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# The information in money

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*The monetary and credit aggregates are among many indicators used to consider future prospects for inflation. This article assesses the information contained in money and credit about future real activity and inflation. Some of the sectoral components of money and credit are found to have explanatory power over certain disaggregated components of spending. But none of the aggregates is sufficiently reliable to justify looking only at money when formulating an inflation assessment.*

## Introduction

In 1970 the Bank of England published two influential papers on money. The first, 'The importance of money' by Charles Goodhart and Andrew Crockett, is well-known. It set down the conceptual foundations underlying analysis of the monetary aggregates. And it provided some of the earliest econometric evidence on the robustness of money demand functions in the United Kingdom—the *sine qua non* of monetary targets.

'The importance of money' set in train a whole literature examining the stability of agents' demand for money balances in the United Kingdom. This reached its zenith during the decade of broad money targeting in the United Kingdom between 1976 and 1986. But with the demise of explicit monetary targets, money demand equations are no longer the fulcrum of the monetary policy framework. Money remains important, in that aggregate money determines the aggregate price level over the medium term. But its importance is no longer seen as being tied umbilically to money demand (in)stabilities.

The centrepiece of the new UK monetary framework, introduced in the autumn of 1992, is an explicit target for underlying inflation. No single indicator assumes primacy as a measure of monetary conditions. Instead, policy decisions are based on an eclectic mix of indicators—monetary and real, quantitative and qualitative—which together offer a guide to future inflation. Monetary and credit aggregates are among these indicators. They help inform the authorities' assessment of future nominal demand—a job to which they are clearly well-suited if the velocity of money is reasonably stable. But to know how important a role the money and credit aggregates ought to play in the assessment of inflation, we first need to determine their information content over future real and nominal magnitudes.

One role for money is as an indicator of monetary conditions over the *medium run*, the period over which we

think of money determining inflation in a causal sense. That was how monetary targets were used in the United Kingdom towards the middle of the 1980s, when there was a shift away from strict intermediate monetary targeting. It is also how the monitoring ranges for broad and narrow money, introduced in autumn 1992, have been used. And increasingly, it is the way in which other central banks are choosing to interpret their monetary targets or monitoring ranges. For example, the Bundesbank's most recent M3 target has a longer-term orientation, with a growth path specified two years ahead.

But money and credit might also serve a *short-run* role, as a guide to real and nominal trends two to three years ahead. This issue was first addressed in the United Kingdom by the second paper published by the Bank in 1970, 'Timing relationships between movements of monetary and national income variables'. That paper, also by Andrew Crockett, sought to identify empirically the leading-indicator properties of the counterparts and components of money over future real spending and inflation in the United Kingdom. The current UK monetary policy framework lends itself naturally to this type of leading-indicator analysis. In the same spirit, this article presents some updated results on money-income correlations, analysing short-term relations between a range of monetary and credit aggregates and several disaggregations of nominal spending.<sup>(1)</sup> It asks *whether* and if so, *when* and *why* money and credit might provide us with information about short-run real and nominal trends in the economy.

## Extracting information from the money and credit aggregates

The economic indicators monitored by the authorities may either contain *incremental* information that is not available from other sources, or may simply *corroborate* features observable elsewhere in the economy. Both types of indicator are of interest to policy-makers. And the money and credit aggregates can play either role.

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(1) This work is reported more fully in *Bank of England Working Paper No 35*, 'Money as an indicator'.

For example, to some extent they are simply demand-determined. Money is then no more than a mirror of events on the real side of the economy. Narrow money—basically, cash in the hands of the public—largely falls into this category, since it is available on demand to the public. But in other instances money and credit may offer genuinely incremental information. This may derive from the greater timeliness of monetary data relative to national income data. More fundamentally, however, it may reflect a causal process at work. An example of this is the situation over the last few years, during which agents have built up broad money balances, perhaps as a response to rising real income and wealth. In this situation, higher money balances are felt to be foreshadowing higher future consumption growth. And that is indeed what has happened during the second half of 1996 and into 1997.

But how do we gauge the information content of the money and credit aggregates? And how do we choose among them? This requires some testing procedure. The approach taken here is to look at the *bivariate* relationship between money and credit and various real and nominal indicators. We ask: is this particular measure of money telling us anything about *future* nominal spending, beyond what is contained in lags of nominal spending itself? If the answer is ‘yes’, then we can trace out graphically the implied leading-indicator relationship from money or credit to income. This serves as a measure of the relationship’s significance, timing and thus economic plausibility.<sup>(1)</sup>

Leading-indicator tests clearly need to be interpreted cautiously. They tell us relatively little about whether the link from money to income is genuinely *causal*. Nor do they tell us whether a particular leading-indicator relationship—or lack of one—will persist in the future. For example, money-income relationships in the United Kingdom are likely to have been adversely affected by the effects of rapid financial liberalisation in the 1970s and 1980s, the period covered by our sample. If there are fewer structural changes in financial technology in the future, then significant money-income relationships may re-establish themselves. Because of this, our results are really only useful as a means of ‘stylised fact-finding’; of determining which short-run money-income correlations have shown up systematically and significantly in historical data. They cannot infallibly predict the future—but then, nor can any empirical work.

Despite its theoretical limitations, leading-indicator information is nevertheless valuable as a guide to future activity and inflation. It is for this reason that the Bank of

Canada, like the Bank of England, actively uses monetary indicator models when forming its inflation assessment, in addition to formal inflation forecasting.<sup>(2)</sup> And though observed time-series correlations are not grounded in theory, they can be used as stepping stones to formal structural modelling of money-income relationships. For example, the most recently estimated money demand equations at the Bank were motivated partly by such correlations.<sup>(3)</sup> Through these structural money demand relations, the short-run predictive role of money and its longer-run causal role can be coherently brought together as one.

So which money-income relationships do we consider? We take a lead from recent research, some of it undertaken at the Bank. On the *money* side, aggregate measures of money and credit are a natural starting point for the analysis: narrow money (M0), broad money (M4), bank credit (M4 lending) and Divisia M4 (a measure of the transactions component of broad money).<sup>(4)</sup> But a key and long-running theme of Bank research is that *sectoral* disaggregation can help when modelling the behaviour of money and credit.<sup>(5)</sup> So we also look separately at links between *corporate*, ie industrial and commercial companies (ICCs) and other financial institutions (OFIs), and *personal* sector money and credit holdings, and various measures of activity and prices.

On *real* variables, we also consider both aggregate and disaggregated measures of spending—real output, its (consumption and investment) components and inflation.<sup>(6)</sup> Research suggests that certain measures of money and credit are more closely associated with particular components of spending: for example, narrow money and retail spending;<sup>(7)</sup> personal sector M4 and consumption;<sup>(8)</sup> and companies’ deposits and output and investment.<sup>(9)</sup> Below we perform ‘horse races’ between each of these *bivariate* (aggregate and disaggregated) money-income correlations in turn.

## The information in money and credit

The strength of the correlations between money, credit and spending is summarised in Tables A–D. Those tables consider money-income correlations for narrow money (M0 and notes and coin); broad money (M4 and its disaggregations); lending (M4 lending and its disaggregations); and Divisia M4 (and its disaggregations). In each case, correlations are considered for aggregate and disaggregated measures of spending and for GDP deflator and RPIX measures of inflation. The last of these is, of course, the UK government’s targeted measure of inflation.

(1) Again, the working paper version gives further methodological details. In summary, we use bivariate Granger-causality tests as a metric of money’s leading-indicator properties, with co-integration between money and income accommodated where necessary. To map out the money-income relations, we use the impulse response functions embedded in the bivariate models. That is, we simulate the effects of money and credit on real and nominal variables by temporarily shocking the residuals from a bivariate money-income model. The working paper also discusses some forecasting and structural stability tests performed on the significant relationships.

(2) Longworth and Freedman (1995).

(3) Thomas (1996), Janssen (1996a).

(4) M0 comprises notes and coin in the hands of the public plus bankers’ operational balances at the Bank of England. M4 comprises deposits held with UK banks and building societies by the domestic non-bank private sector. M4 lending comprises borrowing by the non-bank domestic private sector from UK banks and building societies. Fisher, Hudson and Pradhan (1993) provide a description of the construction and modelling of Divisia money in the United Kingdom.

(5) The earliest Bank work in this area is contained in Price (1972). More recent contributions include Fisher and Vega (1993), Dale and Haldane (1995), Thomas (1996).

(6) The accompanying working paper considers a wider disaggregation of real and nominal variables.

(7) Breedon and Fisher (1996).

(8) Fisher and Vega (1993), Thomas (1996).

(9) Dale and Haldane (1995), Thomas (1996).

A tick (✓) in the table indicates that we can be 90% confident that the relationship between money and income is systematic and non-zero; and a double tick (✓✓) indicates that we can be 95% confident of a systematic, non-zero correlation. A cross (X) signifies that there is weak (or no) evidence of a systematic correlation between money and income. The sample period over which we assess money-income correlations is mainly from 1969 to 1993.<sup>(1)</sup> We are looking for significant correlations at most three to four years ahead. In this way, our tests do not examine the medium-term role of money as a determinant of monetary conditions.

*(a) Narrow money relationships*

Table A considers correlations between M0 and notes and coin and various disaggregations of activity.

**Table A**  
**Narrow money relationships**

	M0	Notes and coin
Nominal GDP	✓✓	✓✓
Real GDP	✓✓	✓✓
GDP deflator	✓✓	✓✓
Consumption	✓✓	✓✓
Durable consumption	✓✓	✓✓
Non-durable consumption	X	✓✓
Fixed investment	X	✓✓
Stockbuilding	✓✓	✓✓
RPIX inflation	✓✓	✓✓

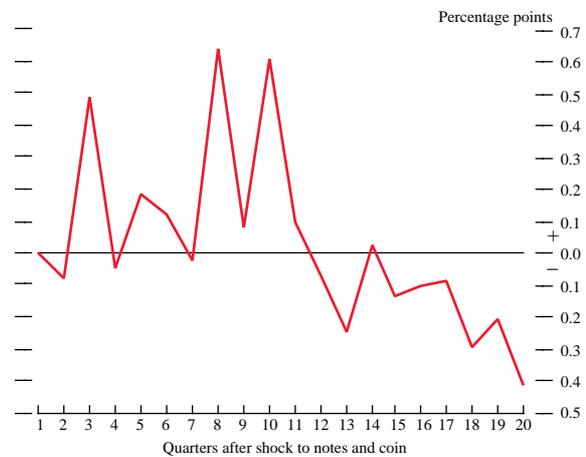
Key:  
 ✓✓ = significant at the 5% level or higher  
 ✓ = significant at the 10% level  
 X = insignificant

The main points from Table A are:

- It is clear that using M0 instead of notes and coin hardly alters the basic results. Money-income relationships are slightly less clearly defined when using M0, owing to the volatility of bankers' operational balances at the Bank of England.
- Narrow money has a well-defined relationship with money GDP in the whole economy. And disaggregating money GDP, that relationship holds with both its real (activity) and nominal (inflation) components.
- The narrow money-*activity* relationship appears strongest with the consumption-related components of spending, for example with retail sales.<sup>(2)</sup> These are likely to correspond most closely to cash-financed expenditures.<sup>(3)</sup> But timing patterns suggest that the narrow money-spending relationship is principally a short-run phenomenon. For example, the effects of a shock to narrow money on real GDP have all but disappeared within four quarters.
- Narrow money has, if anything, an even stronger statistical relationship with both GDP deflator

and RPIX inflation.<sup>(4)</sup> And, unlike its effect on real activity, the effect of a narrow money shock on inflation is long-lived, with a maximum impact after around eight to ten quarters. Chart 1 illustrates this. It traces out the relationship between notes and coin and RPIX inflation, assuming a 1% point shock to (the stock of) notes and coin in the first period. RPIX inflation outturns are persistently positive for around 2½ years. They have a peak response of around 0.5% points after two years. Since this transmission lag is around the same as for interest rates,<sup>(5)</sup> this suggests that notes and coin could prove a potentially useful corroborative indicator of incipient inflationary pressures for monetary policy purposes.

**Chart 1**  
**RPIX inflation response**



- These well-defined leading-indicator relationships between narrow money and future inflation have also been found in previous studies—for example, by Williams, Goodhart and Gowland (1976), Henry and Pesaran (1993), Artis *et al* (1995) and Breedon and Fisher (1996). Because it is demand-determined, cash should in principle be (at best) a corroborative indicator. But in practice the explanatory power of narrow money appears to be incremental: as Breedon and Fisher (*op cit*) show, narrow money contains information beyond that contained in the variables typically thought to be its underlying determinants, such as interest rates and income. There are several possible explanations. One is that narrow money better captures total money spending because it contains information on the 'underground' economy, which is missed by national accounts data.

*(b) Broad money relationships*

Table B gives the results for the relationship between aggregate and disaggregated M4 and various disaggregations of nominal spending.

(1) Though for some of the series the sample is slightly shorter: for example, RPIX inflation figures are only available from 1974, and the Divisia series began in 1977.  
 (2) Not shown in Table A, but given in Table 2 of the working paper version.  
 (3) Breedon and Fisher (*op cit*).  
 (4) The relationship is significant at the 1% level.  
 (5) See, for example, Dale and Haldane (1995).

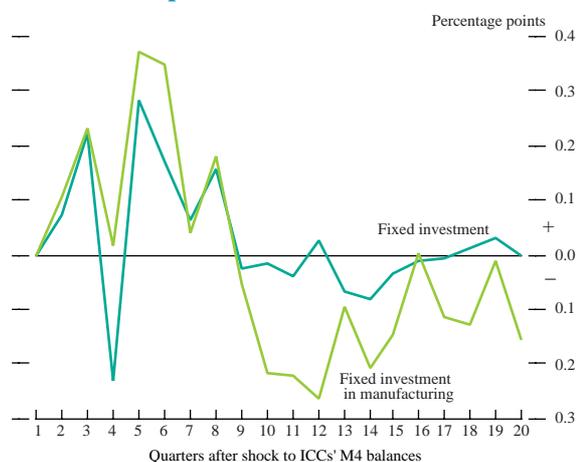
**Table B**  
**Broad money relationships**

	M4 deposits	M4 deposits of ICCs	M4 deposits of OFIs	M4 deposits of persons
Nominal GDP	X	✓✓	X	X
Real GDP	X	X	✓	X
GDP deflator	X	✓✓	✓✓	X
Consumption	✓	X	✓✓	✓
Durable consumption	X	✓	✓✓	X
Non-durable consumption	✓✓	X	✓✓	✓✓
Fixed investment	X	✓✓	X	X
Stockbuilding	✓✓	✓✓	X	X
RPIX inflation	X	X	✓✓	✓✓

The main points are:

- *Aggregate* M4 has in the past performed poorly in predicting short-run movements in *aggregate* measures of spending and prices. There is virtually no evidence of any significant leading-indicator relationship between aggregate M4 and aggregate demand—nominal and real—in the economy over our sample. Or, put differently, the results suggest that the velocity of broad money has been unstable since the late 1960s. That is not particularly surprising. The sample covers a period of rapid and continuing financial liberalisation, during which we would expect the structural relationship between broad money and income to alter. Other countries that have undergone widespread financial liberalisation have also experienced a similar breakdown in simple aggregate money-income correlations, in particular during the 1980s.<sup>(1)</sup>
- But, as the Bank's recent structural money demand work has shown, disaggregating M4 money balances by *sector* helps improve the power of broad money to predict future spending in the short run. The M4 deposit balances of ICCs are an interesting case in point. From Table B, these possess systematic leading-indicator information on both the real and nominal components of money GDP. The nominal money-real activity link is particularly strong for measures of fixed investment and stock-building by companies. For example, Chart 2 illustrates the

**Chart 2**  
**Investment response**



effects of a 1% point shock to ICCs' M4 balances on aggregate domestic fixed capital formation and on manufacturers' fixed investment. The relationships are systematically positive for around eight quarters, with a peak effect of between 0.2%–0.3% points. What might account for this relationship between ICCs' M4 and investment? One story is simply that ICCs increase money balances ahead of making planned—but 'lumpy'—investment outlays. Another, more indirect, explanation is that companies first purchase equity assets with their higher money balances. This in turn raises equity prices, lowers the cost of capital and thus stimulates investment spending. The latter sequence is highlighted in Thomas' (1996) structural modelling of companies' money demand decision-making. Whatever the precise mechanism, the ICCs' M4-investment link appears to be fairly robust and has been used by the Bank as an indicator of firms' future investment plans.

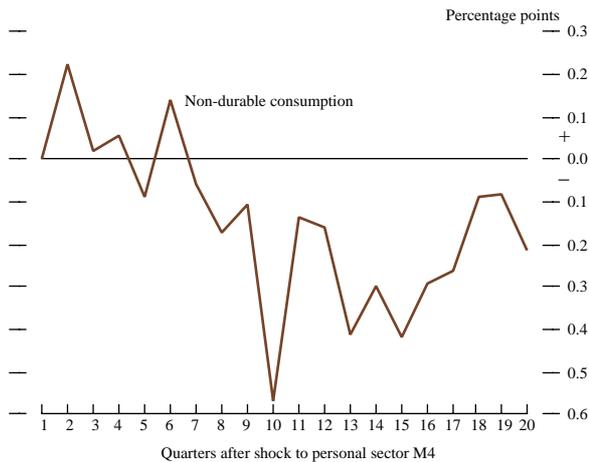
- The possibility of a monetary transmission channel working through asset prices is given added weight if we look at the relationship between OFIs' money holdings and activity. Many of the statistical relationships for ICCs' M4 also hold for OFIs' M4. For example, the link between OFIs' M4 and investment is of similar size and duration to that for ICCs. It is difficult to tell a simple behavioural story about such a relationship, as OFIs make largely portfolio-allocation, rather than direct expenditure, decisions. But one plausible explanation is that OFIs' money holdings are, over time, invested in other real and financial assets. As the price of these assets rises, so too does wealth and with it spending in the economy.
- Finally, looking at the personal sector's M4 balances, the only really significant link is to non-durable consumption. This accords with the findings of Fisher and Vega (1993) and Thomas (1996), both of whom model households' M4 jointly with consumption using a structural approach. Both of these studies conclude that the M4-consumption relationship is far from straightforward. The short-run correlations between M4 and spending can be either positive or negative depending on whether disturbances affect money holdings or consumption. Chart 3 illustrates this finding; it plots the response of consumption to a 1% point shock to personal sector M4. As we would expect, the relationship is positive—exogenously higher money balances boost spending—but is extremely short-lived.

*(c) M4 lending relationships*

Table C summarises the relationship between M4 lending and various disaggregations of nominal spending.

(1) For example, Friedman and Kuttner (1992) highlight the progressive breakdown of the link between M2 and nominal spending in the United States. Estrella and Mishkin (1996) report similar findings for both the United States and Germany.

**Chart 3**  
Consumption response



**Table C**  
M4 lending relationships

	M4 lending	M4 lending to ICCs	M4 lending to OFIs	M4 lending to persons	M4 lending to persons consumption
Nominal GDP	X	X	✓✓	X	X
Real GDP	✓	X	✓✓	X	X
GDP deflator	✓✓	✓✓	X	✓✓	✓✓
Consumption	X	X	✓✓	✓✓	✓✓
Durable consumption	✓	X	✓✓	✓✓	✓✓
Non-durable consumption	X	X	X	X	✓✓
Fixed investment	X	X	X	X	X
Stockbuilding	X	X	✓✓	X	X
RPIX inflation	✓	X	✓✓	X	✓✓

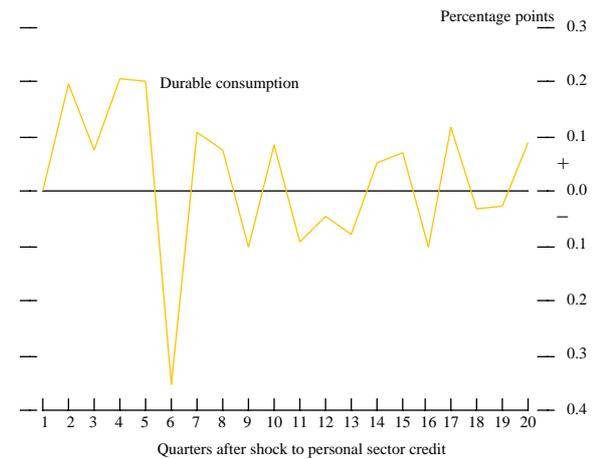
The main points are:

- *Aggregate* measures of credit have in the past fared no better than aggregate M4 in explaining real activity and inflation over the short run. The reasons for this are probably the same. Financial liberalisation has removed many of the earlier restrictions on banks' ability to make loans to households and companies. As fewer agents have become credit-constrained, the credit-income link has probably become weaker, because agents can now substitute at lower cost between bank and non-bank sources of financing.
- But as with M4, a *sectoral* decomposition of credit reveals some more interesting patterns.<sup>(1)</sup> The most consistently systematic relationship is between personal sector lending and consumption. And within this, the strongest credit relationship is with durable consumption. This seems plausible, since durable goods are more likely to be financed by bank loans than by cash or deposits. Also, *total* personal sector lending has a stronger relationship with spending than either of its components—lending for house purchase and lending for consumption. This is consistent with households viewing these two forms of credit as close substitutes. For example, during the 1980s households used house purchase loans to finance consumption—for example, through second mortgages collateralised against housing equity. More recently, when housing

equity has been smaller for many households, they have used consumption loans instead to finance spending.

- As Chart 4 shows, the relationship between personal sector credit and consumption is short-lived, which is to be expected if bank loans are financing, rather than genuinely causing, higher spending. The relationship is also very imprecise. But the link is broadly in line with the view that bank credit is 'special' for some sets of households—namely, those that cannot obtain other sources of financing except at substantial cost.

**Chart 4**  
Consumption response



- That view is further supported when we look at the lending relationships for ICCs and for OFIs. Few are statistically significant, and when they are, the graphical relationships lack any systematic pattern.<sup>(2)</sup> Large firms and financial institutions do, of course, often have alternative sources of non-bank financing—such as capital market issues—into which they can switch at little cost. Bank credit is not 'special' for them. This may well explain the lack of any systematic credit leading-indicator relationships for these types of industrial and financial firm.

(d) *Divisia M4 relationships*

Table D summarises the Divisia M4 results.

**Table D**  
Divisia M4 relationships

	Aggregate Divisia	Corporate sector Divisia	Personal sector Divisia
Nominal GDP	X	✓✓	✓✓
Real GDP	X	✓✓	✓✓
GDP deflator	X	X	X
Consumption	✓✓	✓✓	X
Durable consumption	✓✓	✓✓	✓✓
Non-durable consumption	X	X	X
Fixed investment	✓✓	✓✓	X
Stockbuilding	X	✓✓	X
RPIX inflation	X	✓	✓✓

The main points are:

- As with M4 and credit, there has in the recent past been little systematic relationship between *aggregate*

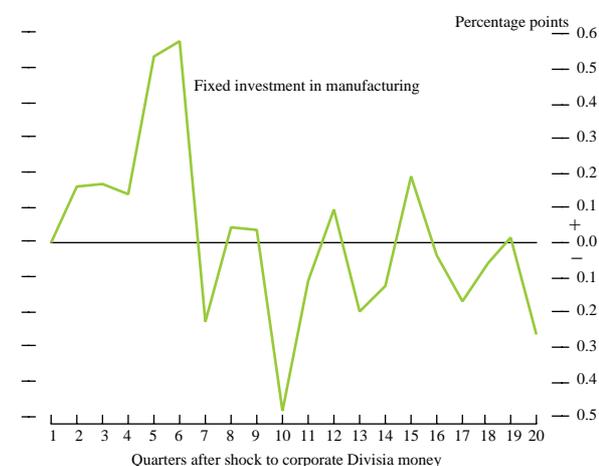
(1) This is in line with the findings of Dale and Haldane (1995), who argued that aggregate measures of credit (and money) obscure otherwise informative short-run profiles from sectoral credit.

(2) The stronger relationships are for OFIs' M4 lending, which may be further evidence of the importance of asset price effects.

Divisia M4 and spending. Divisia is meant to capture the transactions services that money provides. It aims to remove the ‘store of wealth’ component of money, which has increased as a result of financial liberalisation, and to retain the ‘medium of exchange’ component, which ought to be correlated more strongly with current spending. In this way, the velocity of Divisia money should be freer from the destabilising effects of financial liberalisation. But the evidence from Table D suggests that Divisia is not wholly immune to the effects of liberalisation, since it is still difficult to uncover stable aggregate Divisia-income relationships.

- Sectoral disaggregation again helps matters.<sup>(1)</sup> At a sectoral level, many of the more significant relationships simply mirror those with M4. So, for example, the strongest link between personal sector Divisia and spending relates to personal consumption.
- Likewise, corporate Divisia<sup>(2)</sup> has a strong link to future investment spending. This is illustrated in Chart 5. If anything, the link from Divisia to investment is stronger and more systematic than from M4, even though the timing and size of the effect is similar. This is as we would expect if Divisia is indeed a better proxy for the transactions services that money provides.

**Chart 5**  
**Fixed investment response**



## Conclusions

Even under a regime where inflation, rather than any measure of money, is the explicit target of policy, money and credit remain central to the conduct of UK monetary

policy and to the control of inflation. Aggregate measures of money have a causal relationship with the price level over medium-term horizons and so serve as a metric of underlying monetary conditions. And, at the same time, money and credit may also be useful as an indicator of short-run developments in the economy.

The Bank’s more recent results, discussed above, confirm this short-run indicator role. They suggest that, in certain circumstances, money and credit can offer a useful guide to likely developments in activity and inflation. To give a handful of examples, the relationships between narrow money and inflation; between companies’ M4 money balances and future investment and stockbuilding; and between personal sector lending and durables consumption all exhibit well-defined and systematic patterns. An understanding of these relationships can help to inform policy analysis—and has already done so, for example in the Bank’s *Inflation Report*. In particular, there appears to be clear merit in a sectoral analysis of money holdings when analysing their short-run indicator properties. This accords with the findings from previous studies. A sectoral decomposition helps highlight statistical links that are often obscured by aggregate measures of money and credit. And it also helps when telling behavioural stories about why these links might exist—perhaps as a prelude to examining them in a formal structural model. The Bank has instigated monthly collection of the sectoral decomposition of money, which will help in these modelling exercises.

But none of the monetary aggregates has in the recent past offered sufficiently robust early-warning signals to justify looking *only* at money, as would happen under a strict intermediate monetary-targeting regime. There is information in money, but in other indicators as well. The role of the monetary aggregates is best seen as a complement to, and sometimes no more than a corroboration of, the messages from these other indicators. This is a role that they are increasingly coming to play in other countries too, for example in the United States, Canada and Japan. There, as in the United Kingdom, the effects of financial liberalisation have in the recent past hindered any straightforward interpretation of the monetary aggregates. It is possible that a slowing of the pace of financial liberalisation may mean that, in the future, money has a better-defined relationship with nominal spending in the economy. But at present it is too early to know if such an outcome is likely. In the meantime, money still has an important role to play, over both short and medium-run horizons, when gauging incipient inflationary pressures—as originally intimated by Goodhart and Crockett.

(1) Janssen (1996b) conducts some structural modelling of the demand for Divisia at a sectoral level, using the approach in Thomas (1996).

(2) For Divisia money, the transactions money holdings of ICCs and OFIs were not recorded separately at the time of the original study; they are grouped together here as the corporate sector. Since 1996 Q4, the Bank of England has begun publishing separate Divisia series for the ICC and OFI sectors.

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