Bank behaviour and the monetary transmission mechanism

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The monetary transmission mechanism describes the channels through which changes in monetary policy affect the policy target, price inflation. So understanding the transmission mechanism is central to the successful conduct of monetary policy. This article focuses on one aspect of the monetary transmission process: the role of banks.(1)

The article considers the special role played by banks in overcoming problems of imperfect information between borrowers and lenders. This 'specialness' has implications for the conduct of monetary policy and for the measurement of monetary conditions.

We also evaluate the empirical significance of bank behaviour in transmitting monetary impulses, and in doing so explore some stylised features of the monetary transmission mechanism in the United Kingdom. The article concludes that the behaviour of banks significantly affects the impact of monetary policy. And that banks' behaviour—and thus the implied transmission mechanism—differs markedly between the personal and company sectors.

Introduction

A basic principle of economic policy states that, for every target of policy, there must be a corresponding policy instrument. To attain their stated objectives, policy-makers must abide by this rule. Monetary policy is no exception.

In the United Kingdom, both the target and instrument of monetary policy are clearly defined. The *target* of monetary policy is price stability. This target has been explicitly embodied in the new framework for monetary policy, with the introduction of the 1%–4% target range for underlying inflation. The *instrument* of monetary policy in the United Kingdom is equally transparent: short-term money-market interest rates.

The *monetary transmission mechanism* maps the relationship between the monetary authorities' policy instrument—short-term interest rates—and the policy target—price inflation. It describes how private-sector agents respond to the policy actions of the monetary authorities, and how the monetary authorities and the private sector then interact. Understanding the monetary transmission mechanism is thus foremost among the research objectives of central banks. This article draws on recent research in the Bank,(2) which considers one aspect of the monetary transmission process: the role of banks.

What is meant by monetary policy?

As the monopoly supplier of base money, the Bank of England is able to set the price (interest rate) which clears the market for base money.(3) Short-term money-market interest rates are the primary instrument of monetary policy in the United Kingdom. But these interest rates are not the sole arbiter of monetary conditions. And it is monetary conditions generally—rather than short-term interest rates in isolation—which determine nominal spending in the economy. Monetary conditions are better thought of as a spectrum of interest rates, covering many different markets (money, credit, *etc*), and measured at many different maturities (long and short). The central bank cannot *directly* control all of these rates: it directly controls the interest rate in one market—the money market—and at one point in the maturity spectrum.

What is the relationship between monetary policy and price stability?

The link between monetary policy and the final objective of price stability is provided by the authorities' reaction function. This describes how the authorities adjust the monetary instrument in response to the decisions of private-sector agents so as to achieve a target range for price inflation. In the short run, the dynamics of inflation are often dictated by factors outside the authorities' direct

(1) In what follows, 'banks' are taken to mean the M4 institutions; that is, banks plus building societies.
(2) Dale and Haldane (1993a,b,c).
(3) Where base money is defined as notes and coin held by the non-bank public plus the holdings of notes and coin and balances with the Bank of England of the commercial banking system, consolidating the balance sheets of the Bank of England and the Royal Mint.

control, reflecting shocks to markets—both real and financial—which lie outside the direct influence of the authorities.

But in the long run, the price level is determined solely by the actions of the monetary authorities. This power stems from the fact that the central bank alone creates the ultimate means of payment—base money—on which a monetary economy depends. By altering the terms (interest rates) at which this means of payment is provided, the authorities are able to determine the nominal value of transactions in the economy, and hence the price level, in the long run.

Where do banks fit into this process?

In principle, therefore, the link between monetary policy and price inflation is straightforward. The monetary authorities adjust their monetary instrument so as to achieve—at least in the long run—their policy objective. But in practice the channels through which monetary policy is transmitted are both varied and complex. Banks play a unique role in this transmission process, acting as an interface between the policy decisions of the central bank and the expenditure decisions of private-sector agents.

This intermediary function does not, of itself, assign any special role to banks in the transmission of monetary impulses. In a world of perfect information, banks would (at most) play a purely passive role—channeling short-term savings into longer-term investment projects. But because of asymmetries of information between borrowers and lenders, banks are also widely held to be special in the services they provide: as takers of deposits, and as lenders to the private sector. This 'specialness' means that banks' decisions—over the size of their balance sheet and the yields paid on their assets and liabilities—may play an *active* role in the transmission of monetary impulses. It is the role of bank behaviour in the monetary transmission process that the remainder of this article considers.

The role of banks in the monetary transmission mechanism

If bank assets and liabilities have identical characteristics to other borrowing and saving instruments, such as bonds, then bank and non-bank instruments will trade at the same price (and yield). In such a world, the transmission of an official interest rate shock can be defined in two stages.

In the first stage, changes in the official interest rate are translated into all other market interest rates. Since all assets are, in this world, perfectly substitutable, changes in market interest rates along the yield curve will reflect fully the current level and expected future path of the official interest rate.(1) Moreover, the current and expected future path of official interest rates—as embodied in the term structure of market interest rates—would be a fully informative summary measure of the tightness or looseness of monetary conditions.

In the second stage, these movements in market interest rates determine the expenditure decisions of private-sector agents. In a recent *Quarterly Bulletin* article, Easton (1990)—drawing on the Governor's 1987 Mais Lecture(2)—identified three broad channels through which market interest rates might affect the real economy: through the cost of borrowing; through their effect on incomes and wealth; and through their influence on the exchange rate. The article concluded that the impact of interest rates on expenditure in the United Kingdom had become more powerful. The nature of this second-stage process—while still a source of some debate—has been extensively discussed elsewhere. So the primary focus of this article is the first-stage relationship: that between official interest rates and all other interest rates.

In a world of perfect substitutability, the two-stage transmission mechanism operates completely independently of the behaviour of the banking sector. The quantity of bank deposits and credit—and their counterparts, the interest rates on banks' liabilities and assets—are economically indistinguishable from other, non-bank financial quantities and prices, such as bonds. The behaviour of banks can in effect be lumped together with that of all other private-sector agents. As a result, movements in bank deposits and credit (including broad money aggregates such as M4 and M4 lending) would have no greater significance for the future behaviour of the real economy than movements in any other financial quantity.(3) In short, in this scenario, banks play a purely passive role in monetary transmission.

The 'specialness' of banks

But in practice, bank assets and liabilities may not be perfect substitutes for other forms of borrowing and saving instruments. This stems from the role banks play in alleviating the problems of incomplete or asymmetric information in the credit market.

As with many other markets, it is often argued that the efficient functioning of the market for credit is hindered by asymmetries of information between borrowers and lenders. This imperfect information may take many forms: the whereabouts of potential lenders and depositors; the creditworthiness of heterogeneous agents; and the profitability and risk profiles of proposed investment projects. This uncertainty generates a potentially important role for intermediaries which specialise in gathering and distilling agent-specific information. Many economists have suggested that banks perform a unique role in the credit market because of their expertise in screening and monitoring investments which would not be viable in the absence of this information. In other words, banks are 'special'.(4)

(1) Through an expectations theory of the term structure, and assuming risk-neutrality on the part of agents.
(2) Reproduced in the August 1987 *Quarterly Bulletin*.
(3) It is movements in total borrowings and savings—not in their composition—which would affect expenditure decisions.
(4) There is a large, principally microeconomic, literature considering the theoretical underpinnings of this 'specialness'. This literature has recently been surveyed in Kashyap and Stein (1993) and Bernanke (1993). A more detailed review of the interactions between the structure of the financial system and aggregate economic activity can be found in Gertler (1988).

The 'specialness' of banks is reflected in the information costs associated with borrowers switching between bank loans and other forms of financing. Consider a borrower raising finance from a non-bank source, such as by issuing a bond. Before purchasing a bond, investors will wish to consider the security of the investment. How creditworthy is the borrower? How profitable is the underlying investment? If the bond is issued by a large firm, finding the answers to these questions is unlikely to be onerous. For these types of borrower, the information which could be gathered by banks is either publicly available or can be acquired by investors at little extra cost. Since information asymmetries are fewer, bank loans lose their intrinsic 'specialness' over other forms of financing.

Contrast this with the situation faced by households or small firms. The creditworthiness of these types of borrower will be difficult to determine. Information could be made available to investors. But the search costs associated with this would be significant, and often prohibitive. For this group of borrowers, the screening and monitoring services offered by banks represent a significant cost saving. This cost differential acts as an obstacle to households and small firms switching between bank loans and other sources of finance.(1) Bank loans take on a 'specialness'.

Bank deposits may also be 'special'. But the information asymmetries which give rise to the 'specialness' of bank credit are less apparent for bank deposits. Different savings instruments may yield different rates of interest. But this largely reflects differences in the characteristics of the instruments—in their maturity or liquidity—rather than in the information costs associated with switching between them. Accordingly, this article focuses on the specialness of banks which results from differences between bank and non-bank credit, rather than from differences between bank and non-bank 'money'.(2)

The information costs of switching between bank and non-bank credit mean that the rates of return on these instruments differ for some agents. For large firms, the interest rates levied on different forms of borrowing will tend to be very similar. As large firms switch between different forms of financing to find the least costly, competitive pressures will equalise the interest rates charged on these instruments. This correspondence is lost when it is costly to switch between different financing instruments. The reduction in competitive pressures implies that bank-loan rates may move out of line with other borrowing rates; there will be a 'spread' between them. Moreover, this spread may change through time. Interest rate spreads are important for two reasons: they accommodate a well-defined role for banks in the intermediation of funds between borrowers and lenders; and they alter the monetary transmission process.

On the first point, in a world where bank and non-bank instruments can be costlessly exchanged, all asset yields are equalised. Taken to its logical conclusion, since they could no longer make a turn on intermediation, banks would not then exist in their present form. Banks would, in effect, function as no more than wholesale market-makers. But once imperfections in substitutability between assets are recognised, yield spreads emerge. One manifestation of these spreads is the margin banks earn—between the rates at which they lend and those at which they borrow—when intermediating funds. Because banks bridge information asymmetries between borrowers and lenders, this allows them to earn a profit from intermediation, and so provides them with a distinct role.

The existence of interest rate spreads also has implications for the monetary transmission mechanism. Bank-loan rates may now move somewhat differently to corresponding money-market interest rates: the bank-loan/market-interest rate differential—a proxy for banks' margins—is no longer fixed at zero. In particular, changes in bank-loan rates may either 'overshoot' or 'undershoot' corresponding changes in market interest rates; banks' margins may widen or contract. This partial decoupling of bank and other interest rates, in turn, gives rise to a relatively more complex monetary transmission process. This is illustrated in Figure 1.

Monetary transmission in a world with 'special' banks

Monetary policy can still be thought to occur in two stages: a change in the instrument of monetary policy (short-term interest rates) feeds into all other interest rates, which in turn affect the level of nominal spending. But since bank-loan interest rates may move differently to money-market interest rates, private sector spending decisions are now responding to two behaviourally distinct interest rate effects. Monetary policy operates through two channels: the 'money' channel and the 'credit' channel.

The money channel measures the adjustment in nominal expenditure that would result if bank-loan rates moved perfectly in line with money-market interest rates following a monetary policy change. But bank-loan rates may not move perfectly in line. The credit channel measures the adjustment in nominal expenditure which results from bank-loan rates moving differentially to money-market rates.(3) The total effect of monetary policy on nominal spending is then measured as the sum of the money and credit channels.

The credit channel occurs because (bank and non-bank) agents are unable to swap costlessly between bank loans and other sources of finance. Two conditions are necessary for this channel to exist. First, that banks' assets and liabilities are systematically affected by changes in monetary policy.

(1) In the limit, substitution into non-bank credit may be impossible for some agents. This is formally equivalent to quantitative credit rationing; the cost of switching is in effect infinite.

(2) So in what follows, we make two simplifying assumptions: that banks' deposit rates move exactly in line with the corresponding (*ie*, assuming all other characteristics are the same) money-market rates; and, as a result, that banks' specialness derives solely from their assets. These assumptions are relaxed in the later empirical discussion, which considers the importance of both sides of the banks' balance sheet in the monetary transmission mechanism.

(3) See Bernanke and Blinder (1988), Romer and Romer (1990).

And second, that neither the banks nor their customers are able to offset perfectly the change in the quantity of bank loans by switching into alternative instruments.

The existence of a credit channel means that banks play an *active* role in the transmission of monetary policy. Because bank-loan interest rates need not move in line with market interest rates, the banking sector is an active intermediary when passing on monetary policy changes to its customers. Decisions made by the banks about the yields paid on their assets now have an *independent* impact on nominal spending decisions.

As the quantity counterpart of this, bank credit is now economically distinct from other financial quantities. So movements in bank balance sheet variables may provide a useful indicator of the extent to which a change in monetary policy is affecting the real economy; over and above, say, movements in money-market interest rates. This point underlies the continuing importance afforded to bank balance sheet variables, such as broad money, in the conduct of monetary policy.

If bank balance sheet variables are economically distinct, external shocks to these variables will influence final spending. Likewise, shocks to banks' behaviour—for example, as a result of changes in the regulatory regime or financial liberalisation—will also now influence aggregate demand. The range of potential shocks (especially banking sector shocks) influencing the monetary transmission process is thus widened considerably.(1) Clearly, as the sources of uncertainty within the monetary transmission mechanism are enlarged, the authorities' control over the inflationary process in the short run is likely to be reduced.

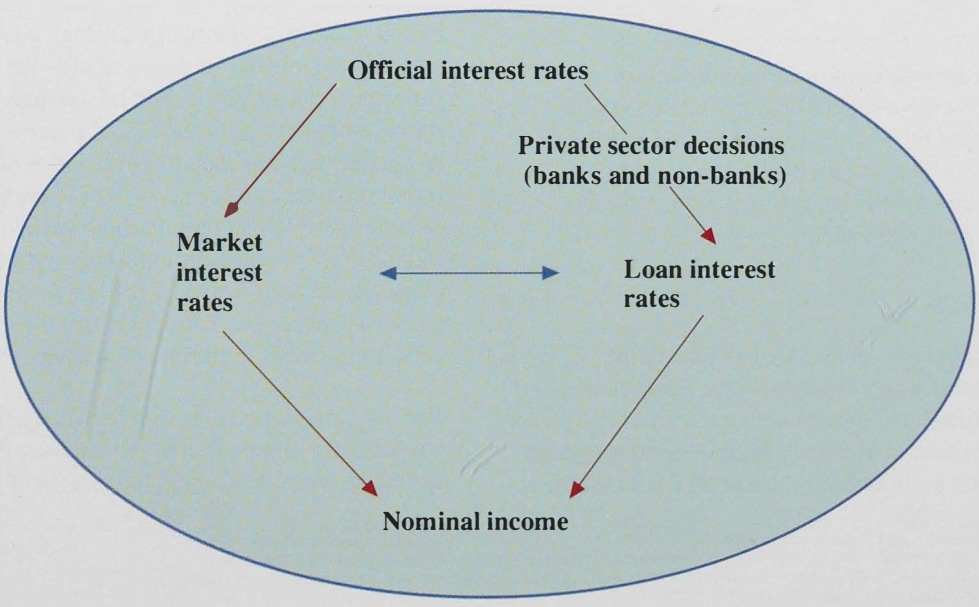
The decoupling of money-market and loan interest rates also means that the term structure of money-market interest rates no longer fully captures the tightness or looseness of monetary policy at any one point in time. Attention also needs to be paid to adjustment in the loan interest rates set by banks. So the (actual and expected) change in official interest rates may no longer be an all-encompassing summary statistic of the marginal impact of a policy change on monetary conditions.

This has a number of implications for the implementation of monetary policy and for monetary control. Even in the absence of external shocks, gauging the effect of a change in monetary policy on final spending becomes problematic. Because of the potentially differential movement in bank-loan interest rates, it is necessary to assess whether bank behaviour—as embodied in the credit channel—increases or decreases the potency of monetary policy.

The credit channel increases the potency of monetary policy if loan rates 'overshoot' money-market rates: that is, if loan rates adjust by more than the corresponding money-market interest rates.(2) Why might this occur? Suppose a monetary contraction shrinks the supply of bank loans. The specialness of banks implies that private sector agents are unable to replace costlessly these bank borrowings with credit from alternative sources. Since borrowers are competing for a smaller volume of bank loans, competitive pressures in the bank credit market are *heightened*. A rise in the bank-loan rate—over and above that in money-market rates—provides the equilibrating mechanism by which this reduced supply of loans is rationed among borrowers.

Consider the reverse case of a monetary loosening, which leads to an expansion in the supply of loans. Then it is the

Figure 1



(1) See Dale and Haldane (1993b), who formalise this notion.
(2) The overshoot case is considered in Bernanke and Blinder (1988).

costs associated with the *banks* investing their assets in other (than loan) markets which causes loan rates to overshoot. Banks reduce their loan rates by more than the corresponding market rates in order to boost loan demand sufficiently to match their increased supply of loans.

The 'undershoot' case occurs if the high (lumpy) costs of switching between different forms of finance act to *stifle* (rather than enhance) competitive pressures in the bank-loan market.(1) In the case of a monetary tightening, the lumpy costs of *banks* switching between assets means that they are reluctant to substitute into bonds, despite them offering a higher rate of return. For a monetary easing, it is the costs faced by *non-bank* private-sector agents when switching away from (higher interest) bank loans which lessens the competitive forces which would normally ensure that banks reduced their loan rates in line with market rates. In both cases, the market in bank credit becomes partially insulated from policy-induced shocks to market interest rates. And, as a result, the bank-loan rate exhibits a 'stickiness'. Thus, in this 'undershooting' case, the credit channel reduces—rather than enhances—the potency of monetary policy.

Which case is the more plausible? In general, the two are likely to co-exist, but for different sets of agents. For example, the overshoot scenario is perhaps more likely for new borrowers: a monetary contraction reduces the pool of *new* loans—increasing competitive pressures and bidding up the loan-rate premium. Whereas the undershoot case is more readily applicable to existing borrowers: existing loans, being akin to contractual arrangements, are less likely to be quickly terminated—lessening competitive pressures and insulating bank-loan rates. But the relevance of undershooting versus overshooting, and the extent of any such decoupling of interest rates, is, inherently, an empirical issue.

Quantifying the channels of monetary transmission

This section considers the empirics of the monetary transmission relationships highlighted in the preceding section. It concludes by estimating a simplified version of the transmission mechanism process sketched out in Figure 1, which allows the importance of banks—and of bank behaviour—to be identified.

The 'money' channel

The money channel can be considered by asking the question: to what extent are changes in the instrument of monetary policy translated into movements in money-market interest rates of various maturities? In the United Kingdom, changes in the short-term interest rates at which the Bank of England lends base money to the discount market provide the signal of changes in the desired level of interest rates. Since the latter half of the 1980s, the Bank has typically initiated changes in its interest rate objective by altering the minimum rate (the 'stop' rate) at which it is willing to discount Band 1 and Band 2 bills from the discount market.(2)

The estimated *short-run* average responses of money-market interest rates—at seven different maturities—to changes in the Bank's Band 1 stop rate between March 1987 and July 1991 are reported in the table.(3) These suggest that a one percentage point change in the Bank's Band 1 'stop' rate leads to a 0.54 percentage point movement in the one-month interest rate on the day of the change, and a 0.79 percentage point cumulative change in the immediately surrounding period (two days before, until one day after, the change). This response falls to a 0.31 percentage point movement (a 0.56 percentage point cumulative change) in the twelve-month rate. The table also reports the smaller mean responses exhibited by longer-maturity interest rates on the day of the change.(4)

Average response of market interest rates to a one percentage point increase in official rates

	1 month	3 months	6 months	12 months	5 years	10 years	20 years
Day of change	0.54	0.39	0.33	0.31	0.15	0.07	0.04
Cumulative short-run response	0.79	0.65	0.64	0.56	0.15	0.07	0.04

As we would expect, the size of the dynamic responses of money-market rates declines across the maturity spectrum: the longer the interest rate maturity, the smaller the *direct* influence of the central bank's official rate. The responses also differ markedly through time depending on: whether or not the policy change was anticipated (or, indeed, was led by) the markets; whether the change was expected to persist; and at what stage—if at all—the change was expected to be reversed. But on average, the short-run relationship between official and money-market interest rates is always less than one-for-one.(5) It is *expectations* of future monetary policy, as well as *current* monetary policy operations which, at least in the short run, dictate the tightness or looseness of monetary conditions. Since these expectations are formed by private-sector agents, the monetary authorities' *direct* control over monetary conditions in the short run is imperfect.(6)

But the *long-run* relationship between official and market interest rates should in theory be unitary: long rates reflect expectations of the future path of official (short) rates, so if

(1) The undershoot case is considered in Dale and Haldane (1993a). The explanation of both the overshooting and undershooting cases suggests that if *either* banks *or* non-bank private-sector agents can costlessly switch between bank and non-bank instruments, the credit channel will not exist.
(2) Band 1 and Band 2 bills refer to eligible bills with less than 14 days and between 15 and 33 days to maturity, respectively. More details about Bank of England operations can be found in the August 1988 *Quarterly Bulletin*.
(3) See Dale (1993) for more details.
(4) These longer rates did not move systematically (or statistically significantly) in the days immediately preceding or following the official interest rate change.
(5) This is consistent with the observed tendency of short-run interest rates to revert over time to their mean level—see below.
(6) But to the extent that a central bank can manage expectations—through credibility, reputation effects *etc*—direct control will be less imperfect.

expectations are formed rationally they should not be systematically incorrect. This accords with our earlier contention that, as the monopoly supplier of the final means of payment, the central bank has ultimate power over the inflation process. Even over relatively small sample periods, such as that used to calculate the short-run responses in the table, this unit long-run relationship can be seen in the data when considering interest rates of a relatively short maturity.(1)

The 'credit' channel

In principle, an exercise similar to the above could be conducted for the credit channel: to what extent do bank-loan rates undershoot or overshoot the movement in corresponding market interest rates? In practice, several factors hinder such an exercise.

The first, and most important from a UK perspective, is the paucity of bank interest rate data. Whereas bank asset and liability quantity data in the United Kingdom are extensively covered, the same is not true of the yields corresponding to these quantities. There are few representative data on the average or marginal interest rates charged on bank loans; even fewer on the rates charged by banks on individual classes of loan, or to different customers. This impedes analysis of the relationship between bank-loan rates and the corresponding market interest rates.(2)

Second, even if comprehensive (average and marginal) interest rate data on bank and non-bank sources of finance were available, the interest rates prevailing in these markets need not necessarily correspond to the 'true' prices facing some borrowers. For some agents, access to certain sources of finance is, in effect, prohibited: either by excessive information costs or, in the extreme, by quantitative rationing. The interest rate which is observed clearing existing demands in these markets will not then be an accurate reflection of the cost facing 'outside' agents wishing to borrow extra funds. The 'true' cost faced by these outside agents (their *shadow price*) is unobservable. Moreover, this true price may differ markedly from the observed market interest rate. The wedge between (unobservable) shadow prices and (observable) market prices will be larger, the greater are the information costs and other barriers to obtaining further lines of credit.

So how might the economic significance of the credit channel in the United Kingdom be quantified? Research undertaken in the United States has followed three broad approaches:

(i) first, a number of studies have considered the behaviour and determinants of bank-loan interest rates, at both macro and micro levels. These studies have often found that loan rates adjust sluggishly to movements in money-market interest rates of like maturity.(3) This stickiness in loan rates is consistent with the 'undershoot' scenario from the earlier section. More generally, loan-rate stickiness is indicative of bank and non-bank instruments being imperfect substitutes as financing instruments—a necessary condition for the credit channel to exist;

(ii) a separate—but related—literature has observed, and attempted to explain, the explanatory power of certain interest rate 'spreads' over final demand.(4) A number of studies have formally linked the predictive power of these interest rate spreads to the monetary transmission process, and to the behaviour of banks within it.(5) The framework from the previous section suggested one channel—the 'credit' channel—which might explain the strong indicator properties of yield spreads over final demand. This explanation is also based explicitly around the transmission of monetary policy shocks.(6) None of the existing studies consider the indicator properties of the money-market/bank-loan interest rate spread which, strictly, is the one implied by the credit channel. But all of the empirical studies of spreads could be thought to be capturing—albeit imperfectly—a similar behavioural mechanism to the credit channel. These spreads studies could therefore be taken as indirect evidence in favour of a 'creditist' view;

(iii) a final strand of literature has sought to model the whole of the monetary transmission process, rather than just measure one or two of the behavioural relationships contained within it. These studies are necessarily 'reduced-form' in nature: the estimated relations between variables are highly simplified and stylised. The importance of bank behaviour within the monetary transmission process is typically tested here by including bank balance sheet data within a system comprising the monetary instrument and its final target. The results from such studies are, on the whole, ambiguous. Conflicting evidence is found on the importance of bank behaviour within the monetary transmission process.(7) Likewise, even if bank behaviour is found to be important, it is unclear whether this role is best captured by money or by credit quantities, or by a combination of both.(8) Despite this, system-wide estimates have offered some useful stylised facts on the nature of the monetary transmission mechanism.

(1) Again, see Dale (1993).
(2) Dale and Haldane (1993b) offer some empirical evidence for the United Kingdom on the official-rate/loan-rate relationship. But the study is necessarily *ad hoc* in its coverage: of both the sample of banks used: and of the bank instruments considered.
(3) See, for example, Goldfeld (1966), Berger and Udell (1992).
(4) For example, a spread recently found to have leading indicator properties over activity in the United States is the commercial-paper/treasury-bill rate differential [Friedman and Kuttner (1992), Stock and Watson (1989)]. For a wider-ranging study of the predictive power of this and other spreads in the United States, see Bernanke (1990).
(5) See Kashyap, Stein and Wilcox (1993), Friedman and Kuttner (1992).
(6) Other behavioural stories have been told, many based around the relative riskiness of different instruments. But risk seems unlikely to explain fully the existence of, and adjustment in, interest rate spreads: see Bernanke (1990).
(7) For the United States, contrast Sims (1972) and Bernanke (1986) with Sims (1980) and Litterman and Weiss (1985).
(8) Again for the United States, compare King (1986), Romer and Romer (1990) and Ramey (1993), with Gertler and Gilchrist (1991), Kashyap, Stein and Wilcox (1993) and Kashyap, Lamont and Stein (1993), and with Friedman (1983) and Bernanke and Blinder (1992).

Of the approaches used in the United States to isolate the credit channel, the first two are effectively precluded in the United Kingdom because of the absence of suitable interest rate data. But the third approach—estimating a simple model designed to capture the whole of the monetary transmission process—is feasible. In principle, the behaviour of banks can be captured equally well by bank quantities (money and credit) as by bank interest rates: one is just the counterpart (or 'dual') of the other. Given that bank balance sheet data are readily available in the United Kingdom, this would therefore seem to be a useful approach.

Moreover, UK money and credit data are collected on a disaggregated—specifically sectoral—basis. This helps further in the identification of a role for banks within the transmission mechanism. Why? The specialness of banks—and thus the potency of the credit channel—is manifest in the dependence of some sets of agents on bank credit. But different sectors have differing degrees of dependence: large firms are typically less dependent on banks than small firms and persons.(1) Monitoring differences in sectoral response thus provides an additional useful means of identifying the credit channel.(2)

In terms of prices, a credit channel emerges because banks charge different loan rates to different sets of agents. The higher the frictional costs—*ie,* the more costly it is for these agents to switch between sources of finance—the higher the loan rates charged relative to comparable money-market interest rates. But these differential loan rates faced by agents are not easily observable: disaggregated loan-rate data are not systematically collected in the United Kingdom. Sectoral quantity data enable us to observe indirectly these unavailable loan-rate data (by the 'duality' argument), and so help identify the credit channel.

Sectoral estimates of the monetary transmission mechanism

This section sets out some stylised estimates of the monetary transmission mechanism in the United Kingdom, and of the role of banks within it. In line with previous studies, the system capturing these interactions is estimated using a Vector AutoRegression (VAR) methodology.(3) Because the relationships which are defined are highly simplified, VAR techniques do not differentiate accurately between competing theoretical explanations of observed phenomena. But they are an efficient means of drawing out 'stylised facts' regarding the monetary transmission process, which can then be set against theory.

The system maps the empirical relationship between the instrument of monetary policy (official interest rates) and its target (price inflation). A number of other variables are included in the estimated system. To the extent that a short-run trade-off exists between output and inflation, movements in real output will also enter the authorities' reaction function in the short run, and so should be included. In addition, the system is augmented with certain financial quantities and prices designed to capture the dominant channels through which monetary policy is transmitted: bank deposit and credit variables to proxy bank behaviour;(4) and the exchange rate and stock prices to pick up additional financial/real interactions.(5) Although simplified, the variables included are widely held to capture many—if not most—of the more important behavioural interactions which make up the transmission mechanism. Given the likelihood of the specialness of banks varying across sectors, separate monetary transmission mechanisms were defined for the personal and company sectors.(6) These sectoral systems were then estimated using monthly data between June 1974 and October 1992.

Once estimated, the systems were used to simulate the effects of an unexpected one percentage point rise in official interest rates on the intermediate and target variables. The responses from these variables for the company and personal sectors are shown in Figures 2 and 3 respectively.(7) The responses cover a five-year horizon, and are measured as percentage deviations from base (except those for interest rates which correspond to percentage point movements).

In general, the qualitative pattern exhibited by all of the variables following a monetary tightening accords with expectations. The effect of an interest rate rise is to: raise the exchange rate; depress share prices; reduce—at least eventually—money and credit growth; and depress demand in the short term and inflation over the medium term.(8) But, within this, there are some interesting dynamic patterns.

The effect of the official interest rate shock is temporary. As the effects of the monetary tightening feed through to demand and prices, the authorities' reaction function leads to an offsetting fall in interest rates: official interest rates 'mean-revert'. In effect, the authorities automatically adjust interest rates such as to stabilise the effects of their initial actions on the economy.

(1) At the end of 1992, bank and building society sterling deposits represented 14% of companies' total financial assets; while borrowings from the same institutions constituted around 11% of total company financial liabilities. The corresponding figures for the personal sector are 25% and 86% respectively.

(2) Studies in the United States, notably Gertler and Gilchrist (1991, 1992) who use a small firm/large firm sectoral distinction, support this contention.

(3) See Dale and Haldane (1993c) for details of the methodology. See also the recent article by Henry and Pesaran in the May 1993 *Quarterly Bulletin.*

(4) That is, behaviour on both the assets *and* the liabilities side of the banks' balance sheet is now accommodated.

(5) Again, definitions and properties of the variables used can be found in Dale and Haldane (1993c).

(6) The personal sector is comprised of households and unincorporated businesses. The company sector comprises incorporated businesses (but not 'other financial institutions'). The sectoral systems were estimated using disaggregated data for both monetary and real-side variables. For the real-side variables, we included industrial production and its associated deflator for companies, and retail sales and its deflator for persons. The VARs also used sectoral measures of bank lending and deposits, defined over the balance sheets of both banks and building societies. For further details, see Dale and Haldane (1993c).

(7) Standard error bands (of ± two standard deviations) are also shown.

(8) To the extent that the responses in the sectoral variables (money, credit, real output and prices) differ between the personal and company sectors, the implied responses in the non-sectoral variables (official interest rates, exchange rates and stock prices) are partial. But using *aggregate* measures of the sectoral variables did not materially affect the *qualitative* responses of the non-sectoral variables. Nor did the inclusion of a long rate of interest, as an alternative channel through which monetary policy might be transmitted.

Figure 2: Company sector

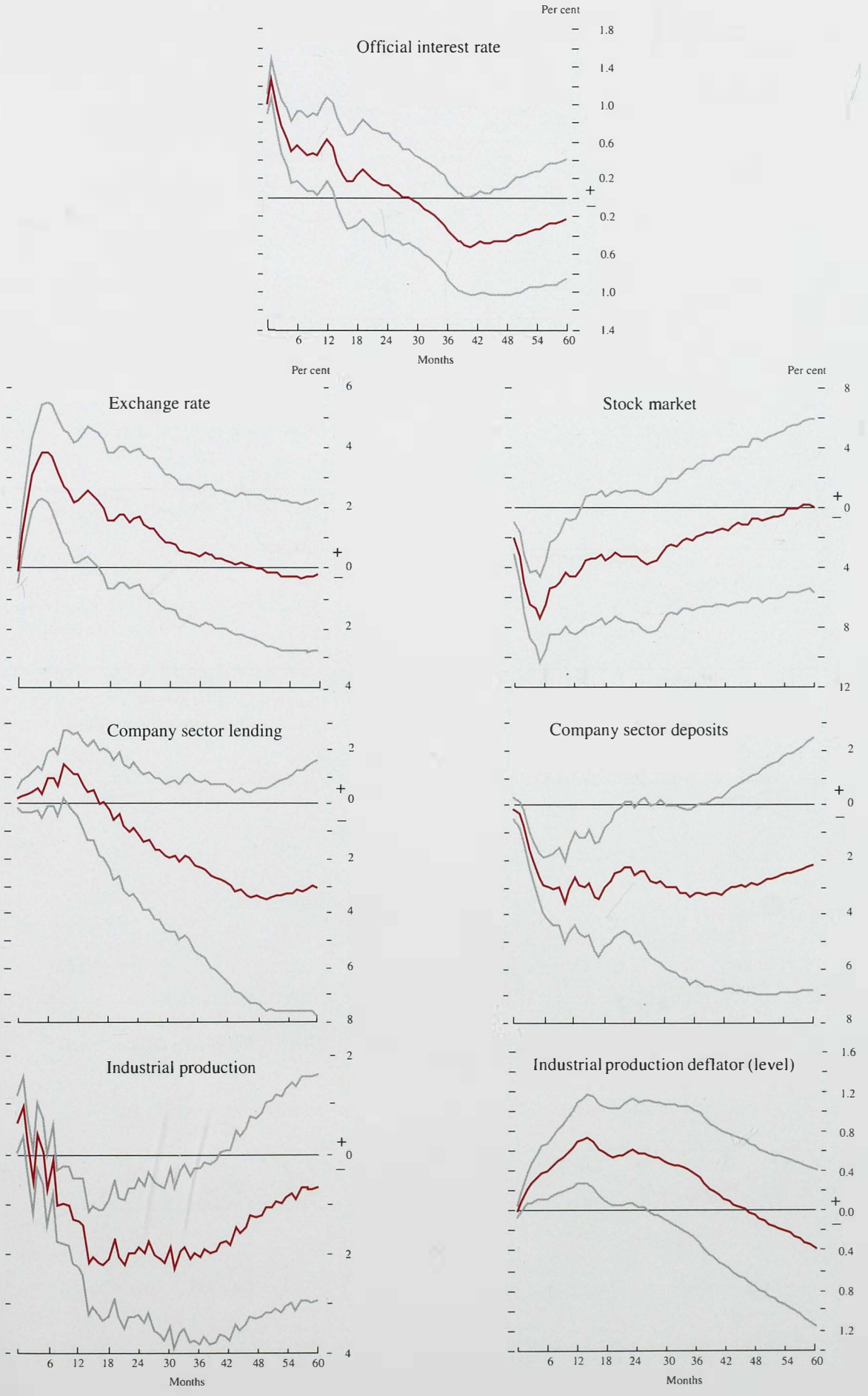
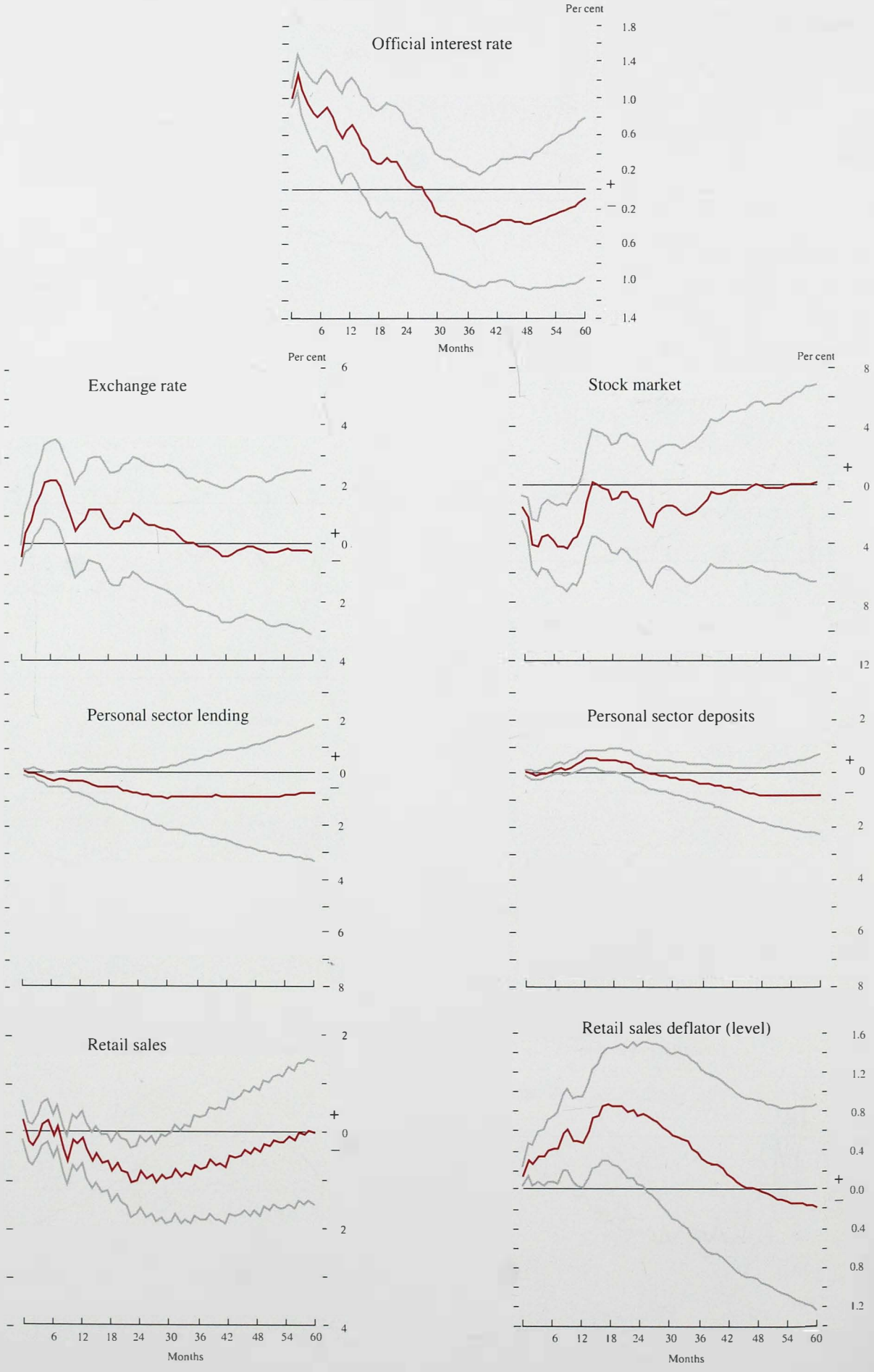


Figure 3: Personal sector



For both sectors, a monetary tightening has a significant *short-run* negative impact on demand. Moreover, the (negative) effects of monetary policy on prices always lag this demand response. This sequencing in price and demand responses suggests that monetary policy 'works' by moving the economy up and down a non-vertical short-run Phillips curve (the relationship between inflation and output/unemployment). But for both sectors, the *long-run* response of demand to a monetary shock is (approximately) zero: monetary policy is output-neutral after five years. This accords with Classical theory: monetary policy cannot be used to affect systematically the level of output in the long run; the long-run Phillips curve is vertical.

In the long run, monetary policy only affects prices. A tightening in monetary policy leads to a lower price level after five years. But a rise in interest rates leads to a *rise* in prices immediately following the shock. This is a property familiar from a number of large-scale macroeconomic models of the UK economy. These models typically rationalise this short-term response by recognising that prices may be set in accordance with some cost mark-up strategy. Thus, a rise in interest rates may raise prices in the short run by raising costs, either directly via the cost of debt servicing or indirectly via wages. This short-run response persists until demand is sufficiently depressed to provide an offsetting influence—as occurs in the system over the medium term.

What additional role does bank behaviour—proxied here by the money and credit responses—have in this framework? We outlined earlier the necessary conditions for a credit channel to exist. These conditions can be compared with the properties of the estimated system to help assess the significance of the credit channel.

The first necessary condition is that monetary policy is able to influence systematically the size of banks' balance sheets. The responses from Figures 2 and 3 support this proposition, with money and credit for both sectors being consistently depressed after the monetary tightening. To the extent that this balance sheet contraction influences total borrowing (differently from that which would result from an equal movement in money-market and bank-loan interest rates), a credit channel can be said to exist.

The short-run responses of money and credit are consistent with the second necessary condition for a credit channel: that agents cannot costlessly switch between differing sources of finance. To see this, consider in detail the sectoral money and credit dynamics.

For companies, the effect of an interest rate rise is to *raise* their bank borrowings in the short term, and to generate an immediate and pronounced contraction in deposits. These responses can be explained by assuming that companies view their assets and liabilities as 'buffer-stocks' of liquidity, which are used to absorb unforeseen shocks to cashflow. Companies meet cashflow shortfalls resulting from the monetary tightening by either building up their liabilities (increasing credit), or by liquidating their assets (reducing deposits). Thus company credit rises, and deposits fall, in the short run. In the longer run, firms scale back their borrowing in line with demand, and partially rebuild their stock of bank deposits. This 'buffer-stock' interpretation of companies' portfolio adjustment is indicative of a sector which is able to draw freely on further lines of credit.(1)

The opposite short-run responses from money and credit are evident for persons. Why? One explanation is that small firms and households face more acute credit-market frictions. Because distress borrowing opportunities do not exist to the same extent for persons, they immediately reduce their borrowing after a rise in interest rates. The perverse short-run response from personal sector deposits is consistent with this: persons view deposits more as an interest-earning component of wealth, than as a buffer-stock of liquidity. So a rise in interest rates *increases* the attraction of deposits in the short run, leading to a portfolio switch away from those assets (such as equities) whose prices may have fallen after the monetary tightening.

According to the above interpretation, sectoral differences in money and credit responses can be traced explicitly to differences in the extent to which agents are able to switch between assets and between liabilities. These differences in substitutability are, in turn, reflected in the usefulness of bank balance sheet variables as advance signals of eventual movements in demand (and hence prices); that is, their usefulness as intermediate indicators for policy. For persons, the slowdown in borrowing clearly *precedes* the slowdown in demand; while the peak response in bank deposits lags that in demand. For companies, the reverse is true: movements in bank deposits provide the more timely signals; whereas credit peaks after demand.

These contrasting responses have two policy implications. First, *aggregate* bank balance sheet variables may provide muddier signals of monetary influences within the transmission mechanism than sectoral measures of money and/or credit. Second, different sides of the banks' balance sheet are preferred intermediate indicators of the eventual impact of monetary policy for different sectors: deposits for companies (where a conventional buffer-stock interpretation of portfolio adjustment appears to apply); credit for persons (for whom bank lending is thought special).

A final test of the importance of bank behaviour is that, if significant, the inclusion of variables designed to capture bank behaviour should alter the estimated impact of monetary policy on nominal spending. Do banks play an active role in the transmission of monetary policy? This proposition can be tested by jointly omitting money and credit from the sectoral systems and seeing whether this has

(1) Gertler and Gilchrist (1991) report similar responses for large firms in the United States. That companies use their bank assets and liabilities as 'buffer-stocks' does not necessarily imply that they are viewed as special by this sector. Companies may be adjusting their bank deposits and loans in conjunction with a number of other assets and liabilities when absorbing unforeseen shocks to cashflow.

a *statistically* significant influence on the results.(1) In both the company and personal sector systems, this was found overwhelmingly to be the case. This suggests a statistically important role for money and credit. But is their joint influence important *economically*?

To gauge this, the responses from our system comprising money and credit were compared with one in which the bank balance sheet variables were omitted. The resulting demand responses are compared in Figure 4. Three points are worth noting. First, there is a noticeable displacement in the responses for both sectors. This suggests that bank behaviour is an economically important determinant of the ultimate impact of monetary policy on demand. Second, these displacements are (proportionally) larger for the personal sector than for the company sector. This suggests that the specialness of banks is greater for persons—as we might expect. Finally, the effect of the bank balance sheet variables on the sensitivity of real output to changes in monetary policy is different across the two sectors: the behaviour of banks reduces the demand response of the personal sector; and increases the demand response of the company sector.

This asymmetric effect is consistent with differences in the operation of the credit channel across sectors. Once the effect of bank behaviour is removed, the differences in the sectoral output responses become less pronounced. We suggested earlier that bank behaviour may cause loan interest rates either to undershoot money-market rates (in which case the potency of monetary policy is lessened), or to overshoot these rates (in which case monetary policy effectiveness is heightened). On this evidence, one plausible interpretation of the data is that the overshoot scenario is more readily associated with companies, and the undershoot case with persons. Personal sector loan rates may be sticky; company sector loan rates less so.

The results from Figures 2 and 3 corroborate this. The effects of an interest rate shock on demand are larger, and occur more quickly, for companies than for persons. For example, the demand effects for companies reach a peak which is roughly double that for persons. And the demand responses for companies are consistently negative after only three months, and peak after seventeen months; the corresponding lags for persons are nine months and twenty-three months respectively. The slower, smaller response in demand from the personal sector is consistent with them being charged loan rates which are 'stickier' in their adjustment than company loan rates.(2)

Summary and conclusions

The monetary transmission mechanism maps the relationship between the instrument of monetary policy and its target. Understanding this mechanism is thus central to the successful conduct of monetary policy. This article has focused on the role of banks in this transmission process.

The importance of banks stems from their expertise in mitigating the problems of incomplete or asymmetric information in the credit market. Banks are, in this sense, 'special'. This specialness implies that bank interest rates need not move in line with other, money-market interest rates in the economy. Policy-makers and commentators alike need to be conscious of this plurality of interest rates

Figure 4: Demand responses

(1) Again, we allow bank behaviour to come through via both bank assets (credit) and/or bank liabilities (deposits).

(2) It should be stressed that this credit channel based explanation is only one of many possible interpretations of the data. For example, bank interest rates may move differently to market rates because the speed at which risk assessments are updated differs across sectors. Alternatively, even if interest rates moved in line, interest elasticities of demand may differ across sectors due, for example, to differences in the composition of persons and companies' balance sheets—generating diverse income and substitution effects across sectors. The VAR evidence cannot distinguish between these competing theoretical explanations.

when assessing the overall tightness or looseness of monetary policy. Moreover, this specialness means that bank credit and deposits are economically distinct from other financial instruments. It is this property which underlies the continuing importance afforded to bank balance sheet variables, such as broad money, in the conduct of monetary policy.

Estimation of a simple system designed to proxy the monetary transmission mechanism in the United Kingdom suggested an important role for bank behaviour. But the importance of banks varies across sectors. There are marked sectoral differences in the channels of monetary transmission and in the ultimate impact of monetary policy on spending. These sectoral differences are usefully distinguished—as has been the historical practice in the *Quarterly Bulletin.* Considering *aggregate* variables in isolation blurs the signals provided by money and credit data. Sectoral measures of money and credit seem likely to provide more accurate and timely signals of future movements in the now explicit target of monetary policy, price inflation.

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