Bank of England

Discussion Papers

No 46

The money transmission mechanism

by

D K Miles

J B Wilcox

December 1989

No 46

The money transmission mechanism

by

D K Miles

J B Wilcox

December 1989

The object of this series is to give a wider circulation to research being undertaken in the Bank and to invite comment upon it; and any comments should be sent to the authors at the address given below.

The views expressed are those of the authors and not necessarily those of the Bank of England. D K Miles is also with the Economics Department, Birkbeck College, Gresse Street, London, W1. The authors are grateful to members of the Economics Division, Bank of England, Christopher Green and Patrick McMahon for comments on the previous draft. Final responsibility for the contents rests solely with the authors.

Issued by the Economics Division, Bank of England, London, EC2R 8AH to which requests for individual copies and applications for mailing list facilities should be addressed; envelopes should be marked for the attention of the Bulletin Group. *(Telephone: 01-601-4030)*

ISBN 0 903314 35 5

ISSN 0142 - 6753

Contents

Page

Abstract

1	Introduction	1
2	Money a veil - the basic quantity equation	1
3	Early Keynesian models	1
4	The definition of money and its control	2
5	Natural rate models with and without rational expectations	5
6	Fixed price models	8
7	The role of the interest rate in the transmission mechanism	8
8	The exchange rate	10
9	Theories of credit rationing	12
10	The impact of removal of credit constraints in the United Kingdom	13
11	Recent developments: price setting agents; multiple equilibria	14
12	Conclusion	15

References 16

THE MONEY TRANSMISSION MECHANISM

This paper surveys some of the work undertaken over the last thirty years to describe the transmission mechanism. Both empirical and theoretical research are discussed and related to the UK economy. Many of the differences that emerge between macrotheorists who have analysed the impact of monetary policy upon prices and output have stemmed from differences in views about labour and goods markets, rather than differences about the links between the money stock and nominal demand. Indeed many of the reduced form models pass over the issue of the the transmission mechanism from money to demand in order to concentrate on the modelling of factor and product markets.

The paper reflects the considerable uncertainty that exists about the importance of particular transmission mechanisms from money to elements of nominal aggregate demand, and the way in which such changes in nominal demand are transmitted to prices and quantities. The transmission mechanism itself is closely linked to the institutional structure. Financial deregulation, removal of exchange controls and the increasing internationalisation of financial markets have all effected the ways in which monetary policy operates. The recognition of the importance of the, partly endogenous, evolution of financial institutions and markets may lead to more institutional models in which way the transmission mechanism operates will depend on the detailed structure of financial markets. Empirical work is likely to change less, largely because the empirical modelling of the process of financial innovation — especially changes in the scope of, and competitive pressures on, financial institutions — is so difficult.

THE MONEY TRANSMISSION MECHANISM

1 Introduction

In this paper our aim is to survey some of the work undertaken over the last thirty years to describe the transmission mechanism. We discuss empirical and theoretical research and try to relate the literature to developments in the UK economy. In recent years the most important differences between macrotheorists who have analysed the impact of monetary policy upon prices and output have stemmed from differences in views about labour and goods markets. Indeed, in the 1970s and 1980s there has been much less emphasis than in the 1960s on the links between changes in the money stock and the level of nominal demand and more on the impact of changes in aggregate nominal demand upon wages, goods prices and quantities. In much theoretical work in macroeconomics nominal demand is modelled in a particularly simple way with aggregate demand depending on the money stock. These kinds of reduced form equations explicitly pass over the issue of the transmission mechanism from money to demand in order to concentrate on the modelling of factor and product markets. As devices to assess the impact of monetary policy such models are limited; for the influence of policy depends on the relative importance and the stability of various possible transmission mechanisms — from money to nominal demand and from demand to prices and output — in designing policy. In particular, the way in which a given change in nominal demand, induced by some change in monetary conditions, will be split between price and quantity responses will itself often depend on how monetary conditions are altered. The most obvious example of the dependence of the price/output effects upon the way in which the level of aggregate nominal demand is changed stems from the important distinction between expected and unexpected changes in macroeconomic policy. For the purposes of practical policy advice it is also important to analyse how a change in monetary policy — say an increase in nominal interest rates — impinges on particular elements of demand; an aggregate, reduced-form link from money to total demand is simply too crude to be helpful here.

In this paper we will assess the relative importance and the stability of various monetary transmission mechanisms in the light of money, price and output trends in the United Kingdom. Part of the value of such an exercise was described by Friedman some twenty years ago when he argued that:

"However consistent may be the relation between monetary changes and economic changes and however strong the evidence for the autonomy of monetary changes, we shall not be persuaded that the monetary changes are the source of the economic changes unless we can specify in some detail the mechanism that connects the one with the other." [Friedman (1969), page 229]

As Friedman implies, without a plausible description of the transmission mechanism one is left puzzling quite how to interpret the enormous outpouring of results reporting correlations of prices, output and money. [On the much discussed empirical issue of money-income causality see the classic articles by Granger (1969) and Sims (1972). For UK evidence see Williams, Goodhart and Gowland (1976) and for a review of more recent literature see Saunders (1988). On the theoretical issues of money-income causality see Tobin (1970) and Kaldor (1982 and 1980).]

2 Money a veil

"It has never been denied that in antiquity the rapid development of the argentiferous lead mines of Laurium raised the price of a medimnus of wheat from 1 to 3 drachmas in the interval between Solon and Aristophanes." (Walras, Elements of Pure Economics)

Despite Walras' observation there is no consensus amongst economists on the relation between the aggregate stock of money, however measured, and the levels of output and prices. Nonetheless, the idea that changes in the level of money lead to equi-proportionate changes in prices, at least in the long run, has a long history going back at least to David Hume. The hypothesis has most usually been expressed with the Fisher equation:

$$MV = PT$$

and the auxiliary hypotheses of (i) the independence of T (real transactions or output) from M ("the" money stock) (ii) the stability of the velocity of circulation — V and (iii) the exogeneity of money. The equation, allied with this set of assumptions, yields the strong neutrality result — money only effects nominal magnitudes and does so in a one for one way; but it cannot be taken as a theory of monetary policy and nor is it helpful to describe the equation as a model. What is missing is any description of the process whereby changes in money, or more generally in monetary policy, come to impact upon prices and or quantities. Developing models which spell out a transmission mechanism inevitably raises further issues — how is money defined?; how is the stock of money changed?; is the relation between money, quantities and prices one which suggests a particular policy rule?

3 Early Keynesian and monetarist models

The formalisation of the basic Keynesian model undertaken by Hicks, and the detailed consideration of various extensions by Patinkin,[a] spelled out several channels by which changes in the stock of money — assumed to be exogenous— influence the

(a) See Patinkin 'Money, Interest and Prices'; Row, Peterson, Evanston (1956).

demand for goods. Summarising these mechanisms Goodhart (1975) says:

'Monetary policy affects expenditure decisions by causing changes in (these) relative yields and also by causing variations in people's wealth through altering the market value of outstanding assets'.

In the standard IS/LM framework, increases in money (usually interpreted as exogenous changes in the quantity of non-interest bearing, outside money) cause a shift in the interest rate on financial assets (bonds) which are money substitutes. The reduction in the return on bonds changes the attractiveness of holding real, as compared with financial, assets and in the consequent transition to a new equilibrium increases the flow of investment expenditure. If, in equilibrium, gross investment is assumed to be an increasing function of the desired capital stock then gross investment is higher in the new equilibrium. In this simple story the transmission mechanism runs from (outside) money to prices of financial assets (bond-yields) to investment expenditure. The difference between nominal and real yields on assets is often handled by assuming zero (or at least fixed) inflation and more direct effects of changing money stocks on expenditure, via wealth effects, are ignored in simple models. Neither of these restrictions is essential. One can make the transmission mechanism in the simple IS/LM framework richer by allowing a direct wealth effect upon consumption and the story, though more complex, is not in principle changed when prices can move. Richer, portfolio models with more assets can allow the impact of changes in money to reverberate throughout the financial system in rather complex ways [see Tobin (1952),(1961),(1968), (1969)]. For example, allowing for less than perfect substitutability between bonds and capital goods, which would imply that the return on these assets will generally differ, adds greater complexity and can generate counter-intuitive comparative static results depending on the assumed substitutabilities between money, bonds and capital goods. [See Tobin (1961),(1969) and B Friedman (1979).]

But despite the great scope for disagreement about price elasticities of demand for various assets, the very different monetary policy proposals advanced by monetarists, new classical and Keynesians (to use convenient labels) remain more a reflection of disagreements about the structure of labour and goods markets. Indeed in some ways there is nothing fundamental about the differences between those economists who in the 1960s believed that the substitutability between money and bonds, and the interest rate elasticity of real expenditures, were such as to make money transmission mechanisms running through such channels weak and those who believed that such mechanisms, and more direct real-balance type effects, were strong. Although the monetarist - Keynesian debate of the 1960s did appear to revolve around disagreements over the substitutability of different assets much more fundamental were the different views on the operation of goods and labour markets which determined how a change in nominal expenditure might be reflected in prices and quantities.

Thus, what gives the policy recommendations in Friedman's 1968 Presidential address their strength is not so much a detailed defence of the hypothesis that the relevant degrees of substitution are such as to make a money to nominal income channel 'powerful', but more a series of simple arguments to show that changes in nominal demand can only effect nominal magnitudes, at least in the longer term. [(a)] Friedman argued that since uncertainty about the price level was itself an economic bad and given that money affects, and in the longer term only affects, prices then a stable path for the money supply was an essential element in macroeconomic policy. He went on to argue that a rate of inflation which was positive encouraged people to economise on holding non-interest-bearing money and that since the production of such money was not costly a low (indeed a negative) rate of money growth was optimal.

What was crucial about Friedman's argument was that a unique equilibrium level of real output existed which was independent of nominal magnitudes. His reference to the levels of trade "ground out" by the operation of the Walrasian auctioneer is important just because in the Walrasian fiction of the auction there is no role for money and the only prices which are determined are relative ones. Money is really only important in the Friedman model because its quantity ties down the price level.

4 The definition of money and its control

Before focussing on the different assumptions about the operation of labour and goods markets, it is important to be clear about just how much is passed over by simply assuming that aggregate nominal demand is a stable, increasing, and in the most restrictive case proportional, function of the supply of nominal money. Two major difficulties may be illustrated using the basic Fisher equation. The first is the definition of money and corresponding transactions; the second, the control of the stock of money, however defined.

(a) The definition of money and its control

If equation *(a)*, where money holdings are made a proportion of the level of transactions, is to capture the demand for money it would seem essential that money should be used primarily for transactions. The broader the definition of money the smaller the proportion used for transactions and the greater for savings. The narrowest monetary aggregate, M0, is mainly notes and coin and, hence, transactions balances. When the velocity relative to GDP is considered (Chart 1) there is a continuous increase over the past twenty years. This illustrates the problem that the velocity of circulation of money, however defined, is unlikely to be constant even when money is used primarily for transactions. Increasing use of bank and building society accounts and credit cards help explain the increasing velocity of M0. Although the velocity has altered over the period it has changed in one direction — a steady increase as cash-saving payments methods have been introduced. The velocity of other measures of narrow money have followed a more erratic course (Chart 1). The relatively rapid growth of interest bearing M1 since 1980 is particularly noticeable, with the

(a) See Friedman (1968).

Chart 1: Velocity of M0, M1 and NIBM1

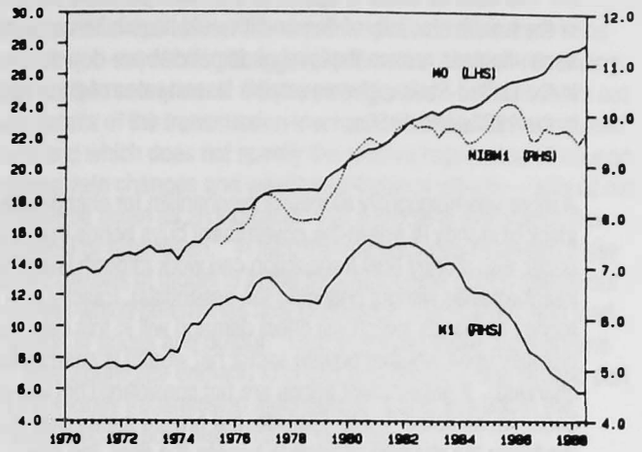


Chart 2: Velocity of broad money

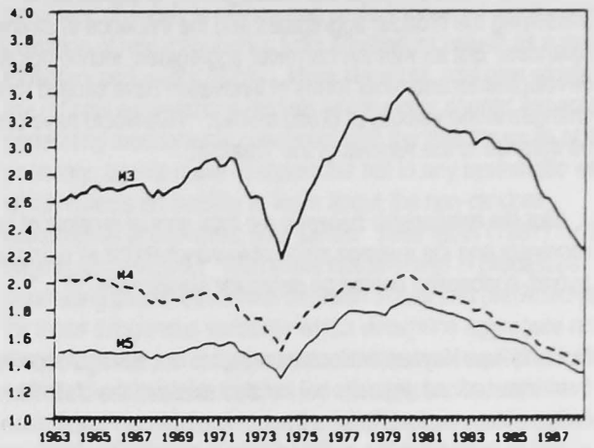


Chart 3: Velocity of sectoral M4 relative to GDP

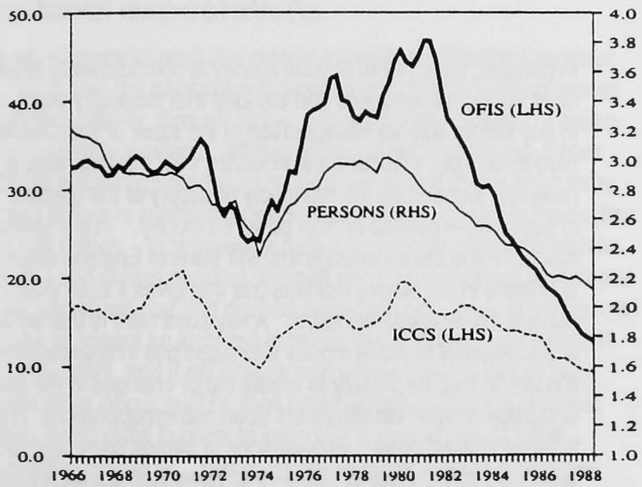


Chart 4 : Annual change in M4 and consumer prices

Per cent

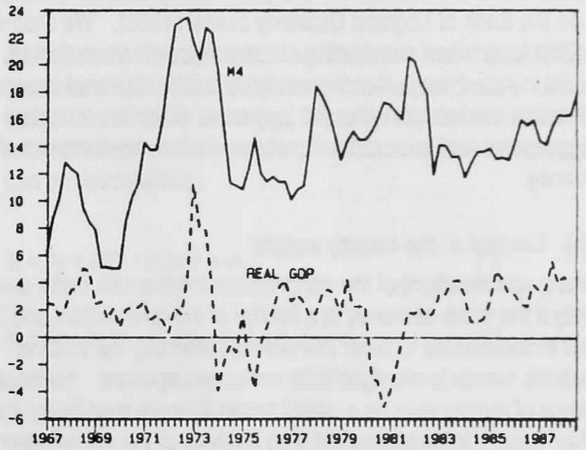
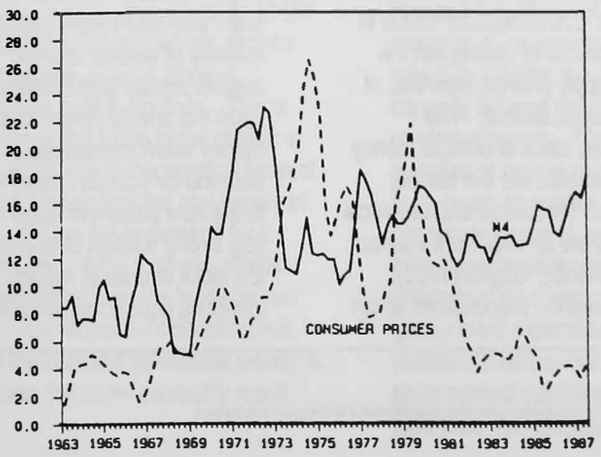


Chart 5 : Annual change in M4 and real GDP

Per cent



growth of interest-bearing chequing accounts increasing the problems in distinguishing between savings and transactions balances. The velocity of broader measures of money relative to GDP (see Chart 2) reflect the heterogeneity of transactions underlying the broader aggregates and the influence of savings balances. But as with the narrower aggregates, technological developments and other forms of innovation have caused dramatic changes in the velocity of broad money. This would have come as no surprise to the Keynes of the Treatise:

"But the relationship between the total annual receipts of income receivers and the average stock of money held for all purposes is a hybrid conception having no particular significance."[(a)]

Not only was Keynes anxious to separate out savings deposits from transactions deposits but he also stressed the distinction between transactions arising from personal income and those from business, with the latter split between industrial circulation and financial circulation (see Chapter 15 of the 'Treatise on Money' and also 'The General Theory of Employment, Interest and Money').

A breakdown of broad money holdings by sector is, however, available. Sectoral velocities (relative to GDP) are shown in Chart 3. The change in these velocities reflect important changes in the financial markets over this period (for a detailed description see the Bank of England *Quarterly Bulletin* 1986). We shall return to this topic when considering credit constraints in section 10. The point to note here is that technological and institutional changes in financial markets can alter the properties of various monetary aggregates and raise difficult problems in the measurement of money.

(b) Control of the money supply

Many specifications of the transmission mechanism make sense only if the stock of money is a liability of the government and does not include inside money. The process whereby the stock of outside money is changed then becomes important. Helicopter drops of money may be a useful fiction in some models but clearly they leave a lot to be desired if an analysis of the transmission mechanism is of interest in itself. The simplest stories of how outside money is increased which are at least institutionally recognisable must make the change in money the result of some transaction between government and the private (including the financial) sector. The simplest mechanism by which outside money changes is as a result of government net purchases (or net sales) of commodities or as a result of a change in the level of transfer payments (eg the payment of a £10 Christmas bonus to old age pensioners). In this case it is crucial to distinguish the demand repercussions of the money supply change from that of the direct government expenditure, or fiscal, effects. The non-fiscal, direct effects of changes in the stock of outside money on private expenditure, via changes in wealth, are the familiar Pigovian real balance effects. There are theoretical and empirical problems with the idea that such effects are an important element in transmitting changes in money to demand. Stiglitz (1982), (1983) has developed a number of irrelevance propositions which show that in an explicitly dynamic general equilibrium model with rational expectations public finance structure is irrelevant. Furthermore, as noted in Greenwald and Stiglitz (1987a), even if the real balance effect is operative then with plausible magnitudes of the wealth elasticity of demand it would have taken a century for such effects to restore the level of demand to pre-depression levels in the United States, given even the fastest rates of price deflation in the 1920s and 1930s.

A more unambiguously monetary mechanism for changing the stock of money is where the government buys bonds from the public with money (this transaction can work through financial intermediaries without changing the essentials). Exactly how this money for bonds switch will effect demand will in this case depend crucially upon whether private sector net wealth is seen as having changed. If government bonds are not considered net wealth, because, as noted first by Ricardo, the private sector may discount the future tax charges needed to service the debt, the money for bonds swap may increase nominal, though in a classical framework not real [see Barro (1974)], wealth by the full extent of the swap. If bonds are seen as being as valuable as currency then the money/bonds switch will only tend to have effects in as much as portfolio reallocation changes the equilibrium pattern of yields on assets.

In practice, the stock of outside money is comparatively small in most Western economies and the idea that monetary policy works in any simple way via manipulation of the stock of such money is hard to accept. Central bank influence over interest rates is, however, founded on the monopoly of supply of the ultimate means of payment — outside or high powered money. In the United Kingdom it is the knowledge that the Bank of England could make shortages in the money markets bite that gives it such power to move short-term interest rates. A key point here is that because of the potential to make money shortages bite in financial markets it is not, in fact, necessary to initiate major changes in the quantity of outside money, via significant open market operations, in order to move interest rates. Expectations of central bank reactions to a failure of interest rates to respond to signs from the authorities that some change is desired can act as a powerful lever for the authorities. What this means is that reduced form relations between the level of aggregate demand and the stock of outside money are rather misleading in suggesting that fluctuations in the quantity of money generate either direct wealth effects or adjustments in the pattern of interest rates, for in practice direct wealth effects[(b)] are not likely to be very significant and interest rates may move significantly with little immediate change in the quantity of outside money. Provided, however, the demand for outside money is not completely inelastic there will be some effect upon the private (financial and non-financial) sectors' holding of money when interest rates change. But if the interest elasticity of demand for outside money is low and if the adjustment of portfolios to the new pattern of rates is slow then one could not expect to find any strong relation between changes in nominal interest rates and the stock of outside money. Certainly it would not be possible to identify a causal relation running from changes in the stock of

(a) "A Treatise on Money", Chapter 24.

(b) ie wealth effects which result from changes in money or bond stocks rather than from revaluations due to changes in interest rates.

exogenously supplied outside money to subsequent movements in the pattern of interest rates.

As a model simplification it is nonetheless common in theoretical work to see used a simple aggregate demand function depending only on the money stock. Such a simplification — which leaves out any details of the transmission mechanism of which it is a reduced form and which does not specify the relative importance of induced interest rate changes and wealth/real-balance effects — should not in itself be taken as an indication that a model is monetarist, new classical or Keynesian. In fact, the key distinction between those broad classes of model is in the structure of the goods and labour markets which determines how changes in nominal demand feed through to prices and output. One might call these mechanisms — from aggregate demand to prices and output — the second part of the money transmission mechanism; it is to this link in the transmission mechanism that we now turn.

5 Natural rate models with and without rational expectations

Early monetarist work [the classic exposition still being Friedman (1968)] saw the transmission process from higher nominal money running, initially, through higher prices (or higher inflation if prices were already moving). With unchanged nominal wages, higher prices encourage producers to increase output. In the short term more labour is supplied as workers are slow to perceive the decline in real wages. In time, wage bargains come to reflect the higher prices and unless nominal demand and prices continue to increase real wages will rise and desired output will fall. If wage bargainers come to expect an increase in prices equal to that experienced in recent years, and if equilibrium real wages need to rise to bring forth extra labour supply, then nominal demand needs to rise at ever faster rates in order to keep real output above its initial (equilibrium) value. This is the now familiar story of a long-run vertical Phillips curve. If one appends to this goods and labour markets theory a reduced form aggregate demand relation making real demand a function of real (outside) money the simple monetarist result of long-run equality of money and price changes can, under further strong conditions, follow. If, however, the real interest rate depends upon the growth of the money supply, super-neutrality of money — the invariance of any real magnitude to changes in the growth of money — is lost. The standard IS-LM model does, in fact, generally make the real interest rate depend negatively on the rate of growth of money, at least along a transition from one steady state growth path to another. This is the so-called Mundell-Tobin effect whereby a rise in the growth of money initially causes a less than equal rise in the nominal interest rate and a more than equal rise in prices so that the real supply of (outside) money is reduced in line with the fall in demand for it induced by higher nominal interest rates. If the long-run capital stock is altered as a result of this transition then the long-run real interest rate may also be affected. The Mundell-Tobin effect will, however, be quantitatively small if the demand for outside money is highly interest inelastic, in which case the super-neutrality result will still hold approximately.

The most influential theoretical development of the 1970s was to take this model but make price and wage bargains more forward looking. In the limit an assumption of super-neutrality for correctly perceived changes in money and perfect foresight would make any deviation of real magnitudes from equilibrium values as a result of monetary policy impossible. More plausible, and now widely used, are rational expectations models which make agents' expectation generating mechanisms consistent with the true structure of the economy; agents make mistakes but not in any systematic way which reflects an inability to learn about the non-random components of economic time series. [See Muth (1961) for the original contribution.] With some randomness in processes generating prices, deviations between actual and predicted paths for those exogenous variables which determine aggregate nominal demand cause real magnitudes to deviate from equilibrium values as individuals mistake nominal for real shocks; but with the underlying assumption of a vertical Phillips curve and a unique real economy equilibrium such deviations will only result from unexpected monetary or fiscal developments [see Lucas (1972), Sargent and Wallace (1975,1976)]. More recently, real business cycle models have been developed which can, unlike the earlier new classical models, generate persistence in the deviations of real magnitudes from equilibrium values. The invariance of real magnitudes to systematic macroeconomic policy is common to both the first and this second generation of new classical models.

A simple new classical model which shows how the neutrality results are derived is the following three equation structure used by Sargent in his 1973 Brookings Paper on interest rates and the natural rate of unemployment. He assumes the macroeconomy can be described by:

$$y_t = k_t + a(p_t - {}_t p_{t-1}) + u_t \qquad (1)$$

$$y_t = k_t + b\,[r_t - ({}_{t+1}p_t - p_t)] + e\,Z_t + e_t \qquad (2)$$

$$m_t = p_t + y_t + dr_t + v_t \qquad (3)$$

y_t, p_t and m_t are the natural logarithms of real national income, the price level and the exogenous money supply, respectively; r_t is the nominal rate of interest; Z_t is a vector of exogenous variables. u_t, e_t and v_t are mutually uncorrelated random variables. ${}_{t+1}P_t$ is the public's expectation, at time t, of p_{t+1}. The variable k_t is a measure of normal productive capacity (eg the log of the stock of labour, of capital or of some linear combination of the two); it is assumed to be exogenous. Equation *(1)* is an aggregate supply schedule making the deviation of output from normal productive capacity depend only on the forecast error for current prices and a random element. This is a Lucas type supply curve which makes supplies of factors of production differ from equilibrium levels only in as much as agents misperceive factor prices. Equation *(2)* is an aggregate demand, or IS, schedule making the deviations of output from capacity inversely related to the real rate of interest and also dependent on a vector of exogenous variables which includes government expenditure and tax rates. Equation *(3)* is a simple portfolio balance equation where bonds and equities are assumed to be perfect substitutes and are alternative assets to real money balances. The demand for money depends on the return on the

other assets and upon real income; thus equation *(3)* is the familiar LM relation.

If agents have rational expectations a number of powerful results emerge from this simple model. First, a natural rate of output exists in the sense that the deviation of output from its normal level is statistically independent of the systematic (and hence forecastable) parts of monetary and fiscal policy. Second, the real rate of interest is independent of the systematic part of the money supply — only random movements in the money supply have effects on both aggregate supply and the real rate of interest. These results depend crucially upon the form of the aggregate supply relation *(1)*; they do not rely upon the relative magnitudes of parameters of the IS or LM curves nor do the results depend upon the simplifying assumption that bonds and equities are perfect substitutes. Indeed any macro-model with rational expectations and a supply function like *(1)* is almost certain to yield ineffectiveness results for systematic monetary policy and, depending on the exact assumptions about the form of money demand functions and the exogeneity of money, will make inflation and the price level depend on the path of the money stock.

The key feature of these models is in bringing out the difference between anticipated and unanticipated changes in monetary policy. In drawing this distinction the models reveal that it can be misleading to talk about the transmission mechanism; for even in the simplest models there are now two transmission mechanisms for monetary policy: one for anticipated monetary policy and a, potentially quite distinct, mechanism for unanticipated policy. In the new classical models anticipated policy will generally only influence nominal magnitudes (ignoring Munell-Tobin type effects as at most second order); unanticipated policy will influence both real and nominal variables.

Further, the added emphasis on the importance of expectations which has followed the new classical "revolution" has prompted economists to take seriously the impact of announcements of future policy. One could view such affects, stemming from the credibility of a statement about future changes in monetary conditions, as another element of the transmission mechanism but one which works before any monetary policy levers are pulled.

Indeed, recent empirical work suggests that announcements of future policy can have effects, especially in financial markets.[a] As yet convincing evidence that announcements have significant effects in the wider economy has not appeared. A much larger literature exists on the empirical evidence for the differential impact of anticipated and unanticipated monetary developments. For the United Kingdom there is strong evidence against the new classical proposition that only unanticipated monetary policy effects real variables [see Alogoskoufis and Pissarides (1983); Fitzgerald and Pollio (1983); Bean (1984); Garner (1982) and Symons (1983)].

As a theory of the transmission mechanism from monetary or fiscal policy to prices and output the new classical models have been widely criticised for failing to account for several clear features of the aggregate time series data for money, output, prices and employment. Most fundamentally the theories seem hard to reconcile with very high serial correlation in deviations of output from trend and the apparent high correlation in the United States between nominal money and real output [see Blanchard (1987)]. Our earlier discussion of the problems of measuring money presage the difficulty that one has in any attempt to relate the predictions of new classical theoretical models with data for the United Kingdom. In the models the money stock is generally exogenously determined by the Authorities. In practice the monetary authorities do not have such control over monetary aggregates. In the United Kingdom interest rates and various credit restrictions have been used to influence the path of money aggregates, though there has always been great uncertainty about how changes in the instruments of monetary policy would impinge on particular measures of the money stock. The problem of predicting how changes in interest rates and credit restrictions will effect monetary aggregates has been particularly acute over recent years when the pace of financial innovation has been rapid. Innovation has made it difficult to gauge the rate of growth of monetary aggregates compatible with low inflation — any correlation between broad money growth and inflation in the 1970s and 1960s has certainly changed since the early 1980s (Chart 4 shows the change in one of the broadest definitions of money, M4, and the change in prices over the past twenty five years); it also makes it hard to isolate those parts of the growth in money which are forecastable by private agents and this makes an assessment of the new classical theory problematic.

It is, however, difficult to reconcile the theories outlined above, which make unexpected money supply changes a key determinant of deviations of output from trend, with the fact that changes in the money supply, interest rates or in credit restrictions are promptly and widely publicised.

Time series data on money, output and prices in the United Kingdom also seem hard to reconcile with new neoclassical models. Chart 5 illustrates the growth of broad money (again we use M4) and real GDP. As a first approximation deviations from recent trend growth rates could be taken as unanticipated movements. The period from late 1971 to early 1973 might then be analysed as an apt illustration of the effect of unanticipated movements in money supply. However, closer examination of this episode indicates that the transmission mechanism at work during that period is unlikely to be accurately represented by the models considered so far. Competition and Credit Control removed restrictions on the financial system, and in particular on the supply of credit, in 1971. Thus, the transmission mechanism at this time partly worked through the removal of credit restrictions, which we examine in more detail in Sections 9 and 10. Furthermore, it is clear that over long periods of time deviations in output from trend have been highly persistent in the United Kingdom . As noted above this is also not easy to reconcile with simple new classical models.

But theories which are consistent with the new classical policy ineffectiveness result and are also consistent with the type of

(a) See Goodhart and Smith (1985) and MacDonald and Torrance [1988 (a), (b)].

Chart 6 : Contributions to Annual Growth of M4

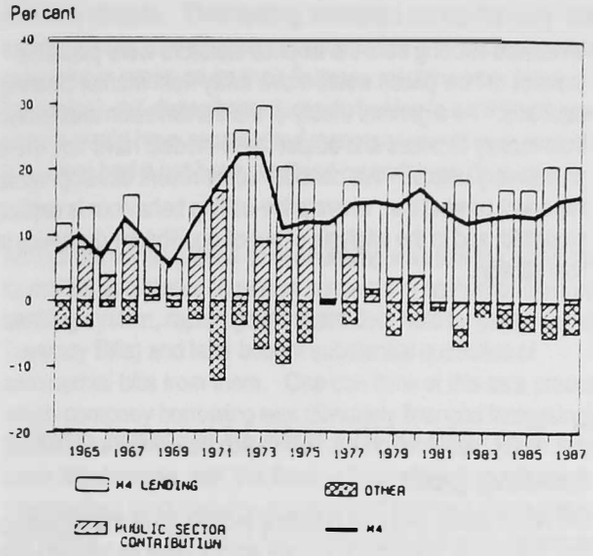


Chart 7 : Public debt in wealth of non-bank private sector and real yeilds

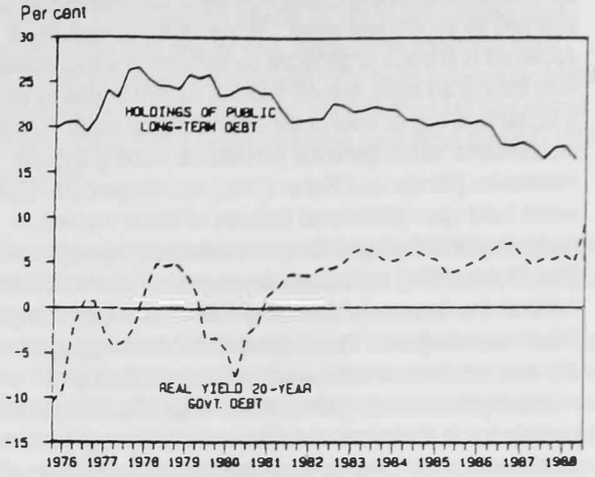


Chart 8 : Annual change in M4 externals counterpart and current balance

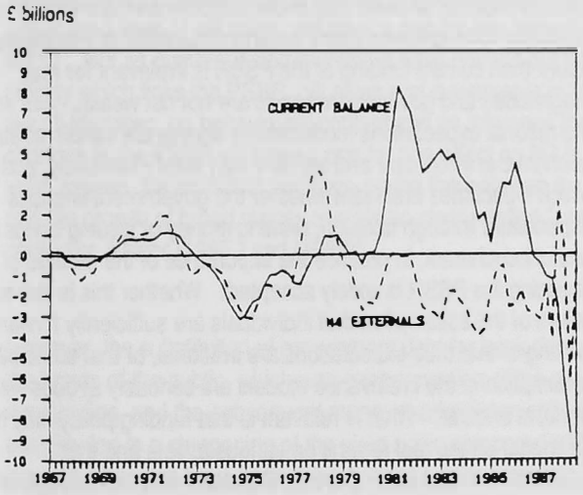


Chart 9 : Exchange rates

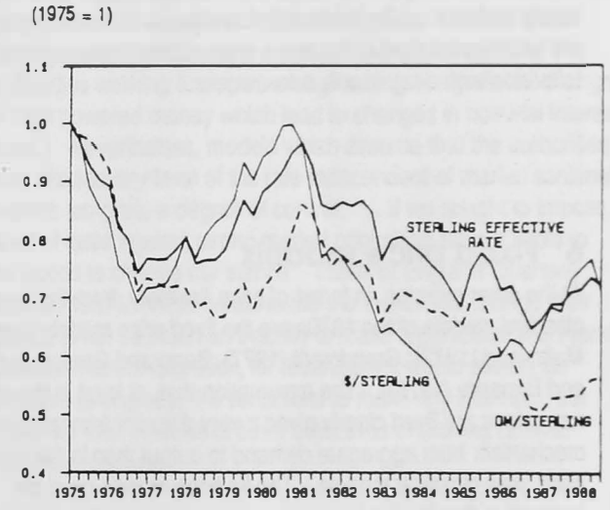
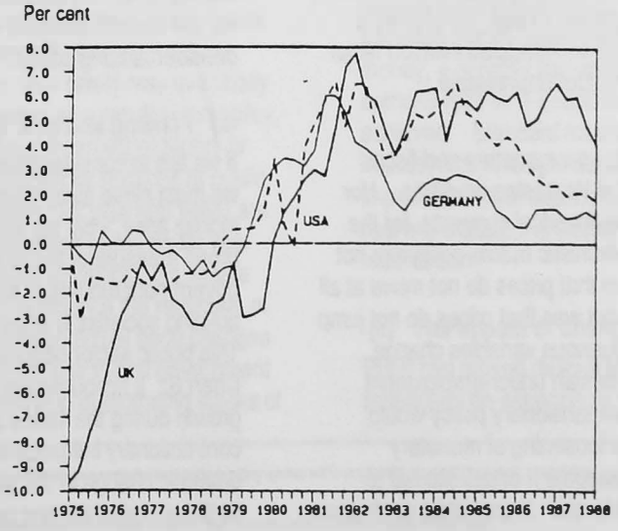


Chart 10 : Real rates to lenders(a)



(a) Gross nominal rate to lender minus proxy for expected rate of change of GDP price inflation (see Bank of England *Quarterly Bulletin* , May 1988).

correlations between macro-aggregates noted above have been constructed, most notably by Lucas [(1979), (1977), (1980)]. In Lucas (1979) unsystematic monetary- fiscal shocks lead to serially correlated deviations in output from trend because of informational lags and an accelerator effect. Irreversibility of investment decisions is enough to generate persistence in output movements from trend if an initial, one-off shock is misinterpreted by agents as a signal for a higher level of the optimal capital stock. Other mechanisms which generate persistence working through inventories [Blinder and Fisher (1981) and Sargent (1979)] and which build upon institutional features of labour markets, in particular the existence of long-term, overlapping wage contracts [see Taylor (1979)] have been developed. If information about nominal shocks was not even available ex-post then changes in the money stock (with the simple reduced-form aggregate nominal demand equations used in such models) could cause misperceptions about relative price changes for a long period and persistence in deviations of output and employment from trend would occur even if capital stock and inventory decisions were easily reversible [see Taylor (1975) and Lucas (1975)].

The plausibility of these mechanisms for persistence of the effects of monetary policy is not high. A theory which, for example, makes large, sustained movements in output, employment and the capital stock depend on unexpected money supply movements is surely undermined by the fact that measures of the money stock are widely published in the press and broadcast on radio and television with a lag of only a few weeks.

6 Fixed price models

At the other extreme, in terms of price flexibility, from the new classical models of the 1970s are the fixed price models [see Malinvaud (1977); Grandmont (1977), Barro and Grossman (1976) and Benassy (1975)]. The assumption that, at least in the short run, prices are fixed clearly gives a very different transmission mechanism from aggregate demand to output than in the flexible price, new-classical models. The fix price models have the implication that in some cases increases in nominal demand, linked as in the new-classical models to increases in the money supply, result in increases in output; in other cases (of repressed inflation) higher stocks of money have no positive, though sometimes a negative, impact on output. In states of repressed inflation factor prices are such as to make higher output unprofitable.

The fix price models showed clearly how monetary and fiscal policies could have real effects out of Walrasian equilibria. Nor were they as restrictive as the name 'fix price' suggests, for the results on the effectiveness of deterministic macro-policy are not nullified if the simplifying assumption that prices do not move at all is dropped. All that need be ruled out was that prices do not jump to (new) Walrasian levels when exogenous variables change. Thus, if the economy were in a Keynesian under-employment regime with constant prices where expansionary policy would increase output, the real effects of a loosening of monetary conditions would not necessarily disappear if prices started to move towards their market-clearing levels. If and when such price movements do take the economy to Walrasian equilibria further expansionary monetary policy will have no effect on output and employment.

What was missing from the fix price literature were plausible theories of how prices would move away from market clearing equilibria. As a general theory of the transmission mechanism from money to prices and output these models have not, therefore, proved very helpful. We consider some recent developments in imperfect competition, where price-setting behaviour is explicitly modelled, and in the analysis of out-of-equilibrium-dynamics in the final section.

7 The role of the rate of interest and funding policy

We noted above that new classical models have the implication that systematic changes in money stocks have no impact upon real interest rates. The implications of assuming rational expectations and efficient capital markets are far reaching and can make other aspects of monetary and fiscal policy irrelevant to real outcomes. Barro's important 1974 paper, which drew on arguments going back to Ricardo, showed that under conditions where individuals, rationally, look to government funding requirements into the distant future then current funding of the PSBR is irrelevant for real magnitudes and government bonds are not net wealth. But while the rational expectations model where agents are certain of the economic environment and act as if they lived indefinitely, and in which it becomes irrelevant whether the government finances expenditure through taxation, printing money or issuing bonds is a useful benchmark, in practice the importance of the method of financing the PSBR is widely accepted. Whether this is due to a failure of the assumption that individuals are sufficiently forward looking or that their expectations are irrational, or that some other assumption of the irrelevance models are seriously at odds with the world, is unclear. What is relevant is that funding policy may have an impact on the real returns on various assets and that fluctuations in real returns are an important channel through which monetary policy works. In this section we consider movements in interest rates and the impact of changes in rates on expenditure. Having up to now considered some classes of theoretical models, we will concentrate here more on empirical findings. We first consider funding policy.

(a) Funding and over funding

If we are to consider changes in methods of financing the PSBR we must move away from the simplification that increases in money arise "from the printing press". If by 'money' is meant a broad measure of the money supply such as M4, then in practice, government funding of the PSBR by borrowing from the banks and building societies is what people now mean by "printing money". This public sector counterpart to broad money growth is shown in Chart 6. It accounted for a significant proportion of broad money growth during the 1960s and 70s but since 1981 has been a contractionary influence on money. Thus, there has been a dramatic change in the way in which the PSBR has been funded. At times during the first half of the 1980s the PSBR was heavily

overfunded, ie, sales of public sector debt to the domestic private sector other than banks substantially exceeded the PSBR in most years, in contrast to the (at times) heavy underfunding of the previous decade. Overfunding increased during the early 1980s as companies resorted more heavily to bank financing (partly as a response to pressure on their finances resulting from fiscal tightening), the deposit counterpart of which in banks' balance sheets would have represented monetary growth in excess of the M3 target had it not been sterilised by additional debt sales.

An indirect consequence of overfunding was that the Bank, through its market assistance to relieve consequent cash shortages in the banking system, repaid government debt held by banks (largely as Treasury Bills) and later bought substantial quantities of commercial bills from them. One can think of this as a process in which company borrowing was ultimately financed increasingly by the non-bank private sector holding long-term debt rather than liquid M3 deposits, with the Bank of England acting as an intermediary (and maturity- transformer) between the public and the banks. The effects of the overfunding policy on money and interest rates are not easy to assess.

Other things equal, a change in the proportion of the PSBR financed through gilt sales, or a change in the size of the PSBR with a fixed level of gilt sales, will have a one for one impact on M3.[(a)] But as numerous commentators have pointed out the identity which links the PSBR, gilt sales and movements in M3 has, like all identities, no behavioural content and an inference that changes in the PSBR will have a one for one effect on M3 is not valid. Indeed, the empirical evidence on the link between the PSBR and the growth of broad money reveals no clear relation [see, in particular, Kaldor (1980) and (1982)].

However, the substitution of government debt for bank deposits in the hands of the public, which was a repercussion of the policy of overfunding, and the subsequent money-market intervention possibly led to a steepening of the yield curve compared with what it would otherwise have been though, once again, empirical evidence on the effect of funding policy on bond yields suggests that if effects do exist they are not strong [see Goodhart and Gowland (1977) and (1978)]. Even the direction of any effect on the *general* level of interest rates is hard to predict; to the extent that lower monetary growth led to lower inflation expectations, *nominal* bond yields (and other longer term rates) may eventually have been generally lower than otherwise as a result of the policy, whereas *real* longer-term rates may have been either higher or lower. Chart 7 shows non-bank private sector holdings of public debt as a proportion of total gross wealth. *Ex post* real yields are plotted on the same graph (gross redemption yields on 20-year government bonds less actual retail price inflation). No simple relation between the two is apparent; in practice the reduction of inflation and the decline in the gap between actual price changes and expectations has more to do with the rise in real government bond yields in the 1980s than any change in outstanding stocks of long-term public debt. The net effect of changes in real government debt on real yields remains hard to identify.

Overall, it is clear that the effects on M3 of overfunding were probably less than one-for-one, since some additional bank borrowing by companies may well have been induced by relatively lower short-term rates; however, the growth of M3 was almost certainly lower than it would otherwise have been [Wright (1984), page 488].

The policy of systematically overfunding the PSBR was abandoned in 1985. It had become apparent by then that much of the fall in broad money velocity during the 1980s was due to financial innovation, that the link between broad money and nominal income was highly uncertain and it was possible for broad money growth to give misleading signals. Overfunding also raised concerns over the growing scale of money-market assistance and the associated allegations about round-tripping. However, the adverse effects of overfunding have never been convincingly demonstrated.

(b) Money-market intervention and short-term interest rates

The authorities also influence rates through operations in the money markets. In principle, it is as a monopolist supplier of high powered money that the authorities have significant influence on rates of interest through the discount market. (But, as noted above, in practice it is not accurate to see the influence of the authorities working through the engineering of significant changes in high powered money which lead to changes in nominal interest rates.) Nevertheless, models which assume that the authorities may choose any level of the rate independent of market sentiment ascribe too great a degree of control: "... if we sought to impose a level of rates against strong market opposition we are liable to be forced to change our stance" (Bank of England *Quarterly Bulletin* 1987). What would make the authorities change their stance is not so much an inability to make a particular short-term nominal interest rate stick, for technically it would always be possible to engineer the conditions to make any rate hold, but more the cost in terms of other objectives of moving rates to "extreme" regions.

The authorities' influence over long-term rates, which may be more relevant than short-term rates for decisions about expenditure on durable commodities, is far from complete. This contrasts with standard macro-models where through changing the stock of money, a variable assumed to be in the power of the monetary authorities to vary exogenously, any level of interest rates can be achieved. Standard macro-models also assume that changes in interest rates brought about by the monetary authorities have an impact upon real expenditure. This link between interest rates and real expenditures is clearly a crucial chain in the transmission mechanism.

(c) The impact of changes in interest rates

But it has proved difficult to identify significant, stable interest rate responses on expenditure.[(b)] Channels which run through the

(a) Greater money-market assistance by the Bank of England to relieve a cash shortage in the banking system will in practice be needed if there are, other things being equal, more gilt sales.

(b) For useful sources on the interest rate properties of large models of the United Kingdom see Chouraqui et al (1988) and Fisher et al (1989).

cost of capital are generally slow and have proved hard to model. One reason for the apparent weakness of such effects may well be that the true cost of capital and stocks are not easy to calculate. But perhaps more importantly the time lag between changes in the cost of capital and any impact of expenditure is likely to be long, even if such effects are eventually significant, but also because it is nominal interest rates which monetary policy affects but it is the real cost of funds which is relevant for expenditure decisions. Conditional on given inflation expectations a change in nominal rates does, of course, change real rates. But the impact of changes in nominal rates on inflation expectations (even the direction of which is by no means clear) and the effects of the tax system make the link between nominal interest rate changes and the real cost of capital hard to predict. More significant may be the fact that the long lags between decision making and implementation of expenditure, and the long life of many capital projects, make it inevitable that decision makers must look at the cost of capital many periods ahead; changes in interest rates which are thought to be temporary are therefore unlikely to have much effect on investment and expenditure on consumer durables. Furthermore, anticipated changes in interest rates, if realised, may have little apparent effect on expenditure as past investment plans, and hence the capital stock, will have already taken them into account.

The introduction of the supply side now means that there is a cost of capital effect on investment and stockbuilding in some models. Most macro-models find that short-term interest rates have a negative impact on consumers expenditure and a powerful depressing effect on house building. Furthermore, there is reason to expect that the effects on consumers' expenditure of changing interest rates may have increased in the 1980s as the debt of the personal sector has risen sharply [see Dicks (1988)]. In the course of 1988 the personal sector's holdings of liquid liabilities exceeded their holdings of liquid assets for the first time in at least twenty years. Thus, income effects of interest rate changes will enhance substitution effects.

Another important channel through which interest rate changes influence demand, and especially prices, works through induced movements in the exchange rate and in real competitiveness. This mechanism has been of great significance since capital controls were removed in the late 1970s. We now consider in some detail the important issues in the links between monetary policy and the exchange rate.

8 The exchange rate

In traditional models of the transmission mechanism with fixed exchange rates, an increase in the supply of money results in a balance of payments deficit and outflows of money which may eventually return the money supply to its original level. Chart 8 shows that over the period 1967-71, when sterling was on a fixed exchange rate, the external counterpart to broad money moved closely with the current account. This association between trade deficits and external influences on money growth did not break down until early in 1977, several years after sterling was floated. An important step in the evolution of monetary policy occurred in the autumn of 1977 (end October) when, in the face of continued strong upward pressure on sterling, exchange market intervention to hold the exchange rate down was abandoned and the currency was left to find its free market level. This step was taken because the domestic monetary consequences of intervention were seen as a threat to the monetary target, attempts to sterilise through extra gilts sales would have put such a heavy burden on funding policy that UK interest rates might have had to rise, thereby inducing further upward pressure on sterling. More fundamentally it was seen that if a non-accommodating monetary policy were to be effective in reducing inflation, it would have to work in part by raising the exchange rate. With a freely floating exchange rate and the abolition of exchange controls in September 1979 the channels through which monetary policy worked altered. Attention has been particularly focused on the link between interest rates and the exchange rate, which is now seen as one of the most powerful transmission mechanisms between monetary policy and prices and output.

One important set of theoretical models which analyse the responses to changing monetary conditions in an open economy with a flexible exchange rate were developed from Dornbusch's seminal paper of the mid-1970s [Dornbusch (1976)]. In the original Dornbusch model important distinctions were drawn between commodities which were traded on internationally competitive markets and those produced only in the home country. The significance of free capital movements and close (in simple cases perfect) substitutability between assets denominated in different currencies was analysed. The original model, with forward looking agents and some prices able to adjust instantaneously to changed conditions, showed that a key mechanism from monetary policy to prices and output would work through the exchange rate. If domestic nominal interest rates were to rise as a result of some tightening in monetary policy then with foreign rates constant and perfect substitutability between foreign and domestic assets the interest rate differential would need to be offset by an expectation of depreciation of the home currency. If long-run purchasing power parity also held and the tightening of monetary conditions implied lower long-term traded goods prices, in domestic currency, then the exchange rate would need to initially jump beyond its higher long-term value. The implications of this mechanism in models with fast moving asset prices (interest rates and exchange rates) but more slowly moving goods prices were analysed in several papers.[a]

Particularly influential was the analysis of the inflation, output, and employment trends in the early 1980s by Buiter and Miller (1981),(1983). The argument here was that by far the most significant transmission mechanism for monetary policy ran from interest rate changes to sharp movements in the exchange rate and competitiveness and then to domestic activity and prices. The sharp rise in the UK real interest rates in 1980 and the rapid deterioration, and subsequent gradual recovery, in real competitiveness seemed to be consistent with exchange rate overshooting (Charts 9 and 10). The empirical significance of

(a) See Buiter and Miller (1982) and the volume edited by Eltis and Sinclair (1981).

Chart 11 : Annual growth rate of M4 mortgage lending and real house prices

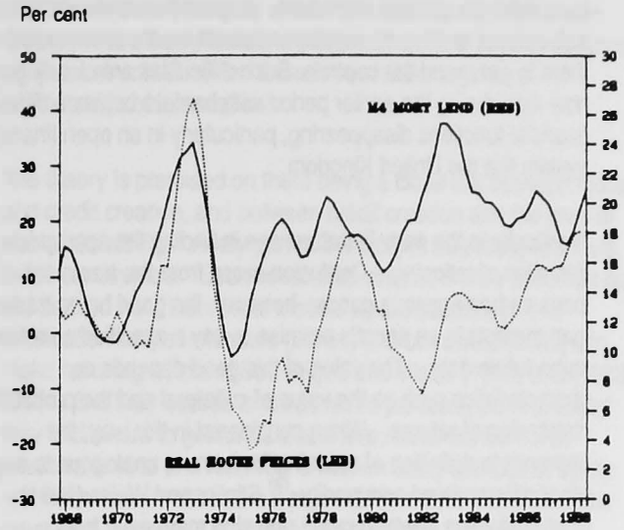


Chart 12 : M4 mortgage lending relative to personal income

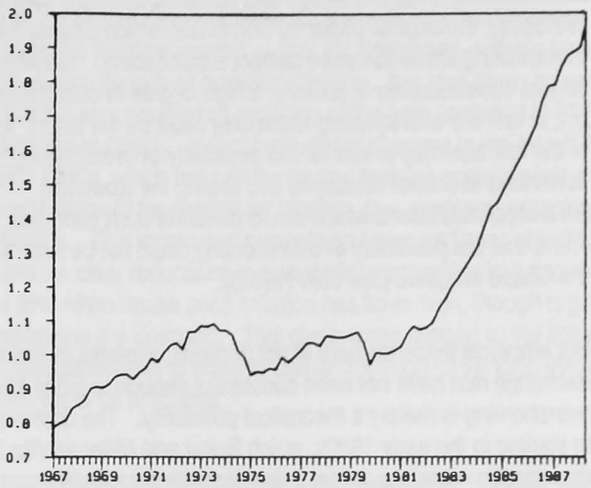
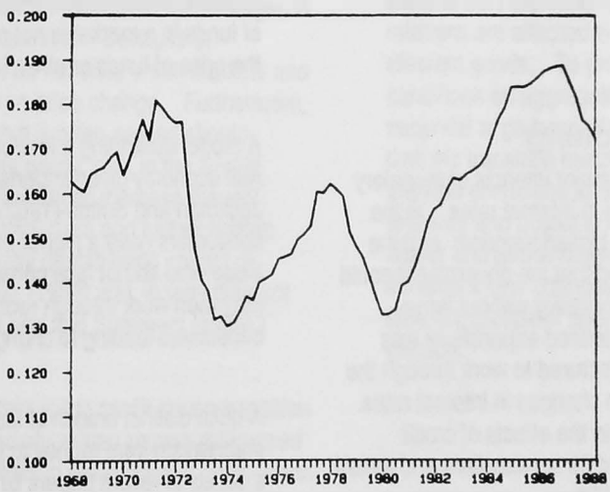


Chart 13 : M4 mortgage lending relative to the value of owner occupied housing



some of the key elements in the overshooting story have, however, been questioned. In particular the claim that dramatic exchange rate movements follow movements in domestic to foreign interest rate differentials has been questioned [see, for example, Beenstock, Budd and Warburton (1981)]. The degree of substitutability between foreign and domestic assets is central to this issue; the original paper by Dornbusch which derived the overshooting result assumed perfect subtitutability. But whilst perfect substitutability is unlikely, a high degree of substitutability is not; in fact the overshooting result only requires the latter. In one of the few attempts to test for the possibility of overshooting by estimating structural equations and testing the (complex) parameter restrictions which would generate such behaviour, Barr found that the possibility of overshooting could not be ruled out for the United Kingdom [see Barr (1982)].

But empirical evidence here is not decisive; attempts to model the exchange rate have not been successful enough to judge whether overshooting is merely a theoretical possibility. The dramatic rise in sterling in the early 1980s, which Buiter and Miller ascribe largely to domestic monetary policy, coincided with the growing contribution of North Sea oil which in itself would have put upward pressure on the pound; disentangling the influence of these financial and real developments has proved difficult. But even if overshooting does not occur the impact of interest rate changes upon the exchange rate can be of key importance; furthermore, the link to the rest of the economy from exchange rate movements is rapid in as much as the cost of commodities priced in foreign currencies moves instantly.

9 Theories of credit rationing

Yet it is by no means clear that all the major impacts of monetary policy are transmitted through changes in interest rates. In the 1950s both the Radcliffe Report in the United Kingdom and the "availability doctrine" in the US stressed that the government could influence expenditure through monetary policy without large changes in the rate of interest even if desired expenditure was interest inelastic. The policy was conjectured to work through the availability of funds rather than through changes in interest rates. This hypothesis stimulated research into the effects of credit rationing [see Baltensperger (1978) and for an excellent and recent review of the literature see Blinder (1987)].

Credit rationing may arise because of the imposition of restrictions on interest rates or loan quantities; because financial institutions pursue objectives other than profit maximisation; or because of informational problems. Situations in which credit rationing resulted from restrictions on the rate of interest, such as interest rate ceilings, were explored by Jaffee (1971) and Jaffee and Modigliani (1969). Controls on lending have been exercised by, for example, the system of Supplementary Special Deposits in the United Kingdom (see Bank of England *Quarterly Bulletin* 1982). The third rationale for credit rationing given above is thought to have applied to building societies in the United Kingdom up to the 1980s. Anderson and Hendry (1984), for example, provide evidence to support the proposition that the building societies did not maximise profits during the period up to the early 1980s but pursued more general objectives. Imposed controls which lead to sub-optimal lending by suppliers of credit create an incentive for them to get round the controls. Such difficulties are clearly greater now than during the earlier period with barriers between different financial functions disappearing, particularly in an open financial system like the United Kingdom.

A difficulty in the early literature was in finding the appropriate definition of rationing. Confusion arose from the treatment of loans as homogenous goods; however, the good being traded in loan markets is an agent's promise to pay a specified sum some at some future date. The value of this good depends on characteristics such as the value of collateral and the probability distribution of returns. When considered in this way, the appropriate definition of rationing for loans is analogous to any other differentiated commodity.[(a)] Stiglitz and Weiss (1981) illustrated ways in which credit rationing may result from informational asymmetries. An example is the case in which in the face of excess demand a financial institution may not increase expected profits by increasing the rate of interest if it is unable to monitor the riskiness of customers. The result follows as raising the rate will, under certain conditions, worsen the mix of customers. The type of credit rationing which emerges from this type of model, where borrowers with similar characteristics are treated differently, is equilibrium rationing. This can be contrasted with disequilibrium rationing where a discrepancy between the demands and supplies of funds in a market is not closed either because of controls over the price of funds or other forms of price inertia.

A model illustrating a feedback from interest rate changes to the real economy given imperfect capital markets was provided by Jackman and Sutton (1982). In the model credit constrained consumers have a higher marginal propensity to consume than those who do not face constraints. The transmission mechanism may then work through redistribution between the two sets of consumers leading to changes in net consumption.

A quite distinct branch of literature which analyses the transmission mechanism from money to prices and output has been stressed in a series of recent papers by Stiglitz and by Greenwald and Stiglitz.[(b)] This work shares some important features with the models of Hart, Fisher and Hahn which focus on deviations in the micro structure of markets from perfect competition which generate non-Walrasian results. (See Section 11 below.) Of central importance in the analysis of the transmission mechanism of Stiglitz is the pervasive influence of information problems in financial markets. What is also distinctive about the mechanisms which Stiglitz describes for the transmission of monetary policy changes to real and nominal variables is that they work through credit markets in ways which reflect the particular forms of financial intermediation which exist in most developed economies. We noted above that much of the theoretical literature in

(a) See Stiglitz and Weiss (1981).

(b) See Greenwald and Stiglitz (1986 and 1987), Stiglitz (1985).

macroeconomies relies on very simple, generally reduced form, relations between nominal money and aggregate nominal demand which omit details of the transmission mechanism. The information-based theories which Greenwald and Stiglitz have developed are firmly rooted in the detailed micro-structure of credit markets, structures which themselves reflect important asymmetries of information.

The theory is premised on there being a close link between money and credit creation, and between credit creation and the level of economic activity. A key part of the story is that many firms are credit constrained. Such constraints are not merely assumed but are derived from theoretical models where asymmetries of information between lenders (banks) and borrowers (firms) can make rationing efficient [See Stiglitz and Weiss (1981) and (1983)]. If firms find their access to credit with a particular bank reduced they find it hard to get funds elsewhere; other banks will be reluctant to lend to a relatively unknown entity and use of equity markets will be unattractive if potential investors interpret a new issue as a sign that a firm is having problems raising funds elsewhere. Thus, restrictions in the supply of bank credit can force cutbacks in real expenditure. The argument is that the transmission mechanism then runs from (perhaps short term) restrictions on high powered money, or direct controls on bank deposits, to reductions in the availability of credit which, with no close substitutes available to firms, hits real output, via inventory reductions and lower investment. The process is cumulative because of important multiplier effects arising from credit constraints. A significant feature of this process is that changes in interest rates do not play an important role. Because of information problems interest rates do not clear credit markets and quantities of credit may move with no price change. Furthermore, the flexibility of output prices, which it is often argued should prevent any real effects of monetary policy, can, in the Stiglitz models, exacerbate problems; falling prices increase the real value of liabilities, increase bankruptcy risks and further tighten credit constraints. [On the potentially destabilising impact of flexible prices see Neary and Stiglitz (1983) and, in very different models, Flemming (1987) and de Long and Summers (1986).]

It is hard to assess just how important is the credit driven transition mechanism outlined in the persuasively written papers referenced above. There are many sectoral links in the proposed chain which connects money shocks, or planned monetary policy changes, to prices and output. This is one of the strengths of the theory in that the mechanisms work through recognisable institutions; there is no black box. The difficulty is that although the phenomena which Stiglitz describes certainly exist (asymmetric information; an apparent reluctance of firms to use equity markets to raise funds; periodic, though hard to measure, credit constraints) the extent of their overall impact remains unclear. Indeed, some of the key features of Stiglitz's model, eg the prevalence of credit rationing of firms, do not find clear support in the limited amount of empirical work in the area [see, in particular, the Wilson Committee (1977)]. Nor are testable implications of the theory clear, though some rather crude tests of a related set of hypotheses were undertaken by Bernanke which give some weight to the idea that the disruption of credit relations were important in one particular episode of US economic history — the Great Depression [see Bernanke (1983) and, for related arguments, Bernanke and Gertler (1985)].

For the United Kingdom there is clear evidence that in one particular financial market — that for mortgages — there have been long periods of quantity rationing. It is less clear, however, that this was equilibrium rationing of the type analysed in Stiglitz and Weiss (1981). In fact institutional changes in the late 1970s and 1980s, which brought banks and building societies into greater competition in the market for lending, saw mortgage rationing decline. This increasing competition between financial institutions and the clear reductions in queues for mortgages, has occurred at a time when house price inflation has been high, though regional variations are dramatic. This gives some support to the link from credit constraints to nominal demand though convincing evidence has yet to be produced. [(a)]

Developments in credit markets are reviewed in more detail in the next section; one point to note here is that if a key transmission mechanism for monetary policy runs through variations in the supply of credit such demand effects as result are not likely to be spread evenly across the economy. For, to the extent that credit restrictions bite, they do so in particular markets and induced changes in demand may be tied to particular commodities — eg housing. The price and quantity responses to nominal demand changes triggered by changes in credit availability are, in turn, likely to vary significantly depending on which class of credit relations are affected since elasticities of supply vary hugely for different goods. To predict the effect of changes in monetary conditions on aggregate prices and output it will therefore be essential to go beyond simple, highly aggregated models which limit the transition mechanism to run from a change in money markets conditions to changes in total nominal demand and hence to prices and output in a way which depends only on aggregate labour and goods market conditions. The next section therefore considers how changes in the availability of credit have affected different groups of agents in the United Kingdom over the past decade.

10 The impact of the removal of restrictions on UK financial system

Credit controls of one form on another were operated for much of the period from 1964-81. Chart 6, above, illustrated the growth of the lending counterpart to broad money. We shall not document in detail the various periods of imposition and removal of restrictions it is however worth noting some of the largest changes. The most noticeable accelerations of the lending series, follow the relaxation of restrictions; for example, the advent of Competition and Credit Control in 1971. In late 1972 restrictions were re-imposed in the form of a call for special deposits applying to the whole banking sector. A further sharp acceleration in lending followed a

(a) For a discussion of further links from asset prices to labour markets see Bover, Muellbauer and Murphy (1988).

temporary release of special deposits early in 1976 and the abolition of the corset in 1980.

The mortgage market was most noticeably affected by the restrictions on credit. Chart 11 shows percentage changes in mortgage lending by banks and building societies and percentage change in real house prices. By influencing the demand for housing relative to other demand, mortgage rationing may have influenced relative prices. Developments in the mortgage market were an important influence on persons holding of deposits with, and borrowing from, the monetary sector over the period. The profile of M4 mortgage lending relative to total personal income is shown in Chart 12. The overall trend is somewhat misleading as an indicator of the ratio for a typical individual as owner occupation has grown significantly over the period. An alternative is to consider the ratio of mortgage lending to the value of the stock of owner-occupied housing, Chart 13. The striking fall during the 1970s and recovery in the 1980s may be attributable to credit rationing and the long lags of adjustment in the mortgage market. High levels of inflation during the 1970s eroded the real value of the mortgage stock; households were unable to restore debt levels in part because debt was usually changed only when moving house and partly because of credit rationing. These adjustment problems also implied that households were unable to obtain the capital gains which arose in the housing market. This rundown in real borrowing (see Chart 13) appears to have had an important effect on persons' expenditure and asset accumulation. Households facing such constraints would have run down liquid assets in order to maintain desired consumption levels.

11 Recent theoretical developments

We have considered theoretical models where prices move instantly to clear all markets; where prices do not move at all; and where some prices may jump and others are sluggish. The effects of monetary policy are, in theory, very different in these models. But two features common to all the models discussed above stand out. First, the size and speed of adjustment of prices in the models is not derived from analysis of the decisions of individual agents. Second, the models generally have unique equilibria which are independent of adjustment paths. Recent theoretical work has aimed at building models where pricing decisions reflect agents' optimising decisions in disequilibrium states; the possibility of multiplicity and path dependency of equilibria have also been the focus of much work. The effects of monetary policy in such models are of particular interest.

(a) Price setting agents

Analysis of the macroeconomic implications of the existence of price setting power by agents has a long history. Arrow (1959) pointed out thirty years ago that if prices are not always somehow equal to their Walrasian market clearing levels then even an economy with many buyers and sellers in each market will be one where agents find the hypothesis that they can buy and sell as much as they want at current prices falsified. Koopmans (1957) made the same point when he wondered how, if agents all take prices as given, prices ever change. Furthermore, under imperfect competition, as in the fixed price models, each agent's actions will generally depend on the realised transactions of others. Clower (1965) observed that this seems a crucial feature of any Keynesian model.

Modelling how prices and quantities move from one equilibrium to another as a result of optimising decisions by individual agents conditional on their expectations of others' decisions has been the aim of a huge amount of research, starting with the seminal paper of Negishi (1960). The existence of price setting, or monopolistic, power does not, however, in itself have any obvious implication for the way in which changes in aggregate nominal demand are transmitted to prices and quantities. (It is a well known result that optimal pricing with constant elasticity demand curves makes equilibrium prices set by imperfect competitors a fixed mark-up on costs; this is quite consistent with Friedmanesque results for the ineffectiveness of monetary policy to change output in the long run.) What has been important in the literature is the idea that how prices set by agents should respond to demand changes depends upon how they perceive the responses of other agents will be. In many models multiplicity of equilibria, some with higher levels of output than others, exist; the economy may get stuck in a low output equilibrium and no unco-ordinated actions by individuals will drive it to a higher output equilibrium [see Hahn (1977), (1978), (1982) where the notion of conjectural equilibria is discussed and in particular the multiplicity of such equilibria].

One example of such a model where monetary policy might be used to move the economy from a low to a high output equilibrium at unchanged prices is developed in an important paper by Hart (1982). The paper is Keynesian in spirit, in that a co-ordinated reduction in the prices of produced goods and of labour, with a constant stock of Hart's non-produced good (the numeraire), could give higher output which is welfare improving; but no one agent perceives it as in his/her interest to initiate such a price cut. An increase in aggregate demand resulting from government policy can, however, achieve the same goal. The robustness of the result is, however, not strong. With essentially similar models Snower (1983) and Dixon (1986) show that monetary policy can often only lead to price changes; there are natural rates of unemployment. In a more recent paper, however, Dixon (1988) develops a model where imperfect competition generates non-Walrasian equilibria where government policy is effective.] More fundamentally, the seminal volume edited by Phelps (1970) showed that it was possible to develop a range of models with non-co-ordinated price setting by individual agents which generated classical results.

(b) Multiple equilibria

It remains, however, a feature of rational expectations models that there generally exist multiple, and often a continuum, of equilibria and that without some restrictions on paths to, or points of, convergence the responses in such models to monetary or fiscal changes are not classical. This is a point stressed in much of the work of Hahn (1978) and (1982) and Fisher (1983). Fisher, in a series of important papers summarised and extended in Fisher (1983), derives several results on paths of adjustment in monetary economies where trades take place out of equilibrium and where prices are set by individual agents conditional on their (rational)

expectations. He finds the following general results. First, that when trade out of equilibrium takes place then if the process of adjustment does converge the final equilibrium of the economy is not independent of the path travelled. Such path dependency, or hysteresis, means that comparative static results are seriously misleading and that policies which appear to have no real effects when attention is focussed only on equilibrium states can have lasting real effects when plausible disequilibrium processes are explicitly modelled. Fisher says:

'The question of whether the economy converges to a quantity-constrained equilibrium, possibly with underemployment à la Keynes, has been seen intimately to involve the question of how perceptions of demand and supply change. Such questions cannot be answered by looking only at the existence of such equilibria; they depend on the specifics of the adjustment process — specifics that are sadly lacking in the present state of the art.'

His conclusion on price dynamics and on adjustment paths of prices to external (eg monetary) shocks also warns against reliance on simple results from models where out of equilibrium behaviour is either ignored or assumed away:

'The way in which prices are formed and the role which they play in the allocation of resources is the central topic of economic analysis. It is no small thing that we are uncertain as to how this takes place. In more specific terms, the answer to the question of how perceived demand and supply change — which, as we have seen, is also the questions of how prices are set — determines whether or not equilibria will be Walrasian.'

These are not a reassuring set of conclusions and yield no easy results on how, in particular, changes in the stance of monetary policy will effect prices and quantities; indeed no explicit analysis of the transmission mechanism is given in Fishers' models. The positive message of the disequilibrium modelling is more to expose the fragility of results on transmission processes derived from models where adjustment paths are ignored or where the economy is assumed to be in a state of perpetual equilibrium with discontinuous jumps in free variables following unforecastable shocks.

12 Conclusion

The relative importance of the various channels of influence from monetary policy to prices and output which we have described remains unclear. This reflects uncertainty both about the importance of particular transmission mechanisms from money to elements of nominal aggregate demand, and uncertainty about theway in which such changes in nominal demand are transmitted to prices and quantities. What is clearly crucial is the way in which changes in monetary policy impact upon the prices of a whole range of financial assets and liabilities — currency, equities, bonds — and on the impact upon the availability of credit. Two points arise from this. First, any impact will almost certainly depend upon whether a given change in monetary conditions is perceived as being temporary or permanent and on whether the authorities, even if they should wish to sustain a particular policy stance, are thought able to do so. Expectations of future policy and the credibility of an announced policy to attain particular goals will be central in assessing the impact of any policy. We have not tried to summarise the huge and rapidly growing literature on credibility, time-consistency and the game-theoretic aspects of macro policy design. In some ways this literature is peripheral to the transmission mechanism as narrowly defined. At the same time issues of credibility and expectations are obviously crucial in many aspects of government and private sector behaviour.

The second point is that both substitutability between various assets, which will determine how wide the portfolio reallocation impacts of monetary policy go, and credit restrictions - two factors which we noted were central to the transition mechanism - are highly dependent on institutional developments. For example, competition between banks and non-bank financial intermediaries affects both credit availability and the number and nature of assets which are close substitutes to those offered by banks. Financial deregulation, removal of exchange controls and the increasing internationalisation of financial markets have had, and will have, dramatic effects on how monetary policy operates. It is impossible to assess the changing nature of the transmission mechanism without reference to the, partly endogenous, evolution of financial institutions and markets, within which the process must be worked out. The perception of this may lead to a shift of emphasis in modelling. Reduced-form type models may increasingly be replaced by institutional based models where the way in which the transmission mechanism operates will depend on the detailed structure of financial markets. Empirical work is likely to remain more traditional, largely because the empirical modelling of the process of financial innovation — especially changes in the scope of, and competitive pressures on, financial institutions is problematic. The tractability of this empirical problem is still hard to gauge; this makes the extent to which more institutional models will be empirically testable equally hard to assess.

References

Alogoskoufis, G and Pissarides, C (1983): 'A Test of Price Sluggishness in the Simple Rational Expectations Model: UK 1950-1980', Economic Journal, 93, pp 616-28.

Anderson, G and Hendry, D (1984): 'An Econometric Model of United Kingdom Building Societies', Oxford Bulletin of Economics and Statistics, 46, pp 185-211.

Arrow, K (1959): 'Towards a Theory of Price Adjustment' in The Allocation of Economic Resources ed M Abramovitz, Stanford: Stanford University Press.

Baltensperger, E (1978): 'Credit Rationing: Issues and Questions' Journal of Money Credit and Banking, X,pp 170-83.

Barr, D (1982): 'Exchange Rate Dynamics: An Empirical Analysis', Centre for Labour Economics Discussion Paper No 200.

Barro, R (1974): 'Are Government Bonds Net Wealth', Journal of Political Economy, 88, pp 1095-1118.

Barro, R and Grossman, H (1976): 'Money, Employment and Inflation', Cambridge, Cambridge University Press.

Bean, C (1984): 'A Little Bit More Evidence on the Natural Rate Hypothesis from the UK', European Economic Review, 25, pp 279-92.

Beenstock, M; Budd, A and Warburton, P (1981): 'Monetary Policy, Expectations and Real Exchange Rate Dynamics' in The Money Supply and the Exchange Rate, ed Eltis, W and Sinclair, P Oxford, Oxford University Press.

Benassy, J-P (1975): 'Neo-Keynesian Disequilibrium Theory in a Monetary Economy', Review of Economic Studies, 42, pp 503-24.

Bernanke, B (1983): 'Non-monetary Effects of the Financial Crisis in the Propogation of the Great Depression,' American Economic Review, Vol 72.

Bernanke, B and Gertler, M (1985): 'Banking and Macroeconomic Equilibrium', NBER Discussion Paper 1647.

Blanchard, O (1987): 'Why Does Money Affect Output? A Survey', NBER discussion paper No 2285, (June).

Blinder, A (1987): 'Credit Rationing and Effective Supply Failures', Economic Journal, Vol 97, pp 327-352.

Blinder, A and Fisher, S (1981): 'Inventories, Rational Expectations and the Business Cycle', Journal of Monetary Economics, 8, pp 277-304.

Bover , O Muellbauer, J and Murphy , A (1988): 'Housing, Wages and UK Labour Markets', CEPR Dicussion Paper.

Bulter, W and Miller, M (1981): 'The Thatcher Experiment: An Interim Report', LSE Centre for Labour Economics Discussion Paper 106 (December).

Bulter, W and Miller, M (1982): 'Exchange Rate Overshooting and the Real Cost of Bringing Down Inflation', European Economic Review.

Bulter, W and Miller, M (1983): 'The Macroeconomic Consequences of a Change in Regime: The UK Under Mrs Thatcher', Brookings Papers on Economic Activity. The Brookings Institute, Washington, DC.

Chouraqui, J-C, Driscoll, M and Strauss-Kahn, M-O (1988): 'The Effects of Monetary Policy on the Real Sector: An Overview of Empirical Evidence for Selected OECD Economies', OECD Department of Economics and Statistics Working Paper.

Clower, R (1965): 'The Keynesian Counter-revolution: A Theoretical Appraisal' in The Theory of Interest Rates, ed Hahn and Brechling, London, MacMillan.

de Long, J and Summers, L (1986): 'Is Increased Price Flexibility Stabilising?', American Economic Review, 76, pp 10.

Dicks, M (1988): 'The Interest Elasticity of Consumers' Expenditure', Bank of England Technical Series Paper No 20.

Dixon, H (1986): 'A Simple Model of Imperfect Competition with Walrasian Features', Birkbeck College Discussion Paper in Economics, No 186 (April).

Dixon, H (1988): 'Unions, Oligopoly and the Natural Rate of Employment', The Economic Journal, 98, pp 1127-1148.

Dornbusch, R (1976): 'Expectations and Exchange Rate Dynamics', Journal of Political Economy, 84, pp 1611-1176.

Eltis, W and Sinclair, P (eds) (1981): 'The Money Supply and the Exchange Rate', Oxford: Oxford Univesity Press.

Fisher, F (1983): 'Disequilibrium Foundations of Equilibrium Economics', Cambridge, Cambridge University Press.

Fisher, P G, Tanna, S K, Turner, D S, Wallis, K F and Whitley, J D (1989): 'Comparative Properties of Models of the UK Economy', National Institute Economic Review, No 129, pp 69-87.

Fitzgerald, M and Pollio, G (1983): 'Money, Activity and Prices: Some Inter- country Evidence', European Economic Review, 23, pp 279-314.

Flemming, J (1987): 'Wage Flexibility and Employment Stability', Oxford Economic Papers, 39, pp 161-174.

Friedman, B (1979): "Crowding Out or Crowding In?" Brookings Papers on Economic Activity.

Friedman, M (1968): 'The Role of Monetary Policy', The American Economic Review, 58, pp 1-17.

Friedman, M (1969): 'The Optimum Quantity of Money', London: MacMillan.

Garner, C (1982): 'Tests of Monetary Neutrality for the United Kingdom', Quarterly Review of Economics and Business, 22, pp 81-95.

Goodhart, C (1975): 'Money, Information and Uncertainty', London, MacMillan.

Goodhart, C and Gowland, D (1977): 'The Relationship Between Yields on Short and Long-Dated Gilt Edged Stocks', Bulletin of Economic Research, Volume 29, pp 96-106.

Goodhart, C and Gowland, D (1978): 'The Relationship Between Long-Dated Gilt Yields and Other Variables' 'Bulletin of Economic Research, Volume 30, pp 59-70.

Goodhart, C and Smith, R (1985): 'The Relationship Between Exchange Rate Movements and Monetary Surprises: Results for the United Kingdom and United States Compared and Contrast', The Manchester School, 53, pp 2-22.

Grandmont, J (1977): 'Temporary General Equilibrium Theory' Econometrica, XLIII, 535-572.

Granger, C (1969): 'Investigating Causal Relations by Econometric Models and Cross-Spectral Methods', Econometrica, 37.

Greenwald, B and Stiglitz, J (1986): 'Imperfect Information, Credit Markets and Unemployment', NBER Discussion Paper No 2093 (December).

Greenwald, B and Stiglitz, J (1987): 'Money, Imperfect Information and Economic Fluctuations', NBER Discussion Paper No 2188 (March).

Hahn, F (1977): 'Exercises in Conjectural Equilibria', Scandinavian Journal of Economics, Vol 79, pp 210-226.

Hahn, F (1978): 'On Non-Walrasian Equilibria', Review of Economic Studies, 45, pp 1-18.

Hahn, F (1982): 'Money and Inflation', Oxford, Basil Blackwell.

Hart, O (1982): 'A Model of Imperfect Competition with Keynesian Features', Quarterly Journal of Economics, XCVII, pp 109-138.

Jackman, R and Sutton, J(1982): 'Imperfect Capital Markets and Monetarist Blach Bax: Liquidity Constraints, Inflation, and the Assymetric Effects of Interest Rate Policy,' The Economic Journal, 92, pp 108-28.

Jaffee, D M (1971): Credit Rationing and the Commercial Loan Market, New York, Wiley.

Jaffee, D M and Modigliani, F (1969): 'A Theory and Test of Credit Rationing', American Economic Review, 59, pp 850-72.

Kaldor, N (1980): 'Evidence to the Treasury and Civil Service Committee', July, HMSO.

Kaldor, N (1982): 'The Scourge of Monetarism', Oxford, Oxford University Press.

Keynes, J (1930): A Treatise on Money, London: MacMillan.

Keynes, J (1936): The General Theory of Employment, Interest and Money, London: MacMillan.

Koopmans, T (1957): Three Essays on the State of Economic Science, Harvard Press.

Lucas, R (1972): 'Expectations and the Neutrality of Money', Journal of Economic Theory, 4, pp 103-124.

Lucas, R (1977): 'Understanding Business Cycles' in Stabilisation of Domestic and International Economy ed Brunner, K and Meltzer, A: Amsterdam North Holland.

Lucas, R (1979): 'An Equilibrium Model of the Business Cycle', Journal of Political Economy, 83, pp 1113-1144.

Lucas, R (1980): 'Methods and Problems in Business Cycle Theory', Journal of Money Credit and Banking, 12.

MacDonald, R and Torrance, T (1988a): 'Monetary Policy and the Real Interest Rate: Some UK Evidence', Scottish Journal of Political Economy, Volume 35, pp 361-371.

MacDonald, R and Torrance, T (1988b): 'Exchange Rates and News: Some Evidence Using UK Survey Data', The Manchester School, LVI, pp 69-76.

Malinvaud, E (1977): 'The Theory of Unemployment Reconsidered', Oxford, Basil Blackwell.

Miller, M (1985): 'Monetary Stabilisation Policy in an Open Economy', Scottish Journal of Political Economy, 32, pp 220-233.

Muth, J (1961): 'Rational Expectations and the Theory of Price Movements', Econometrica, 29, pp 315-335.

Neary, P and Stiglitz, J (1983): 'Towards a Reconstruction of Keynesian Economics: Expectations and Constrained Equilibria', Quarterly Journal of Economics.

Negishi, T (1960): 'Monopolistic Competition and General Equilibrium', Review of Economic Studies XXV III, pp 196-201.

Patinkin, D (1956): Money, Interest and Prices, Row, Peterson and Evanston.

Phelps, E (ed) (1970): Microeconomic Foundations of Employment and Inflation Theory, Norton, New York.

Sargent, T (1973): 'Rational Expectations, the Real Rate of Interest and the Natural Rate of Unemployment', in Brookings Papers on Economic Activity, Vol 2, Washington, Brookings Institute 1973.

Sargent, T (1979): Macroeconomic Theory, Academic Press.

Sargent, T and Wallace, N (1975): 'Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule', Journal of Political Economy, 83, pp 241-254.

Sargent, T and Wallace, N (1976): 'Rational Expectations and the Theory of Economic Policy', Journal of Monetary Economics, 2, pp 169-183.

Saunders, P (1988): 'An Empirical Investigation of the Effects of Monetary Changes on the UK Economy', Scottish Journal of Political Economy, 35, pp 372-386.

Sims, C (1972): 'Money, Income and Causality', American Economic Review, 62.

Snower, D (1983): 'Imperfect Competition, Underemployment and Crowding-Out', Oxford Economic Papers, 35, pp 245-270.

Stiglitz, J (1982): 'On the Relevance or Irrelevance of Public Financial Policy: Indexation, Price Rigidities and Optimal Monetary Policy', in Inflation, Debt and Indexation, ed Dornbusch, R and Simonsen, M, MIT Press.

Stiglitz, J (1985): 'Credit Markets and the Control of Capital', Journal of Money Credit and Banking, 17, pp 133-152.

Stiglitz, J and Weiss, A (1981): 'Credit Rationing in Markets with Imperfect Information', American Economic Review, Vol 71, pp 393-410.

Stiglitz, J (1982): 'On the Relevance or Irrelevance of Public Financial Policy', NBER Working Paper No 1057, (April).

Stiglitz, J and Weiss, A (1983): 'Incentive Effects of Termination: Applications to the Credit and Labour Markets', American Economic Review, Vol 72, pp 912-927.

Symons, J (1983): 'Money and the Real Interest Rate in the UK', Manchester School, pp 250-265.

Taylor, J (1975): 'Monetary Policy During a Transition to Rational Expectations', Journal of Political Economy, 83, pp 1009-1021.

Taylor, J (1979): 'Staggered Price Setting in a Macro Model', American Economic Review, pp 108-113.

Tobin, J (1952): 'Asset Holdings and Spending Decisions', American Economic Review, 42, pp 109-23.

Tobin, J (1961): 'Money, Capital and Other Stores of Value', American Economic Review, 51, pp 26-37.

Tobin, J and Brainard, W (1968): 'Pitfalls in Financial Model Building', American Economic Review, 58, pp 99-122.

Tobin, J (1969): 'A General Equilibrium Approach to Monetary Theory', Journal of Money, Credit and Banking, 1, pp 15-29.

Tobin, J (1970): 'Money and Income: Post Hoc Ergo Propter Hoc', Quarterly Journal of Economics, Volume 84, 2.

Wilson Committee (1977): Committee to Review the Functioning of Financial Institutions, London, HMSO cmmd 7937.

Williams, D, Goodhart, C and Gowland, D (1976): 'Money, Income and Causality: The UK Experience', American Economic Review, 66.

Wright, P (1984): 'Funding The Public Sector Borrowing Requirement 1952-1983', Bank of England *Quarterly Bulletin*, December.

Bank of England Discussion Papers

	Title	Author
1-5,8, 11-14, 16-17, 20-22,31	*These papers are now out of print, but photocopies can be obtained from University Microfilms International* [a]	
6	'Real' national saving and its sectoral composition	C T Taylor A R Threadgold
7	The direction of causality between the exchange rate, prices and money	C A Enoch
9	The sterling/dollar rate in the floating rate period: the role of money, prices and intervention	I D Saville
10	Bank lending and the money supply	B J Moore A R Threadgold
15	Influences on the profitability of twenty-two industrial sectors	N P Williams
18	Two studies of commodity price behaviour: Interrelationships between commodity prices Short-run pricing behaviour in commodity markets	 Mrs J L Hedges C A Enoch
19	Unobserved components, signal extraction and relationships between macroeconomic time series	T C Mills
23	A model of the building society sector	J B Wilcox
24	The importance of interest rates in five macroeconomic models	W W Easton
25	The effects of stamp duty on equity transactions and prices in the UK Stock Exchange	Mrs P D Jackson A T O'Donnell
26	An empirical model of company short-term financial decisions: evidence from company accounts data	Mrs G Chowdhury C J Green D K Miles
27	Employment creation in the US and UK: an econometric comparison	I M Michael R A Urwin
28	An empirical model of companies' debt and dividend decisions: evidence from company accounts data	Ms G Chowdhury D K Miles
29	Expectations, risk and uncertainty in the foreign exchange market: some results based on survey data	M P Taylor
30	A model of UK non-oil ICCS' direct investment	E J Pentecost
32	The demographics of housing demand; household formations and the growth of owner-occupation	M J Dicks
33	Measuring the risk of financial institutions' portfolios: some suggestions for alternative techniques using stock prices	S G F Hall D K Miles
34	An error correction model of US consumption expenditure	I R Harnett
35	Industrial structure and dynamics of financial markets; the primary eurobond market	E P Davis
36	Recent developments in the pattern of UK interest rates	D K Miles
37	Structural changes in world capital markets and eurocommercial paper	J G S Jeanneau
38	Stockbuilding and liquidity: some empirical evidence for the manufacturing sector	T S Callen S G B Henry
39	The ralationship between employment and unemployment	M J Dicks N Hatch
40	Charts and fundamentals in the foreign exchange market	Mrs H L Allen M P Taylor
41	The long-run determination of the UK monetary aggregates	S G Hall S G B Henry J B Wilcox
42	Manufacturing stocks; expectations, risk and cointergration	T S Callen S G Hall S G B Henry
43	Instability in the euromarkets and the economic theory of financial crises	E P Davis
44	Corporate governance and the market for companies: aspects of the shareholders' role	J Charkham
45	Stock-flow consistent income for industrial and commercial companies: the UK experience	K D Patterson
46	The money transmission mechanism	D K Miles J B Wilcox

Technical Series

	Title	Author
1-11, 14,20	*These papers are now out of print, but photocopies can be obtained from University Microfilms International* [a]	
12	The development of expectations generating schemes which are asymptotically rational	K D Patterson
13	The arch model as applied to the study of international asset market volatility	R R Dickens
15	International comparison of asset market volatility: a further application of the ARCH model	R R Dickens
16	A three sector model of earnings behaviour	D J Mackie
17	Integrated balance sheet and flow accounts for insurance companies and pension funds	Raymond Crossley
18	Optimal control of stochastic non-linear models	S G Hall I R Harnett M J Stephenson
19	A multivariate GARCH in mean estimation of the capital asset pricing model	S G Hall D K Miles M P Taylor
21	Modelling of the flow of funds	D G Barr K Cuthbertson
22	Econometric modelling of the financial decisions of the UK personal sector: preliminary results	D G Barr K Cuthbertson
23	Breaks in monetary series	S L Topping with S L Bishop
24	Modelling money market interest rates	J S Flemming D G Barr
25	An independant error feedback model of UK company sector asset demands	D G Barr K Cuthbertson
26	A disequilibrium model of building society mortgage lending	S G Hall R A Urwin

(a) These papers are no longer available from the Bank, but photocopies can be obtained from University Microfilms International, at White Swan House, Godstone, Surrey RH9 8LW.