

3. Monetary Targets and Economic Policy

Control of Monetary
Aggregates

Relationships between
Monetary and Fiscal Policy
Document

5

THE RELATIONSHIPS BETWEEN MONETARY AND FISCAL POLICY

1. This paper seeks to answer two questions which I was asked when invited to provide a paper for the seminar: "Where, if at all, are the monetary implications of fiscal policy assessed and reviewed? Do these assessments affect fiscal decisions?" The scope originally suggested was wider than this, but much of the ground has been covered in recent speeches by the Governor of the Bank of England, Sir Douglas Wass and the Chancellor of the Exchequer. Copies of these speeches are attached and no attempt is made either to recapitulate the arguments or summarize the conclusions in this paper.

2. I shall concentrate on the way in which the Treasury examines the interaction between fiscal and monetary policy. This is done at a comparatively fine level of disaggregation and involves relationships between a large number of variables. Formal econometric models of the different sectors of the economy can play an important part in this sort of analysis and for the past few years the Treasury has put a great deal of effort into developing models of domestic and international monetary markets. A description of the philosophy underlying these models and the way they relate to the macroeconomic forecasts forms the main part of this paper. Before describing them however it may be helpful to consider the broad outlines of the linkages between fiscal policy, monetary and external policy since these shape the structure of the models we have developed and the relationships between them. The paper concludes with a brief look at the role and limitations of analysis based on the models in helping policy formulation.

Linkages between Fiscal Policy, Monetary Policy and External Policy

3. The Government has an intermediate policy objective for the growth of the money supply, expressed in publicly stated guidelines for the growth of the monetary aggregates. These are expressed in terms of the behaviour of sterling M3 and domestic credit expansion. It is assumed that policy will continue to be based primarily on these aggregates, the properties of which are considered below.

Sterling M3 (£M3)

4. £M3, the wider definition of the money supply consists of

M1 plus all other sterling deposits (including time deposits) of UK residents in both the private and public sectors, including sterling certificates of deposit. It is relatively easy to define because it is confined to the banking system.

5. As a policy variable £M3 has the advantage of direct links with key areas of economic policy. The accounting relationship can be set out as follows:

Public Sector Borrowing Requirement

- Sales of Public Sector Debt to the Non-Bank Private Sector
- + the increase in Banks' Lending in Sterling to the Private Sector
- External Finance of the Public and Banking Sectors
- the Increase in the Banks' Non-Deposit Liabilities
- = the change in Sterling M3

(these accounting relationships are set out in detail in Table 7.3 of Financial Statistics).

6. There is thus a direct link with fiscal policy, through the size of the PSBR; with the authorities' open market operations; with bank lending to the private sector; and with external flows and exchange rate policy - the external adjustments are essentially the private sector's balance of payments on current and capital account.

Domestic Credit Expansion - DCE

7. The ceilings to which we are officially committed by our agreement with the IMF relate to DCE. This is intended to provide a measure of domestically created money supply. DCE can be defined as the PSBR, less sales of public sector debt outside the banks plus bank lending in sterling to the private and overseas sectors. The difference between DCE and £M3 is - broadly speaking - the balance of payments of the private sector. So, if a country is in balance of payments deficit, DCE will be greater than £M3 and vice versa.

8. The importance of DCE thus depends on the weight given to the external position. If the supply of domestically created money is kept below the amount which the public wants to hold it would induce inflows from overseas. By one route or another restricting DCE would contribute to a process that brings about improvements in the balance of payments on current and/or capital account. It

is thus an important policy variable when monetary policy is directed primarily to external objectives. The use of £M3 as a target variable would have the disadvantage in these circumstances that a growth objective for it could be met in part - for a time at least - by increasing the external deficit. When the external position is as strong as it has been during the past year, DCE ceases to become an effective constraint.

9. It is not always easy to disentangle the direction of causality. A very strong external position creates good conditions for selling public sector debt and reduces the need for domestic bank lending; it thus brings about conditions in which DCE may be relatively low. On the other hand, if the growth of DCE is kept below the growth in the demand for money, the external position will tend to strengthen further.

10. In practice both effects can operate at the same time and interact with each other; but as long as we have specific objectives for the balance of payments and the exchange rate DCE can provide useful information about the relation of monetary policy to these objectives.

The Public Sector Borrowing Requirement

11. The relationship by identity between the borrowing requirement and £M3 and DCE points to an important link between fiscal policy and money supply. The PSBR is perhaps best seen as a measure of the public sector's need for finance, although it is not in fact a measure of the total amount that the public sector has to borrow in a given period - since by convention, transactions of the Exchange Equalisation Account that need financing (ie changes in foreign exchange reserves) are excluded and so are refinancings or repayments of existing debt. Changes in the reserves do not depend on government policies on public expenditure, tax rates and nationalised industries prices in the same way as those receipts and outgoings that contribute to the PSBR. The amount of existing debt that has to be rolled over in the period is also excluded; it depends on past rather than present receipts and outgoings and on past debt management policies.

12. It would of course be wrong to assume from the identity relationship that a given increase in the PSBR would produce an increase of the same size in £M3 or that there is any close relationship, year by year, between them. Different public expenditure and tax measures, which have the same effect on the PSBR, can have very different effects

on real demand and hence private sector saving and investment and monetary conditions. The financial effects of fiscal policy also depend on how the authorities seek to finance the PSBR. Through their open market operations the monetary authorities are able to influence interest rates and the amount of liquidity in the economy so that where the PSBR is financed by sales of gilts to the non-bank private sector its expansionary effect on the money supply is much less than where it is financed by borrowing from the banking system.

13. However, as a general proposition a big fiscal deficit will tend to lead to a rapid growth of money supply and/or to higher interest rates. Other things being equal, the higher the PSBR the higher interest rates will have to be in order to achieve the sales of public sector debt to the non-bank sector and contain bank lending to the private sector in order to meet any monetary target. The rise in interest rates associated with a larger deficit and a given monetary policy would offset to some extent the effects of the fiscal expansion. It follows that it is essential to examine fiscal and monetary policy simultaneously and co-ordinate them as far as practicable.

The External Position

14. The external position exercises a crucial influence on domestic monetary policy. Exchange rate policy is central to the ability of the authorities to control interest rates and influence the growth of the money supply. In a world of fixed exchange rates an independent monetary policy is impossible. Overseas interest rates play an important role in determining domestic monetary conditions and domestic interest rate levels. When the authorities are intervening to influence the exchange rate, external influences on the money supply can be substantial. The impact of these external flows is however extremely complex. Only transactions between non-residents and the non-bank private sector directly affect the money supply, although other flows may affect the exchange rate (to the extent that it is allowed to adjust) or interest rates (where the exchange rate is completely fixed) and hence may influence the demand for money. The full effect of external flows to the non-bank private sector will, however, depend on how they affect output and prices and hence the demand for money.

15. By contrast a freely floating exchange rate gives the authorities a wider measure of freedom to control domestic interest rates and thus the domestic demand for money. With a freely floating exchange rate the direct effect of external flows on the monetary aggregates will be small - though not always negligible. Under these conditions monetary policy has a rapid impact on the rest of the economy through its effects on the exchange rate and thence through the effects of changes in the exchange rate on prices, the current account balance and the level of activity.

Instruments of Monetary Control

16. The growth of £M3 thus depends in large part on fiscal policy and the external position. Government can however exert a degree of control over the growth of the money supply by changes in the level and structure of interest rates or by quantitative restrictions on credit. Since the introduction of the policies associated with "Competition and Credit Control" it has preferred the former, though circumstances have at times obliged it to use the latter through the imposition of a supplementary special deposits (SSD) scheme. SSDs act as a control on the growth of banks' interest-bearing eligible liabilities and so constrain the funds they have available for lending.

17. The structure of interest rates can, in the short run, influence the growth of the money supply as much as changes in their general level. This can be illustrated by the "round tripping" that took place in 1973. Companies then took advantage of lower interest rates on their overdraft facilities (related to bank base rates) than the interest rates they could earn on wholesale time deposits and certificates of deposit (related to money market rates) to borrow money and lend it back to the banks thus inflating the money supply. This situation arose when monetary policy was tightened by calls for special deposits and banks reacted by liability management - selling certificates of deposit in order to bid for reserve assets - rather than by reducing lending and raising base rates promptly. The authorities used SSD controls to avoid this

perverse response, but now both they and the banks would view more rapid shifts in base rates to keep them in step with money market rates as a more appropriate way of avoiding the problem. There are drawbacks to using SSDs - whether to deal with "round tripping" or excessive monetary growth resulting from other causes: they restrict competition and encourage the development of parallel mechanisms for channelling funds through institutions not subject to SSD controls. Moreover, to the extent that they cause the personal and company sectors to reduce their bank deposits and holdings of certificates of deposit, and take up instead other assets which fall outside £M3 but are in practice equally liquid, it is questionable to what extent there is any underlying change in monetary conditions.

18. External factors can generally be seen as having a greater influence on short than on long-term interest rates, for in a world where rates of inflation in different countries are likely to differ widely, people would find short term assets denominated in different currencies much better substitutes than longer term assets, because of the great difficulties in forecasting future exchange rates and rates of interest in different countries in the more distant future and the greater risk of capital loss on long term assets if one's forecasts are wrong. Expectations about the future rate of exchange can play a major role in determining the level of UK interest rates (in relation to those prevailing in the rest of the world), particularly at the short end, and may affect the rate of growth of the money supply.

Policy Analysis

19. From the forgoing it will be clear that the pursuit of monetary guidelines has implications for many other areas of policy and fiscal policy is only one of them. These may become evident through the operation of monetary instruments, especially the level and structure of interest rates, changes in the exchange rate or other aspects of external policy such as exchange control, and constraints on fiscal policy.

20. Exactly how these all link up can be illustrated by returning to the question posed at the beginning of this paper - where are the monetary implications of fiscal policy assessed and reviewed? The answer is in the Treasury and the Bank in order to assist the

Chancellor of the Exchequer to select an appropriate mix of fiscal and monetary policies in relation to the Government's broad objectives and other policies. The main occasion for such an assessment is of course the annual Budget, but there may be other occasions for review during the year which follow broadly the same process.

This has three broad stages:

- a. The preparation of base forecasts.
- b. The analysis of policy changes.
- c. Ministerial decisions on fiscal and monetary policy.

The Base Forecast

21. In order to illustrate how the process takes place under current conditions, let us assume that the forecasters prepare a base forecast with the following characteristics:

- a. A given stance of monetary policy - either a certain growth in £M3 over the forecast period or some given assumption about velocity.
- b. The exchange rate floating freely - without official intervention.
- c. Public expenditure and taxation based on existing policies. How exactly these are determined is not relevant to this stage of the exposition.

22. Treasury forecasts have four separate but closely related elements:

- a. World economic prospects
- b. Output, income and expenditure including the current account of the balance of payments
- c. Domestic financial flows
- d. External financial flows.

23. The preparation of the first, though an integral part of any forecast, need not be described in the present context. The second, prepared with the assistance of the NIF model, is pretty well known; the model is published and updated regularly, and

used in various forms by outside agencies. The third and fourth make up the financial sector of the forecast; this is less familiar and is described below.

Domestic Monetary Flows

24. The Treasury and the Bank work closely together in the whole financial field, and the domestic financial forecast is produced jointly. The traditional procedure has been described by M E Hewitt*. It is based on the same assumptions as the NIF and the external forecast and uses a flow of funds approach to construct a forecast consistent with them.

25. This procedure has many advantages. Tracing flows of funds through a detailed matrix is a salutary discipline and is an essential component of any forecast when one considers how pervasive is government policy over the whole financial field.

26. Under this system, consistency between the real and financial forecasts depends essentially on:

a. Close collaboration at working level between the various forecasting teams as the forecasting round develops. Financial factors react on the National Income Forecast both through some of the modelled relationships and in the judgement which is applied to the output of the model in arriving at the forecast. Similarly the National Income Forecast - especially saving and investment by the main sectors of the economy - reacts on the financial forecasts. The process is one of regular but manual iteration - the crucial element is the close collaboration between the various forecasters and the judgements which they make.

b. Expectations and confidence play a very powerful role in the financial forecasts. There are of course great hazards in forecasting confidence. The financial flows reflecting the financial forecasters view of confidence are however taken into account in the NIF in the way described above.

c. The assumptions are of course the same for all the forecasts. But those which concern monetary instruments are adjusted as the forecasting round proceeds. When we have a clearly stated monetary policy - such as that provided by

* Financial Forecasts in the UK - Bank of England Quarterly Bulletin June 1977

the present guidelines for the growth of ~~£M3~~ - the level and structure of interest rates, and the exchange rate are adjusted in the light of the picture shown by these intermediate stages in the forecasting process so that in the final forecast the growth of the monetary aggregates is broadly in line with the policy. The extent of the adjustment in the case of the exchange rate also has to reflect other policy considerations. But this presents perhaps the most obvious example of iteration between the forecasts.

27. The process of manual iteration between the two parts of the monetary sector and between it and the real sector is exceedingly cumbersome and time consuming if - as is usually the case - there are a number of variants, especially if no one variant is selected as a main case.

28. The Treasury has therefore put a great deal of its research effort in recent years into the development of fully computerised models of external and domestic financial flows. We have now reached the stage at which the capital flows model is fully programmed to iterate with the NIF model and a fully estimated model of domestic financial flows is being used in parallel with the flow of funds forecast.

The Monetary Model

29. The monetary model which is described more fully in an annex is designed to be used with the external capital flows model to explore the relationship between domestic and external markets. It is not a reduced form "monetarist" model explaining nominal incomes and prices directly by the money supply, and possibly other variables such as fiscal policy. Our model can only do this in conjunction with the NIF model.

30. A major reason for rejecting the reduced form approach was that for policy purposes it is just as important to understand the channels through which monetary policy works as to get an overall estimate of its impact. We also wanted to develop a model which could be relatively easily adapted to deal with changes in the institutional structure. Reduced form models take the money supply as exogenous and thus beg the question of how the money

supply is actually determined.

31. Non financial decisions of the private sector are contained within the NIF model. These relationships are influenced by financial factors such as interest rates and the availability of credit and provide inter alia the financial surplus of the private sector. The monetary model allocates these surpluses and deficits across financial markets and in conjunction with the external capital flows model determines interest rates and the exchange rate in the process. Running the models together produces a simultaneous solution of real and monetary variables.

32. These financial surpluses must be allocated across the various markets in a way that satisfies balance sheets constraints. Each sector's financial surplus together with the increase in its liabilities must obviously equal its acquisition of financial assets. In practice this is achieved by making one asset a residual, determined by the accounting identity referred to above. This offers an embarrassment of choices: at the simplest level of aggregation we can model the demand for money or the demand for bonds but not both independently.

33. In principle both approaches should give similar results but in practice differences emerge. Demand for money relationships traditionally reflect transactions theories neglecting speculative aspects whereas theories of the demand for bonds are essentially speculative. We thought the speculative factors important enough to require an explicit model of the private sector demand for gilts. Given explicit models of bank lending to the private sector, national savings and the like, the demand for money is then determined as the residual in the non-bank balance sheet identity.

34. To the extent that money is demand determined or interest rates are fixed, such a specification of demand, albeit indirect, is all that is necessary to determine the quantity in circulation. However, the growth of the markets in wholesale bank liabilities and similar developments have given bankers much more scope over their liabilities and the interest rates offered on them. Similarly the assessment of monetary stance in terms of quantities rather than rates makes supply factors more important and rates more endogenous. Of course in the limiting case of a monetary target

the supply is fixed and the demand for money determines the level and structure of interest rates.

The Interim Monetary Sector

35. In order to help with the simulation of policy options until the full monetary model became operational, we constructed an interim monetary sector. It was an early version of this model which was used for the purpose of the policy simulations described in the February issue of the National Institute Bulletin. Using the model has given us valuable experience in producing a computer solution of real and monetary variables. This is particularly important in the sort of regime which I postulated in paragraph 21. And we can now let the computer do much of the tiresome work of iterating between the exchange rate and the reserves to search out the exchange rate path consistent with the assumed policy on official intervention. The interim monetary sector can also be useful in looking at variants to the main forecast, permitting them to be carried out more quickly, although judgemental modification may well still be required.

External Capital Flows

36. We have also developed a fairly conventional structural model of capital flows, which both provides an overseas sector for the monetary model and completes the balance of payments in the NIF model. The approach is based on portfolio theory, and assumes that foreign and domestic assets are imperfect substitutes. According to this theory, the allocation of total portfolios between sterling and foreign currency assets depends on their relative rates of return and the risks of capital loss. The relevant rates of return are defined to include expected changes in exchange rates as well as interest rate differentials. Capital flows result from the adjustment of actual to desired stocks, in response to changes in relative yields and changes in wealth.

37. The most volatile capital flows, therefore, are related primarily to changes in interest rates and exchange rate expectations. The main behavioural relationships are at a fairly high level of aggregation. A separate sub-model disaggregates these flows into the categories required by the monetary model.

38. Exchange rate expectations are modelled explicitly - a feature which is crucial to the flexible use of the whole model under different exchange rate regimes. This is, of course, a difficult area and one in which judgement and intuition necessarily play an important role. We have therefore deliberately developed a considerable degree of flexibility in the treatment of expectations.

39. A distinction is drawn between:

- a. Longer run expectations about the exchange rate on the part of those engaged in foreign exchange transactions. This is best thought of as their equilibrium rate, and
- b. the view they take in the short run: their expected rate one quarter ahead.

40. The equilibrium rate may be determined by either relative competitiveness or relative money supplies adjusted for trend differences in real growth, or some combination of the two. The expected rate takes account of what has actually been happening to the spot rate, and allows for an extrapolative element in the formation of expectations. We can also allow expectations to be affected by the visible balance, relative to the trade balances of the rest of the OECD. And these various influences on expectations can be combined together in any way we desire. The usual procedure in forecasting is to look at the implications of a range of assumptions about expectations, and how they are formed. The formulation used in the final forecast typically reflects a range of factors.

41. Our attempts to test these various formulations of expectations over the recent past suggest that functions based on relative money supplies tend to perform rather better than those based on, for example, competitiveness or the visible balance. It seems plausible that one of the more important ways in which the money supply may affect the economy in the short run is through its effect on confidence. Furthermore, fluctuations in monetary growth may be expected to lead to capital flows that will affect the exchange rate directly.

Exchange Rate Determination

42. The development of a capital flows model has enabled us to

experiment with different approaches to predicting the exchange rate in preparing forecasts and in setting up variants. The old approach was to fix the path of the exchange rate either in real or nominal terms, and consider the implications for the monetary aggregates, the reserves and the economy in general. An alternative approach - still scarcely beyond the development stage - is to make assumptions about the change in the reserves, and the growth of the money supply, and let the model "solve" for the exchange rate and interest rates. To give some of the flavour of how the capital account model works in conjunction with all the other models referred to in paragraph 23. I will round off this section on the external side by briefly describing how we would forecast a freely floating exchange rate in line with the assumptions in paragraph 21.

43. Many balance of payments flows in the short run are relatively insensitive to the current exchange rate. The current account is largely determined by past movements in competitiveness, by domestic demand and world trade. To a lesser extent some capital flows can also be regarded as fairly insensitive to the exchange rate in the short run. But "short term" capital movements, on the other hand, depend crucially on market operators' assessment of the profits to be made from holding sterling, a major determinant of which is the expected change in the exchange rate.

44. Changes in the actual exchange rate clear the foreign exchange market by changing the expected return on holding sterling. Short term capital flows are thus induced to offset the surplus or deficit on other balance of payments transactions. If "underlying" balance of payments flows are in surplus, then the exchange rate must appreciate sufficiently to persuade those undertaking foreign exchange transactions that the prospects for future gains are at least somewhat less than they were, and so trigger an outflow of short term funds. How much the exchange rate has to move to achieve this result depends both on the way in which speculators form their expectations and on the responsiveness of capital flows to changes in exchange rate expectations. Clearly modelling expectations adequately is crucial to this approach. At the same time, however, it is obviously the case that the resulting exchange rate path will also depend on anything and everything that in a fixed rate world

would be reflected in movements in the reserves.

The Analysis of Policy Changes

45. A base forecast gives a quantitative estimate of the economic conjuncture and its prospects for the development of the economy on given assumptions. While forecasting is necessarily subject to great uncertainties, this base forecast does provide a starting point for defining the options. A further important role is to help policy formulation by carrying out simulations to assess the impact of changes in policy.

46. Different fiscal packages can be examined in conjunction with varying assumptions about monetary policy and policy in the foreign exchange markets. It would, for example, be possible to show the implications for the economy of a given fiscal boost on the assumption that ~~velocity~~ velocity remains as in the base case, on the assumption of a more relaxed monetary policy - say with interest rates unchanged - or on the assumption of the same growth in the money supply in nominal terms as in the base forecast, and with the application of different sorts of monetary instruments. Different sorts of fiscal package - different combinations of tax and expenditure measures - would have different monetary effects. So would different attitudes towards intervention in the foreign exchange market. And all these combinations will have different implications for the real economy.

47. All this is however only part of a complex process in which the costs and benefits of different fiscal packages are assessed taking into account also the implications for wage bargaining, industry, social objectives and many other issues. These were discussed in the speech by Sir Douglas Wass to which I referred earlier.

Ministerial Decisions

48. It must also be emphasised that after all the analytical work which I have described is done, Ministers are provided only with the most general guide to the appropriate combination of monetary, fiscal and other policies in the circumstances foreseen. There are a number of reasons why this is so.

49. There is a large margin of error in the forecasts and related simulations. This is particularly true of many of the

inputs to the forecast of £M3 growth. The current account and the PSBR, with large quantities on each side of the account are very difficult to forecast accurately. Moreover, financial markets are by their nature subject to sudden moods which just cannot be predicted. The most we can do is point to the direction of movement - we cannot be confident that we have their extent or timing right.

50. Economic analysis is only as good as the underlying relationships in the models and the judgement applied by those who use them. Ministers take account of our analytical work, but we do not urge them to accept it as gospel or containing an accuracy which it cannot possess. There is little danger in practice of their doing so because they have throughout the year the benefit of an expanding quantity of other forecast and other analyses of suggested policy options - some of which are based on very different models.

51. It is also extremely difficult to find reliable and uncontroversial measures of either the stance of fiscal policy or the stance of monetary policy - a subject which Mr Goodhart will be dealing with.

52. The Treasury will of course give its considered advice to the Chancellor on the range of fiscal and monetary policy options which seem possible. But the Treasury is not the only source of advice; other Ministers and other organisations also become involved. As I have been talking mainly about the financial field, I should perhaps make the obvious point that the Governor of the Bank of England will formulate his own advice across the whole area of policy both domestic and overseas. Though there is a fair amount of co-ordination between the Treasury and the Bank to make sure that there is a common assessment of the prospects, the opinions and advice which are given are by no means always identical. The Bank contributes its special knowledge of financial institutions and its experience as a direct operator in the financial markets on behalf of the Treasury. The Treasury's particular slant in relation to this is integrating those policies with the rest of the government's policy in general, with industrial policy, incomes policy and macroeconomic policy as a whole.

53. Ministers are essentially in the business of assessing the risks inherent in the different options facing them. Monetary and

fiscal policy are both intermediate objectives and may be assigned different weights at different times even given the same priorities for the primary objectives to which they relate. Moreover, primary objectives and the weight which Ministers put on them have a political dimension in its widest sense. The choice between the importance attached to counter-inflation, growth, employment and external objectives cannot be determined by economic analysis alone. But this analysis can, and does, help illustrate the possible risks and constraints on different courses of action.

1.3.78

Annex

THE TREASURY MONETARY MODEL: A SHORT ACCOUNT

For the last three years a research program has been under way within HM Treasury directed towards the construction of a model of the UK monetary sector. The model has been designed to assist in the joint Treasury/Bank of England financial flows forecast and to iterate with the National Income Forecast (NIF) model*.

Such iteration produces a general equilibrium solution of real and monetary variables. Among other things this makes it easier to analyse formally the effects of monetary and fiscal policy. This paper gives a brief description of the model, its formal structure, characteristics and implications. A more detailed technical account is available on request.

2. The monetary model can be used with a model of external capital flows** to explore the relationship between domestic and external markets. It should at the outset be stressed that the model is not a reduced form "monetarist" model explaining nominal incomes and prices directly by the money supply, and possibly other variables such as fiscal policy. Our model can only do this in conjunction with the NIF or some similar apparatus.

3. A major reason for rejecting the reduced form approach was that we felt it just as important to understand the channels through which monetary policy worked as to get an overall estimate of its impact. We also wanted to develop a model which could be relatively easily adapted to deal with changes in the institutional structure. Reduced form models take the money supply as exogenous and thus beg the question of how the money supply is actually determined; moreover these methods are not directly applicable to open economies such as the UK. Informal monetarist analysis however does offer a check on the overall shape of any forecast provided jointly by the NIF and a financial model such as that described here.

4. Our forecasting methods are based upon the concept that monetary and non monetary instruments are traded by various sectors through markets in which interest rates move to equate supply with demand.

*This model is published as "HM Treasury Macroeconomic Model, Technical Manual 1977"

**Outlined in "A Quarterly econometric model of the Capital Account in the UK Balance of Payments" M C Beenstock and S R Bell, unpublished Treasury paper.

Thus a specification of behaviour in these markets allows interest rates and quantities including the monetary aggregates to be determined simultaneously.

5. These markets are represented by the rows of the matrix of Table 1. The columns similarly represent the financial balance sheets of different sectors which must sum to measures of financial wealth. The level of sectoral and asset aggregation is higher than that used in the financial forecast.

6. Looking at the matrix via the liabilities of each sector in turn, the liabilities of the public sector include notes and coin (row 1) reserve assets (row 3) and a "gilts" aggregate (row 5). Most of the monetary instruments are supplied as bank liabilities which are divided into retail deposits (row 8), essentially those yielding a zero rate of return or one related to base rate, and parallel money deposits (row 9), those offering a market related rate such as certificates of deposit (CDs). Bank assets include the liabilities of the public sector of which reserve assets are important, and also advances to the overseas and non bank private sectors (row 7). Discount houses are in some ways similar to banks but their call money liabilities have reserve asset status and these are subject to different regulations. Since we base the model of bank behaviour on the reserve asset and other conventions followed by the commercial banks we treat the discount market and "other banks" (Bank of England and Giro) as separate sectors. The framework is completed by the balance sheets of the private and overseas sectors.

Non-Bank Behaviour and the Demand for Money

7. The non financial decisions of the private sector are contained within the NIF model. These relationships are influenced by financial factors such as interest rates and the availability of credit and determine inter alia the financial surplus of the private sector. The monetary model allocates these across financial markets and in conjunction with the capital flows model determines interest rates and the exchange rate in the process. Running all the models together produces the desired simultaneous solution of real and monetary variables.

8. The equations are of the stock-adjustment type in which assets and liabilities are adjusted over time towards long run values which

depend upon wealth, income and relative interest rates. It is assumed that persons and non bank companies take rates in these markets as independent of their decisions and in this section we analyse their decisions assuming that rates are fixed. Their "decision tree" is shown in Diagram 2. Bank lending is determined, given bank rates, by a compromise of demand and supply. The estimated equations reflect both influences. Cumulating financial surpluses and capital revaluations give an estimate of net financial wealth. Adding on bank lending and other liabilities gives a measure of gross wealth.

9. As the diagram shows, these funds must be invested in gilts, national savings, tax reserve certificates and liquid assets. Econometric equations have been developed to handle the demand for gilts and national savings. The gilts equation is based on a speculative demand theory in which investors look at the yield gap between long and short interest rates and compare this with expected capital gains or losses. Various formulations of expectations have been tried, and much of our present research effort is devoted to this area. The demand for national savings is more straightforward; we explain it by interest differentials and income flows.

10. Tax reserve certificates and the like are handled judgementally and liquid assets as a budget residual. A system of portfolio allocation equations disaggregates liquid assets into reserve assets, local authority deposits, CDs, retail bank deposits and cash. The aggregate is dominated by the last three of these items which are the components of sterling M3. So the demand for money is determined indirectly, essentially as the result of decisions relating to financial surplus, bank lending and investment in gilts. This is a feature the model shares with the financial flows forecast.

11. In principle this approach should give similar results to alternatives which model the demand for money directly, considering the demand for gilts to be the residual. However, in practice different results can emerge. Theories of the demand for bonds are by nature speculative, neglecting the transactions motive for holding money. On the other hand most estimates of the demand for money have been based on the transactions demand, thereby sweeping speculative factors under the carpet. We thought the speculative factors important enough to require an explicit model of the demand

for gilts. Consequently, the performance of the model in this area depends critically upon the success with which we handle the expectational factors affecting gilt sales.

Bank Behaviour, Policy Reaction Functions and the Supply of Money

12. To the extent that money is demand determined a specification of demand is all that is necessary to determine the quantity in circulation. It is undoubtedly true that historically money has been largely demand determined. Bankers had little scope for changing their deposit rates or other terms to vary the inflow of deposits and the authorities usually saw their role in the bond market as one of steadying interest rates. However, recent developments associated with the growth of the parallel money markets in the 1960s and 1970s and the move to "Competition and Credit Control" (CCC) in September 1971* have necessitated the modelling of supply factors - particularly for the wider aggregates which include wholesale deposits.

13. We look first at the decisions of a typical commercial bank and in particular at its degree of control over its monetary liabilities. These are set out in Diagram 3. Banks act as oligopolists in advances and "retail" deposits markets setting their rates in line with MLR and market rates. The model allows for lags in this relationship. As described earlier, advances then result as a compromise between demand and supply. Banks have little scope for affecting retail deposits through non price terms and in the model they are taken by the banks as exogenous.

14. Together with a judgemental assumption about non deposit liabilities, retail deposits and advances leave a residual amount of finance available for investment in, or to be obtained from, other markets. We term this residual "investible funds". It is a key model variable since it is largely beyond the banks immediate control and any fluctuations in these funds must be financed in other markets.

15. Traditionally movements in deposits and advances have been financed by precautionary holdings of notes and coin and reserve or near reserve assets. The latter include gilts and local authority deposits. However, the development of an active market

*A useful and up-to-date discussion of these developments is to be found in J Barge and P J Wise, "Competition and Credit Control - Six years on", Journal of the Institute of Bankers April 1977

in their certificates of deposit has enabled banks to place large quantities of these liabilities at their own initiative. This is an important feature of current banking practice and plays a similarly important part in the model. It enables banks to run down their precautionary reserves to minimal levels, relying upon such "liability - side liquidity" in order to meet an outflow of funds. Since all banks are likely to be experiencing an outflow at the same time over reliance on this form of liquidity will be costly. The likelihood of these costs must be weighed against the known cost of the alternative, holdings of excess reserve assets.

16. In the model excess reserves are inversely proportional to the cost of holding reserve assets rather than higher yielding Local Authority (LA) deposits or CDs. So if the initial Treasury bill - LA deposit rate differential is high the banks will rely on issuing CDs, keeping reserves at the minimum ($12\frac{1}{2}\%$ of eligible liabilities) as in 1972-75. If, as has been the case since 1975 the differential is negligible, the banks will maintain excess reserves adequate to cope with any likelihood. This is a key feature of the model as is demonstrated in the next section. The central line of the flow diagram shows the choices open to the banks in these markets.

17. A part of all deposits ($12\frac{1}{2}\%$) is not available for lending because it has to be invested in reserve assets; some may also be held in special deposits. Furthermore both retail and wholesale deposits are handled net of these reserve assets and special deposits. The net figures are grossed up to obtain total eligible liabilities, special deposits and balances at the Bank of England. Together with the equation for excess reserves, this determines total reserve assets. These relationships are illustrated in the lower half of the diagram.

18. The discount market is usually handled judgementally since the frequency with which the rules of the game have changed in this area preclude econometric modelling. Given the importance of reserve asset creation by these institutions we have however built in some ad hoc feedbacks in some simulations.

19. The supply side of the model is completed by a set of reaction functions for the monetary authorities. Since one of the aims of

the project is to analyse the effect of different policies these are imposed rather than estimated. The model is most easily set up if the authorities fix all rates on central government debt, so that the only endogenous rates are parallel money market and bank rates. However we usually allow all rates to "float" in order to clear markets given fixed supplies. It is equally possible to give the authorities money supply or other targets which they attempt to meet by varying rates on or supplies of their debt.

20. The parallel money market includes local authority debt but this is not used as a policy variable, so that rates in this market can only be influenced indirectly by policy. Special deposit calls mainly work through the responses of banks in this market. The supplementary special deposit scheme ("the corset") also works through this market. Due to a lack of data on its operation banks' reactions to the scheme are imposed rather than estimated.

21. Minimum lending rate plays only a minor role in the model. It is usually linked through "the formula" to the Treasury bill tender rate. If the formula is suspended, changes have a weak influence on bank rates and even this link is questionable empirically. It is likely however that breathing life into the discount market will give this policy instrument more bite.

Some Characteristics and Implications

22. The main interactions in the model can be illustrated by an examination of how the model reacts to an external stimulus such as a reduction in the PSBR. We suppose in this example that this is matched by a financial deficit on the part of the private sector. In the short run this will mainly be financed by a rundown of liquid assets, especially retail bank deposits. There will also be a tendency for bank borrowing to rise.

23. We have seen that the banks' reaction to such outflows will depend critically on their initial reserve ratios. Reductions in investible funds mainly increase CD issues which drive rates against the banks. These rate changes moderate the sales of CDs, encouraging a rundown of reserves instead. In the model this response to rates

is non linear, so that if initially short term interest rate differentials are low and reserve assets excessive the overall effect of the outflow will be to reduce bank reserve ratios. There will be a rise in the general level of rates, producing a secondary fall in the demand for money. On the other hand if differentials are high and the scope for reserve asset reductions limited then the outflow will almost exclusively be met by CD issues. A much larger rise in CD rates will occur and this rate will tend to rise relative to other rates, especially if these are being fixed by the authorities.

24. In this instance the secondary rate effects may lead to a perverse overall response of the monetary aggregates. The CD rate leads other rates, increasing the demand for CDs and other "wholesale" components of M3. To the extent that these funds come out of gilts and other public sector liabilities that is the end of the story. However, as presently specified, bank rates tend to fall behind market rates so that much of the finance comes from bank advances and retail deposits. If this is the case the banks collective bidding for CDs will largely be self defeating, indeed the reserve assets required on CD issues financed by bank loans can reduce the net finance available to them. In the model these processes can be unstable in the absence of remedial action by the authorities. They are not unlike the "round tripping" actually seen during 1973 and 1974.

25. One clear implication is that Treasury bill rates should not be allowed to get too far out of line with other short rates otherwise banks will rely on CD issues when the system is squeezed, making it likely that special deposit calls and other attempts at control have to be reversed or a "corset" imposed to avoid round tripping and other perversities.

1.3.78

Talk given to the Institute for Fiscal Studies by P E Middleton on 7 March 1978.

TABLE 1

BALANCE SHEET OF THE TREASURY MODEL OF THE UK MONETARY SECTOR

Financial Instruments	Public Sector PU	12 $\frac{1}{2}$ % Banks* CB	Other Banks* OB	Discount Houses DH	Non-bank Private PR	Overseas OS	Nominal Interest Rates
Notes and coin	CASH _{PU}	CASH _{CB}			CASH _{PR}		zero
Banks balances at Bank of England		BBAL	BBAL				zero
Interest-bearing reserve assets (Treasury and local authority bills, call money)	RESV	RESV _{CB}	RESV _{OB}	RESV _{DH}	RESV _{PR}	RESV _{OS}	Treasury Bill Rate
Special Deposits		SDEP	SDEP				Treasury Bill Rate
Other marketable government debt (mainly gilts)	GILT	GILT _{CB}	GILT _{OB}	GILT _{DH}	GILT _{PR}	GILT _{OS}	Rate on 2 $\frac{1}{2}$ % Consols
Non-marketable government debt	NMKT				NMKT _{PR}	NMKT _{OS}	Various
Banks' £ lending	LEND _{PU}	LEND _{CB}	LEND _{OB}	LEND _{DH}	LEND _{PR}	LEND _{OS}	Mark-up on Base Rate
£ sight and time deposits ('retail' deposits)	BDEP _{PU}	BDEP _{CB}	BDEP _{OB}	BDEP	BDEP _{PR}	BDEP _{OS}	Base rate related
Parallel money: a) CD's + inter bank, b) local authority temporary debt		CDEP _{CB} LATD _{CB}	CDEP _{OB} LATD _{OB}	CDEP _{DH} LATD _{DH}	CDEP _{PR} LATD _{PR}	CDEP _{OS} LATD _{OS}	3 month LA Deposit Rate
Net foreign currency liabilities	SWIP _{PU}	SWIP _{CB}		SWIP _{DH}	SWIP _{PR}	SWIP _{OS}	Covered euro-dollar rate
Foreign exchange reserves	FX					FX	US Treasury bill rate
Net government indebtedness to Bank of England	GINDBD		GINDBD				
Miscellaneous liabilities (net)	MISC _{PU}	MISC _{CB}	MISC _{OB}	MISC _{DH}	MISC _{PR}	MISC _{OS}	
Total Financial Assets Less Liabilities = Financial Net Worth	NW _{PU}	NW _{CB}	NW _{OB}	NW _{DH}	NW _{PR}	NW _{OS}	

* Bank of England Banking Dept and Giro

* Those banks subject to 12 $\frac{1}{2}$ % reserve requirement.

DIAGRAM 2

Flow diagram of non bank decisions

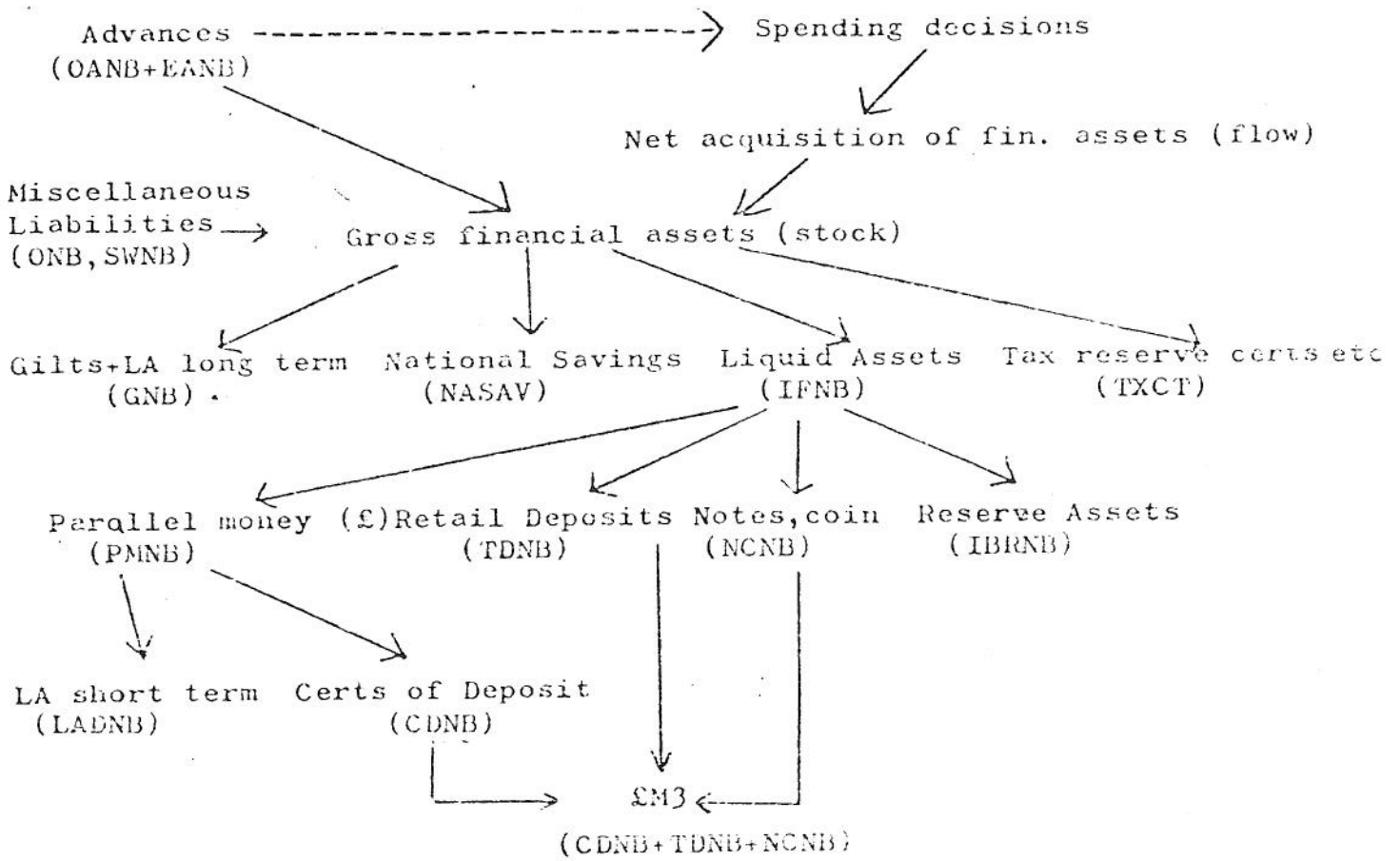
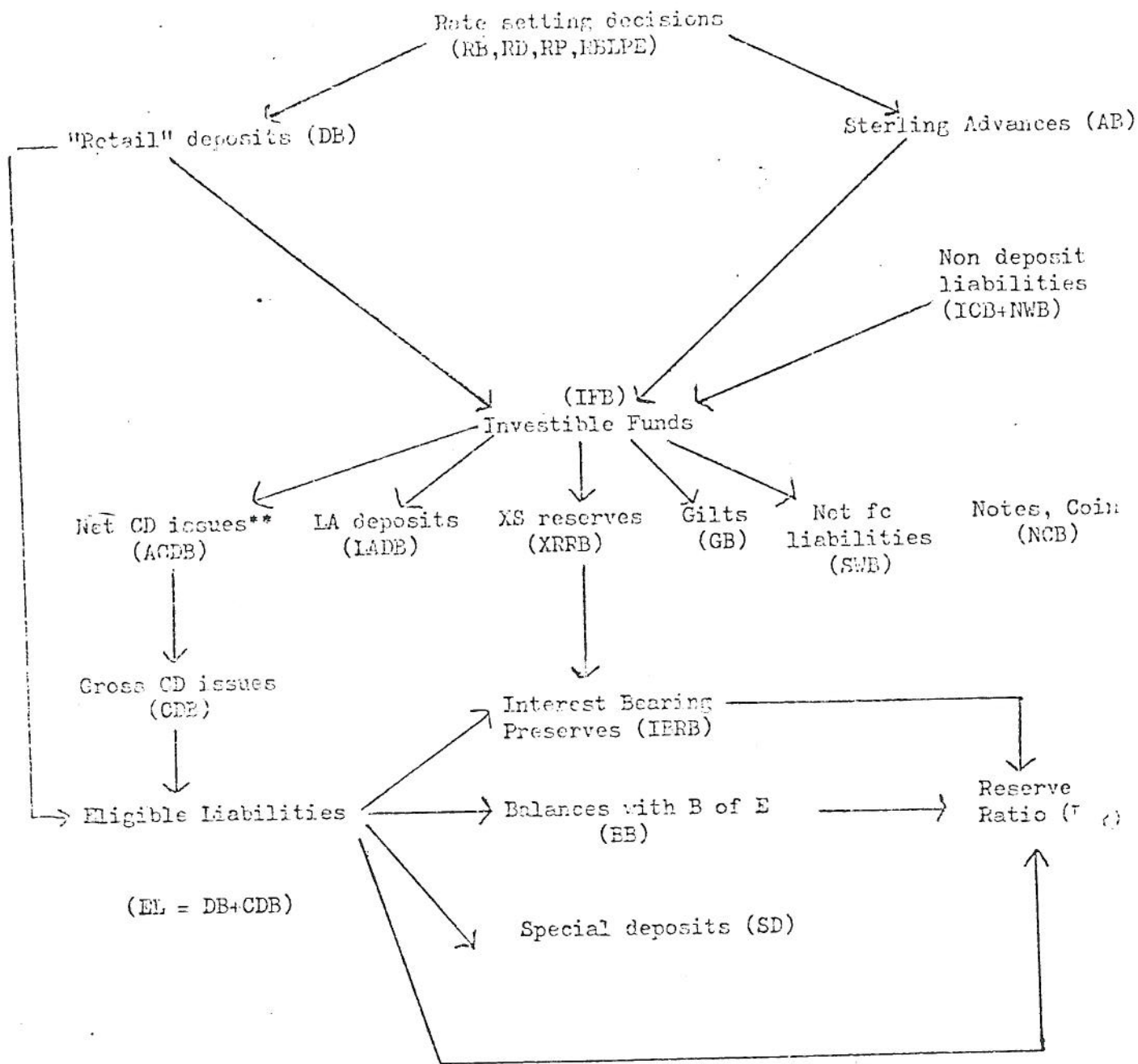


DIAGRAM 3

Flow diagram of bank decisions



*Investible Funds equal non deposit liabilities plus retail deposits net of required reserves and special deposits, minus bank advances.

** Net Certificate of Deposit issues equal the total issue minus an allowance for required reserves and special deposits.