households' precautionary saving.

Chart 10 indicates that the effects from higher precautionary saving and other short-run influences have meant that personal sector money holdings have remained higher than their equilibrium level (denoted by M4* in Chart 10) throughout 1995, despite an estimated average rise of 1.1% a quarter in the long-run demand for money from the growth in wealth and disposable income. The gap between actual and equilibrium M4 holdings amounted to roughly 2% in the fourth quarter of 1995, equivalent in nominal terms to just under £10 billion or just over 2% of annual consumption. The chart also indicates that personal sector money balances tend to be above long-run equilibrium when consumption is below its equilibrium level (denoted by C* in Chart 10). Together this suggests some overhang of liquidity which, if past evidence is any guide, could potentially be translated into higher future consumption if consumer uncertainty subsides.

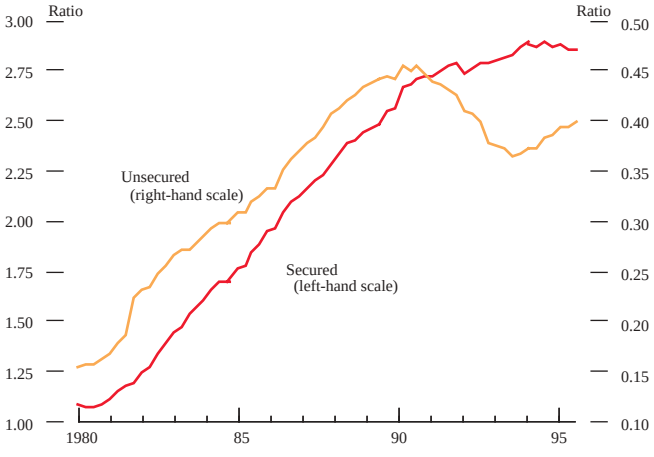
Chart 10
Personal sector money and consumption relative to long-run equilibrium



A further possible influence on personal sector deposits is that well-publicised conversion and merger and acquisition activity in the building society sector led to strong inflows into building societies in search of windfall gains. The November 1995 *Inflation Report* indicated that there was some evidence of this having a net impact on personal sector M4, with a slight strengthening of inflows into building societies at the expense of unit trusts and national savings in the first half of 1995. And there may have been a 'lock-in' effect with depositors reluctant to withdraw funds from the relevant societies even though returns on alternative assets may have been favourable. But some of the funds flowing into these building societies are likely to have come from other accounts within M4—from banks and other building societies. Moreover the fact that individuals' *bank* deposits also grew strongly in 1995 suggests that speculative inflows can, at best, provide only a partial explanation of stronger personal sector M4 growth.

Turning to the demand for credit by the personal sector, the most interesting development in 1995 was the strong growth in (unsecured) consumer credit, while the growth rate of (secured) mortgage lending remained relatively subdued.

Chart 11
Secured and unsecured debt-income ratios(a)

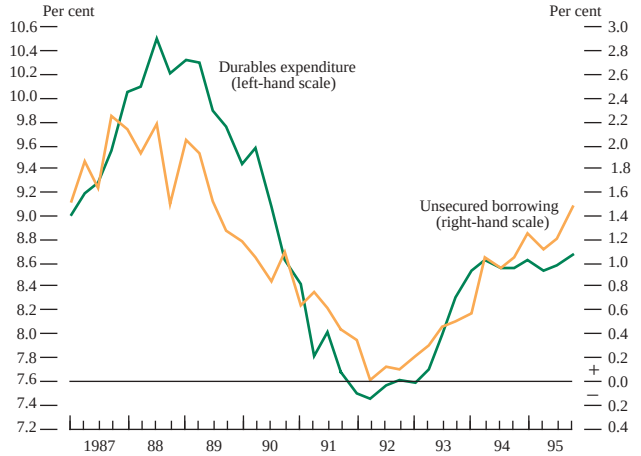


(a) Stock of debt as a proportion of quarterly disposable income.

Chart 11 shows the stock of secured and unsecured personal sector M4 lending as a proportion of disposable income. The personal sector's secured debt burden has increased during the 1990s, albeit at a much slower rate than during the 1980s. The unsecured debt-income ratio, on the other hand, declined in the early 1990s, but has since started to rise again. The faster growth in consumer credit in 1995 may reflect a desire to restore unsecured borrowing to the ratio existing prior to the late 1980s.

Unsecured lending flows are quite small relative to overall consumer spending—the stock of unsecured lending amounts to just over 12% of the total stock of personal sector M4 lending (excluding unincorporated businesses). Since consumer credit consists largely of credit card borrowing and personal loans it is most likely to be related to spending on durable goods. Chart 12 shows that the ratio of durables expenditure to income is indeed quite closely correlated with the unsecured borrowing ratio (the flow of unsecured borrowing as a proportion of disposable income). This may in part be related to anticipated income arising from building society mergers and maturing TESSAs. Agents may have brought forward purchases of durable goods financed by unsecured credit, perhaps on low (zero) interest terms, with the intention of using windfalls or maturing TESSAs to pay off this debt.

Chart 12
Unsecured borrowing and durables expenditure as a percentage of personal disposable income(a)



(a) Quarterly flows as a percentage of disposable income.

Chart 12 also shows, however, that most recently the unsecured borrowing ratio has grown somewhat faster than would have been expected from the durable goods to income ratio. Unsecured borrowing may have substituted for borrowing which would previously have taken a secured form—such as second mortgages or, more generally, borrowing against 'positive equity'(the difference between the value of a property and the amount of the first mortgage against it).

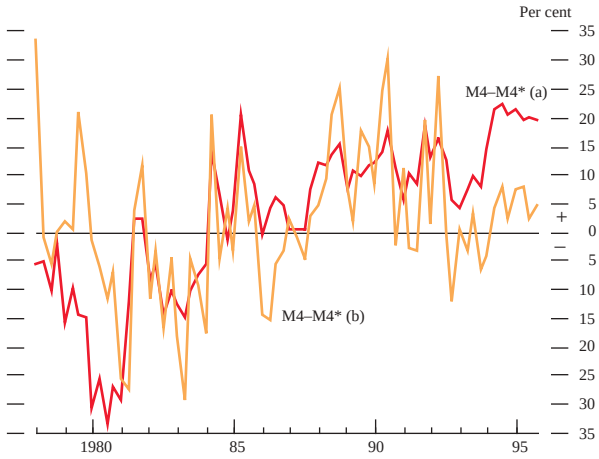
Bringing together the deposit and borrowing behaviour of the personal sector during 1995, there is also a puzzle as to why deposits and unsecured borrowing both grew so rapidly. Part of the answer may be that the data reflect (at least) two types of household, one of which increased deposits in response to greater uncertainty, while the other may have increased both deposits and borrowing in response to higher current and anticipated income and wealth.

Corporate sector: ICCs and OFIs

(a) ICCs' M4

ICCs' deposits were very weak during the first three quarters of 1995. This may have reflected an adjustment to the strong build-up in deposits in 1993 and early 1994. Chart 13 shows the gap between ICCs' money balances and

Chart 13
ICCs' M4 relative to long-run equilibrium



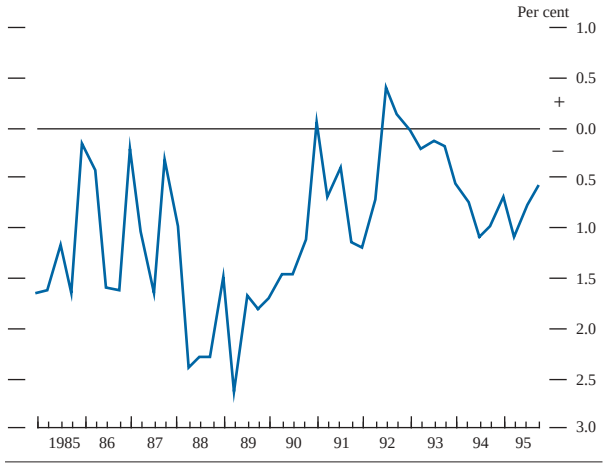
(a) Excluding inflation in M4*.
(b) Including inflation in M4*.

their long-run equilibrium levels (denoted by M4* in the chart) using estimates from the model presented earlier. It shows that the earlier build-up of deposits by ICCs led to a large divergence between actual and long-run equilibrium holdings (although if inflation effects in the model are treated as long-run influences on the demand for money the degree of 'excess' liquidity is not so large). Any divergence between actual and equilibrium money holdings at the end of 1994 may have acted as a brake on the growth of ICCs' deposits throughout 1995—as Chart 13 shows, the gap was partially reversed during the first three quarters of the year. This divergence may also have been a contributory factor to higher equity prices in 1995, as was suggested by the model. The stronger growth in ICCs' deposits of £3.5 billion in the final quarter of 1995 may reflect the liquidity generated by lending for mergers and acquisitions. Some ICCs may be holding the proceeds of equity sales temporarily on deposit prior to purchasing other (real or financial) assets.

(b) OFIs' M4

The model for OFIs' M4 holdings suggests that relative rates of return and wealth are the most important determinants of OFIs' deposits. Chart 14 shows the most important relative rate of return used in the model—the

Chart 14
Spread of own-rate on corporate sector deposits over Treasury bill rate



own-rate on corporate sector deposits less the three-month Treasury bill rate. The own-rate on corporate sector deposits rose marginally relative to the bill rate during 1995 but the spread remained small (since wholesale deposits and other money-market instruments are close substitutes). In addition, recent gains in the stock market may have increased the expected return on equities, reducing the incentive for OFIs to hold deposits.

OFIs' increased demand for money balances in 1995 may therefore have been a response primarily to increased wealth (stronger stock and bond prices). Chart 15 plots OFIs' deposits as a proportion of wealth (gross financial assets), which shows that although money balances rose slightly faster than wealth in 1995, the ratio of money to wealth is not high by recent historical standards. But since OFIs hold only a small proportion of their assets in the form of money balances, small shifts in this ratio imply a large impact on broad money.

Chart 15
OFIs' M4 deposits (break-adjusted) as a percentage of gross financial wealth

(c) ICCs' and OFIs' borrowing

The major problem in interpreting the strength of ICCs' borrowing during 1995 has been the pattern in real-side activity data. GDP growth slowed in 1995 and stockbuilding made a major contribution to the growth which did occur, while whole-economy investment expenditure was rather subdued. One possibility is that the increase in stocks was the result of an unanticipated slowdown in demand growth and that firms who maintained output in the face of that downward shock to demand (and firms' income) might have borrowed to finance their increased stocks.

Table C shows a selection of sources and uses of funds by ICCs. It shows that the undistributed income (retained earnings) of firms weakened in 1995, which may have put pressure on firms to raise external funds. Table C also indicates that the value of the physical increase in stocks was not large enough to explain the turnaround in ICCs' borrowing. But if stock appreciation is considered in addition to the physical increase in stocks, the figures then become more comparable with the growth in credit. The replacement cost of the existing level of stocks rose throughout the first three quarters of 1995, most probably due to the rise in raw materials prices up until the middle of 1995. To the extent that stocks need to be turned over quite rapidly, this would have created an additional need for finance by the corporate sector. But it would also imply that physical stockbuilding was largely voluntary, in anticipation of future input price rises.

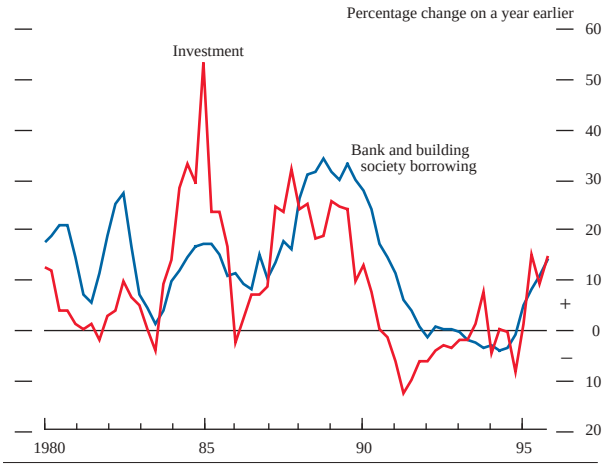
Table C
Selected sources and uses of funds by ICCs in 1995

	Uses				Sources		
	Fixed investment	Investment in UK company securities	Physical stockbuilding and work in progress	Stock appreciation	Undistributed income (less stock appreciation)	M4 lending to ICCs	Net sterling capital issues
Quarterly flows in £ millions; seasonally adjusted							
1994 average	11,617	1,059	839	884	16,234	-379	3,225
1995 average	12,754	4,377	997	1,017	14,708	4,378	2,878
1995 Q1	11,449	7,866	180	1,328	14,605	6,101	2,606
1995 Q2	13,425	570	1,268	1,195	15,880	2,187	2,310
1995 Q3	12,953	4,369	1,671	1,123	14,966	3,327	3,059
1995 Q4	13,189	4,703	869	423	13,382	5,901	3,538

Sources: Bank of England and ONS.

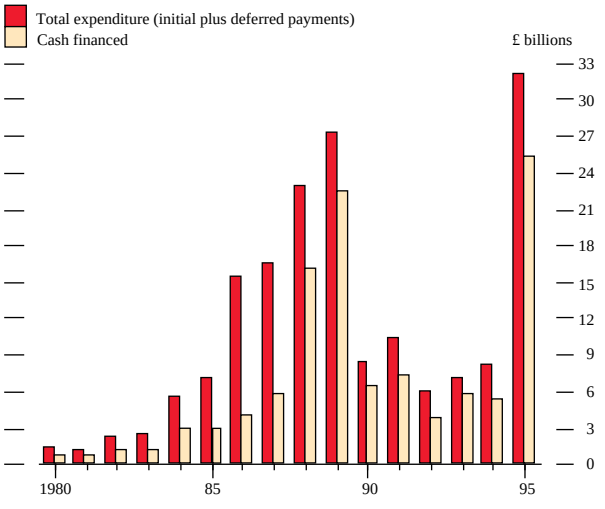
It is less easy to link stronger M4 lending to ICCs (and large net capital issues) to the weakness of whole-economy investment in 1995. But this weakness masks important sectoral differences. In particular, as Table C shows, nominal investment by ICCs picked up markedly in 1995. Chart 16 shows that comparing the four-quarter growth rates of ICCs' nominal investment with M4 lending to ICCs reveals a reasonable degree of correlation during 1994 and 1995, so that part of M4 lending may also be explained by stronger nominal investment by ICCs. Much of this higher nominal investment activity appears to have been due to capital goods price inflation, with the whole-economy investment deflator rising by 5.1% in 1995, while part was also due to lower sales of land and existing buildings by ICCs to other parts of the private sector than in 1994.

Chart 16
ICCs—annual growth in bank and building society borrowing and nominal investment expenditure



Lending to both ICCs and OFIs may also have picked up because of the strength of mergers and acquisition activity in 1995. This was associated with a more general rise in the stock market. Table C shows a large investment by ICCs in UK company securities throughout 1995 and Chart 17 shows that the value of both total and cash-financed mergers and acquisitions activity rose to record levels (although part of the increase in the reported figures represents the inclusion of mergers and acquisitions activity in the financial sector for the first time). The initial rise in such activity and the stock market will not only have led to higher borrowing by firms undertaking the take-overs but may also have encouraged other firms, both OFIs and ICCs, to take positions in shares and other securities financed by bank borrowing.

Chart 17
Value of mergers and acquisitions activity in the corporate sector(a)



Source: ONS.

(a) 1995 includes financial institutions.

Behaviour of banks and building societies

Broad money growth may reflect changes in the provision or 'supply' of credit by banks and building societies to both the private and public sectors. There is some evidence of an increased willingness by banks to lend to the private sector over recent quarters. Spreads between lending and deposit rates narrowed significantly in the first half of 1995, especially to UK corporates. For example, average spreads on banks' syndicated loans to large companies are estimated to have fallen by around 10 basis points to about 55 basis points between 1994 and 1995. This might reflect lenders becoming generally more optimistic about creditors' ability to repay debt, as indicated by the lower provisions made against domestic loan books over the last two years. Alternatively, or additionally, lower spreads may reflect greater competition among banks and building societies, especially in areas such as the mortgage market and lending to large corporates. Narrower spreads and margins are likely to increase the volume of intermediation undertaken by banks and building societies—and thus to increase M4. Meanwhile, data for the large British banks(1) show that over recent years they have increased significantly the amount of capital they hold as a proportion of their risk assets, so they are not currently constrained by capital requirements from expanding their lending in response to an increased demand for borrowing.

Banks and building societies also took up a significant amount of public sector debt (Treasury bills and gilts) during 1995 (see Table D). The government's borrowing from the banking system increases M4 in a similar way to private sector borrowing (assuming no changes in the other counterparts to M4), as banks and building societies bid for deposits to finance the expansion in their assets. This made a significant contribution—in an accounting sense—of nearly 2% to M4 during 1995.

Table D
Increase in holdings of government debt by banks and building societies in 1995

£ billions; *percentages in italics*

	Banks	Building societies	Total bank and building society (increase as a percentage of stock of M4)	
Gilts	2.9	-1.6	1.3	
Treasury bills	6.7	2.8	9.5	
Total net purchases of Government debt	9.6	1.2	10.8	*1.9*

All of these factors suggest that changes in the willingness to lend to both the private and public sectors may have had some role to play in accounting for the expansion of banks' and building societies' balance sheets in 1995.

Summary

Broad money continues to be an important variable in the assessment of inflationary pressures. But the message it conveys is often difficult to disentangle, because the transmission of both nominal and real shocks to the rest of the economy involves a complex interaction between money, credit, interest rates and nominal activity.

(1) See Bank of England (1995).

Our econometric research suggests that analysing money at the sectoral level—and the joint modelling of sectoral money holdings with other variables—makes this interaction clearer, in particular because the determinants of money holdings and their relationship with other variables differ across the personal and corporate sectors.

This approach goes some way towards explaining developments in sectoral holdings of broad money during 1995 and illustrates the possible links between these holdings and future nominal demand. This is discussed further in the May *Inflation Report*, in the light of the sectoral money and credit data for the first quarter of 1996.

Appendix

Econometric relationships

As outlined in the article, our most recent research suggests that M4 holdings should be modelled by sector and jointly with other real and financial variables as a system of equations. The methodology used to estimate the structural models is the 'encompassing VAR' approach[1] which first estimates a statistical representation (reduced-form representation) of the system, in the form of a linear vector autoregression or VAR. A variety of structural models can subsequently be tested against this to see if they can encompass this statistical representation. This procedure involves placing and testing different 'identifying' restrictions on both the short and long-run relationships between the variables, based on different theoretical hypotheses.[2] This framework also allows exogeneity hypotheses to be tested, which may permit the modelling of a simpler 'conditional' or 'partial' system of variables with some variables not needing to be modelled.[3]

Since the time series properties of the data suggest that a large number of the variables used in the estimation are non-stationary across the sample period, efficient estimation requires the analysis to be carried out in two stages. First, the number of long-run relationships are estimated and identified using the Johansen full information maximum likelihood (FIML) procedure.[4] Second, a dynamic (error-correction) simultaneous equation model is derived, which requires further identifying restrictions to be tested. Simplifying exogeneity restrictions are tested between the two stages.

Personal sector

For the personal sector a system of eight variables was initially estimated, consisting of real personal sector M4 (deflated by the consumer price deflator) ($M4p/Pc$); total real consumption spending (C); real personal disposable income (Y_d); the own-rate of interest on personal sector deposits (i_{dp}); the three-month Treasury bill yield as an alternative rate of return (i); the quarterly rate of consumer price inflation (π_c); real gross financial and tangible wealth of the personal sector (Wp/Pc); and the change in the unemployment rate (Δu). All data were seasonally adjusted and all were logged except the interest rates, the inflation rate and the change in the unemployment rate, which were defined as proportions (ie 10% = 0.1). The sample runs from 1977 Q1 to 1994 Q4. Two long-run relationships were found to be present in the data, which could be identified as a money demand relationship and a consumption function given by:

$$LnM4p/Pc = 0.5\ LnY_d + 0.5\ LnWp/Pc + 0.44\ (i_{dp} - i) - 6.4\ \pi_c$$

$$LnC = 0.9\ LnY_d + 0.1\ LnWp/Pc - 0.64\ (i - 4\pi_c) - 1.21\ \Delta u$$

where $i - 4\pi_c$ is the three-month *ex post* real interest rate.

Weak exogeneity tests based on these long-run relationships suggested that we could proceed to model just money and consumption simultaneously. This yielded a two-equation simultaneous error-correction model with error-correction terms *ECMm* and *ECMc* defined as the deviations of actual money holdings and consumption from their long-run levels:

$$\Delta LnM4p/Pc_t = -\underset{(0.21)}{0.61}\,\Delta LnC_t + \underset{(0.13)}{0.39}\,\Delta LnM4p/Pc_{t-1} + \underset{(0.08)}{0.18}\sum_{i=0}^{1}\Delta LnY_{dt-i} - \underset{(0.10)}{0.15}\Delta^2 i_{dpt} + \underset{(0.03)}{0.06}\,\Delta LnWp/Pc_t$$
$$- \underset{(0.15)}{1.2}\,\Delta\pi_{ct} - \underset{(0.02)}{0.11}\,ECMm_{t-1}$$

$$\Delta LnC_t = \underset{(0.09)}{0.46}\,\Delta LnM4p/Pc_t + \underset{(0.13)}{0.41}\,\Delta LnM4p/Pc_{t-1} + \underset{(0.08)}{0.12}\,\Delta\pi_{ct-1} + \underset{(0.05)}{0.12}\sum_{i=0}^{1}\Delta LnY_{dt-i} - \underset{(0.06)}{0.24}\,\Delta i_t$$
$$+ \underset{(0.05)}{0.09}\,\Delta i_{t-1} + \underset{(0.03)}{0.09}\,\Delta LnWp/Pc_{t-1} - \underset{(0.37)}{1.92}\,\Delta^2 u_t - \underset{(0.38)}{1.07}\,\Delta^2 u_{t-1} - \underset{(0.04)}{0.20}\,ECMc_{t-1}$$

Figures in parentheses are coefficient standard errors.

(1) See Hendry, D F and Mizon, G E, *op cit*.
(2) See Bårdsen, G and Fisher, P G (1993) and Johansen, S and Juselius, K (1994).
(3) See Urbain, J (1995).
(4) See Johansen, S (1988).

The model also contained a constant and two dummy variables for 1979 Q2 (1,-1 in Q2 and Q3) and 1988 Q3 (1,-1 in Q3 and Q4). The equations are stable under recursive estimation and pass all misspecification diagnostics at the 5% level. The residual standard errors are 0.70% and 0.59% respectively. The equations are estimated by FIML and the structural model passes the encompassing VAR test.[1]

ICCs

For ICCs, a system of nine variables was considered: real personal sector M4 holdings by ICCs, deflated by the GDP deflator ($M4i/Pg$); real whole-economy gross fixed capital formation (I); real GDP (Y); a weighted own-rate on corporate sector deposits (i_{dc}); the three-month Treasury bill rate as an alternative rate of return (i); the real cost of capital (c_k); ICCs' real gross financial wealth (Wi/Pg); the rate of inflation given by the quarterly change in the log of the GDP deflator (π_g); and a term in capacity utilisation (cu)—the percentage of firms reported to be working below capacity from the CBI survey. This last variable is used to proxy the effect of the existing capital stock on investment. Similar proxies have been used in other investment studies.[2] Again all data were seasonally adjusted and, except the interest rates and inflation, were all logged. The sample runs from 1977 Q1 to 1994 Q4. Three long-run relationships were apparent in the data which could be identified as:

$$LnM4i/Pg = 0.5\ LnI + 0.5\ LnWi/Pg + 2.9\ (i_{dc} - i) - 5.66\ c_k$$

$$LnI = LnY - 3.23\ c_k$$

$$c_k = \bar{c}_k$$

The cost of capital was found to be stationary around a constant mean. The exogeneity tests suggested that we could proceed with a three-equation model of money, investment and the cost of capital. The full structural error-correction model was given by:

$$\Delta LnM4i/Pg = \underset{(0.08)}{0.42}\ \Delta LnM4i/Pg_{t-1} - \underset{(0.21)}{0.47}\ \Delta LnI_t - \underset{(0.08)}{0.31}\ \Delta LnI_{t-1} + \underset{(0.35)}{0.68}\ \Delta i_{dct} - \underset{(0.39)}{0.90}\ \Delta i_{dct-1} - \underset{(0.29)}{0.73}\ \Delta i_t$$
$$- \underset{(0.03)}{0.13}\ cu_{t-1} + \underset{(0.38)}{0.84}\ \Delta LnY_t - \underset{(0.46)}{1.93}\ \pi_{gt-1} - \underset{(0.33)}{1.41}\ \Delta\pi_{gt} + \underset{(0.36)}{0.84}\ \Delta\pi_{gt-1} - \underset{(0.03)}{0.18}\ ECMm_{t-1}$$

$$\Delta LnI = - \underset{(0.62)}{1.4}\ \Delta c_{kt} - \underset{(0.32)}{0.95}\ \Delta i_{dct-1} + \underset{(0.09)}{0.15}\ \Delta LnWi/Pg_t + \underset{(0.21)}{0.66} \sum_{i=0}^{1} \Delta LnY_{t-i} - \underset{(0.04)}{0.15}\ cu_{t-1} + \underset{(0.30)}{0.4}\ \Delta\pi_{gt}$$
$$+ \underset{(0.33)}{0.65}\ \Delta\pi_{gt-1} - \underset{(0.06)}{0.22}\ ECMi_{t-1}$$

$$\Delta c_k = \underset{(0.09)}{0.11}\ \Delta i_t - \underset{(0.18)}{0.84}\ \pi_{gt-1} + \underset{(0.12)}{0.34}\ \Delta\pi_{gt-1} - \underset{(0.04)}{0.09}\ \Delta LnWi/Pg_{t-1} + \underset{(0.07)}{0.13} \sum_{i=0}^{1} \Delta i_{dct-i} - \underset{(0.01)}{0.06}\ ECMm_{t-1}$$
$$- \underset{(0.07)}{0.29}\ ECMc_{kt-1} + \underset{(0.02)}{0.03}\ ECMi_{t-1}$$

Figures in parentheses are coefficient standard errors.

with $ECMm$, $ECMi$ and $ECMc_k$ the deviations of actual money balances, investment and the cost of capital from their respective long-run levels. A constant and two dummy variables for 1983 Q3 (1,-1 for Q3 and Q4) and 1984 Q2 (1,-1 for Q2 and Q3) were also included. None of the three equations showed any signs of instability and all passed a range of misspecification tests, although the cost of capital equation did show some faint signs of heteroscedasticity. Overall the model does not fit the data as tightly as the personal sector model, perhaps reflecting the difficulties in proxying holding period rates of return on alternative assets available to the corporate sector.

OFIs

Initially a system of six variables was considered consisting of real OFIs' M4 using the GDP deflator ($M4o/Pg$); real total financial assets of OFIs (Wo/Pg); the own-rate on corporate sector deposits (i_{dc}); a three-month Treasury/commercial bill rate[3] (i_b); a three-month holding period return on equities, calculated as the dividend yield plus the three-month percentage change in the FTSE actuaries all-share index (i_k); and the inflation rate given by the three-month change in the log of the GDP

(1) See Hendry, D F and Mizon, G E, *op cit*.
(2) See Bean, C (1981).
(3) The choice made little difference to the results.

deflator, (π_g). The sample period of the data was from 1978 Q1 to 1994 Q4; all data were seasonally adjusted and both money and wealth were logged. The Johansen procedure suggested that two long-run relationships were present in the data, which could be identified as the demand for M4 by OFIs and a deposit rate setting relationship for banks and building societies, which might best be interpreted as an 'inverse' supply relationship for OFIs' M4.

$$LnM4o/Pg = LnWo/Pg + 21.3\,(i_{dc} - i_b) + 1.5\,(i_{dc} - i_k) + 6.0\,(i_{dc} - 4\pi)$$

$$i_{dc} = 0.93 i_b + 0.008\, LnM4o/Pg$$

The elasticity of money demand with respect to the 'money-market' spread is large, suggesting that only a small change in relative rates of return is necessary to induce a large increase in the demand for money by OFIs. Exogeneity tests suggested that only money and deposit rates needed to be modelled together. Again two *ECM* terms were defined for the deviations of actual M4 holdings and deposit rates away from their equilibrium values—*ECMm* and $ECMi_{dc}$. The dynamic structural model was given by:

$$\Delta LnM4o/Pg = \underset{(0.95)}{3.305}\,\Delta i_{dct} + \underset{(0.12)}{0.43}\,\Delta LnM4o/Pg_{t-1} - \underset{(0.58)}{0.8}\,\Delta i_t - \underset{(0.37)}{1.5}\,\Delta\pi_{gt} + \underset{(0.03)}{0.09}\,\Delta i_{kt-1} - \underset{(0.01)}{0.06}\,ECMm_{t-1}$$

$$\Delta i_{dc} = \underset{(0.013)}{0.05}\,\Delta LnM4o/Pg_{t-1} - \underset{(0.07)}{0.22}\,\Delta i_{dct-1} + \underset{(0.04)}{0.48}\,\Delta i_t + \underset{(0.07)}{0.26}\,\Delta i_{t-1} - \underset{(0.05)}{0.09}\,\Delta\pi_{gt} - \underset{(0.005)}{0.01}\,\Delta i_{kt}$$
$$+ \underset{(0.01)}{0.02}\,\Delta LnWo/Pg_t - \underset{(0.08)}{0.48}\,ECMi_{dct-1}$$

Figures in parentheses are coefficient standard errors.

A constant and two dummies for 1985 Q1 (1,-1 in Q1, Q2) and 1987 Q1 (1,-1 in Q1, Q2) were also included. The fit of the model is satisfactory and there were no signs of instability or failure of the diagnostic tests. But given the volatility of OFIs' deposits the model above should be considered as an illustrative rather than definitive specification for OFIs' M4 holdings.

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